Understanding Body Image and Eating Disorder Risk Across Development

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Abstract

Body image and eating disorder development is complex and the chronological patterns of this development are relatively understudied. Additionally, many methodological issues exist within the field of body image and eating disorder risk in childhood which present difficulties in recruitment and study design which should be addressed. Furthermore, body image has historically mainly been studied in the West, and research into body image cross-culturally is sorely lacking.

This thesis presents five empirical chapters researching body image and eating disorder risk across childhood and adolescence and concludes with a broader look at body image across the lifespan. Chapter 3 presents a longitudinal cohort study which considers predictors of eating disorders from 7-15 and found different pathways for boys and girls, as well as the mediating effect of depression for girls only. Chapter 4 employs behavioural play with dolls and qualitative methods to explore the relationship between gender stereotypes and ideal body internalisation in children as young as 4-years-old. Chapter 5 is the first ever study to look at where children and adolescents look on their body using eye-tracking methods and how this is related to body part satisfaction and overall body satisfaction, as well as identifying the development of body avoidance. Chapter 6 uses an innovative virtual reality paradigm to explore children's thoughts about different sized bodies using a mixed methods approach and finds that children and adolescents both have strong preferences for lower adiposity bodies. Finally, Chapter 7 looks at body image and sociocultural pressure across the lifespan and cross-culturally to explore the lifetime developmental patterns of body image.

Together, this thesis highlights the developmental patterns of body image and eating disorder risk in individuals aged 4-80-years-old. Each empirical chapter employs different methodologies and age ranges to create a full and detailed picture of how one's body image develops and what sociocultural, biological, and psychological influences are salient at each point in our lives.

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Declaration

I confirm that none of the material presented in this thesis has been submitted elsewhere for any other qualification and is my own work unless referenced otherwise.

Statement of copyright

Publications and submitted work

Chapter 7 has been published in July 2024, the formatting was changed to align with the overall thesis:

Hanson LN, Gott A, Tomsett M, Useh E, Yeadon-Caiger E, Clay R, et al. (2024) Examining body appreciation in six countries: The impact of age and sociocultural pressure. PLoS ONE 19(7): e0306913. https://doi.org/10.1371/journal.pone.0306913

Note on pronouns

In this thesis, both 'I' and 'we' pronouns are used. 'I' has been used in the Introduction (Chapter 1), Methodology (Chapter 2) and General Discussion (Chapter 8) where I am the sole author. 'We' has been used in the empirical chapters that have been written as manuscripts for publication to acknowledge the contributions of other authors.

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Dedication

This thesis is dedicated to my grandparents, Norman and Marjory Cowie, who would have been so proud.

Chapter 1: Introduction

Body image is a multifaceted and complex phenomenon relating to an individuals' thoughts, feelings and behaviours relating to their body (Bailey et al., 2017; J. K. Thompson et al., 1999). Body image has been related to a host of important outcomes such as the development of eating disorders (McClelland et al., 2020; Prnjak et al., 2022) and other mental health conditions (Bornioli et al., 2021; E. Choi & Choi, 2016), life satisfaction and quality of life (Davis et al., 2020; Nayir et al., 2016), and identity (Vankerckhoven, Raemen, et al., 2023). However, the development of risk and protective factors for body image and eating disorders in young children has been relatively unresearched. Given the importance of body image in many facets of one's experience of the world, it is important that we understand how body image develops, what influences it, and how it relates to both negative and positive outcomes. This thesis aims to examine factors which influence body image development in individuals from age 4 to 80 using innovative methodologies, and how these factors interact to predict the development of eating disorders in childhood and adolescence. The following chapter will explore the facets of negative and positive body image, outline relevant models of body image and eating disorder symptoms, and discuss body image and eating disorder development through childhood and adolescence.

1. What is body image?

Traditional body image literature has a strong focus on negative evaluative body image, but in recent years research has been supporting the theory that body image is multifaceted and complex. There are several areas of body image which can be considered: evaluative (our attitudes towards our body), affective (how we feel about our body), cognitive (how we perceive our body), and behavioural (behaviours related to our body). Most body image literature focusses on evaluative body image (i.e., how we evaluate our body and what body shapes, sizes, or other features that we consider to be good or bad) by asking questions such as 'I like how my body looks' (Body Esteem Scale for Adults and Adolescents; Mendelson et al., 2001). Affective components are often considered in relation to evaluative components, and we generally find that negative evaluation of one's body is coupled with negative affect concerning one's body (although not always). Affective components tend to focus on one's feelings about their body, such as 'I feel really good about the way I look' (Embodied Image Scale; Abbott & Barber, 2010) and less about whether how we look is akin to the sociocultural ideal. Cognitive components of body image are often considered separately from evaluative and affective elements, and concern how we perceive our body in relation to the world around us. Finally, behavioural components of body image are concerned

with how we behave in relation to how we evaluate, feel, and perceive our body, and also with body schema and semantics (e.g., association between clothing and appropriate body part). The main focus of research so far has been on evaluative body image, which can be broken down into two key areas: negative body image and positive body image.

Negative evaluative body image consists of subfactors such as body size and shape dissatisfaction, body misperception, and low body esteem. Having a more negative evaluative body image has been linked to a host of negative outcomes, such as higher risk of eating disorders (Brannan & Petrie, 2011; Munkholm et al., 2016; Stice & Shaw, 2002; Walker et al., 2018), depression (Ahuvia et al., 2022; Barnes et al., 2020; E. Choi & Choi, 2016; Duchesne et al., 2017; Friedman et al., 2002), anxiety (Barnes et al., 2020; Duchesne et al., 2017; Juarascio et al., 2011; Rosewall et al., 2019), lower life satisfaction (Davis et al., 2020; Frederick, Sandhu, et al., 2016; Fyodorova et al., 2021b), lower self-esteem (Duchesne et al., 2017; Frederick, Sandhu, et al., 2016), and future risky behaviours (Andrew et al., 2016a; Bornioli et al., 2019) in women from Western countries.

On the other hand, positive body image is a broader concept which includes body appreciation, high body esteem, functional body image, and body satisfaction (Avalos et al., 2005; More et al., 2022; Tiggemann & McCourt, 2013). For Western women, having a positive body image has been found to be a protective factor against disordered eating (Bruce & Ricciardelli, 2016; Cardoso et al., 2020), and self-objectification (Alleva et al., 2015), as well as increasing quality of life (Cash et al., 2004), self-esteem (Halliwell, 2015; Tylka & Wood-Barcalow, 2015; E. F. Williams, 2004) and healthy behaviours such as using sunscreen or seeking medical attention when needed (Andrew et al., 2016a). Individuals with a positive body image tend to have a more functional view of their body (Wood-Barcalow et al., 2010) and admire their body for its strength and abilities (Tylka & Wood-Barcalow, 2015). It has also been linked to rejection of Western body ideals (Andrew et al., 2016b; Avalos et al., 2005) which are proposed as risk factors for body dissatisfaction. Furthermore, it is associated with positive actions such as implementing self-care routines, more intuitive eating, and greater likelihood of exercising for function rather than appearance (Avalos et al., 2005; Homan & Tylka, 2014). Additionally, most effective body image interventions include some element of increasing positive body image (Guest et al., 2019; Tylka & Wood-Barcalow, 2015), indicating that positive body image is an important factor in the prevention of negative body image and its consequences.

Body esteem is an independent element of evaluative body image which influences both positive and negative body image. It is distinct from body appreciation and dissatisfaction in that it is a broader

concept which refers to self-evaluations of one's own appearance or weight, and how the body is thought of by others (Mendelson et al., 2001). It has been found to go through significant changes from childhood to adolescence, with girls experiencing a decrease in general appearance esteem and weight esteem in early adolescence which then stabilises and remains constant into early adulthood (Frisén et al., 2015). Nelson and colleagues (2018) found that high body esteem at age 10 acts as a protective factor against identity confusion at age 24, regardless of whether body esteem was maintained or whether it declined across adolescence. High body esteem has also been found to be a protective factor against thin-ideal internalisation and eating disorder symptoms in 12- to 17-year-olds (Flament et al., 2012), indicating that by age 10-12, body esteem has developed and can have a significantly positive effect on the development of body image. Furthermore, Morin and colleagues (2011) found that body esteem was generally high at age 12 and increased throughout adolescence. They also found that body esteem was low for girls with advanced pubertal development, but that as most other girls advanced through puberty their body esteem rose. They theorise that girls who are advanced in pubertal development at 12-years-old feel unhappy with their body being noticeably different to that of their peers, but as more girls go through puberty, girls who have delayed puberty become more unhappy as they no longer resemble the majority of their peers. This highlights the importance of puberty in the development of body image, and how individuals become concerned about how their body 'fits in' with that of their peers. Notably, however, despite the many protective benefits of body esteem, and its ties to pubertal development, no studies to date have considered body esteem in pre-adolescents. As such it is critical that we expand our understanding of how body esteem develops and what factors (other than body image) promote high body esteem.

Functional body image refers to seeing your body in a functional manner, understanding it for its strengths, and valuing strength and physical ability over aesthetic ideals such as thinness (Abbott et al., 2012; Abbott & Barber, 2010, 2011; C. P. Allen et al., 2019; Riboli et al., 2022). It is thought to be a protective factor against body dissatisfaction and disordered eating (Tylka & Homan, 2015) and women who exercise for functional motivations have significantly more positive body image and better eating attitudes than those who exercise with appearance goals such as losing weight (Panão & Carraça, 2020; Tylka & Homan, 2015).

Functional body image is a relatively new area of body image research, resulting in little research on its development. Some factors which have been suggested to contribute to functional body image development are involvement in physical education (C. P. Allen et al., 2019), sport participation (Abbott & Barber, 2011), and age (Abbott et al., 2012). Research into functional body image in adolescents has found that girls are less likely to consider the body functionally and are more focussed on aesthetics than

boys (Abbott & Barber, 2010). Riboli et al. (2022) found that girls in mid- to late puberty recalled their 'child' body in a very functional and positive manner, while their 'new' body was generally described as an object and girls reported more dissatisfaction now than in childhood due to the change in how the body is viewed. This indicates a clear shift in how the body is viewed before and after puberty, as well as the potential positive effects of considering the body in a functional rather than aesthetic manner.

2. Negative evaluative body image and eating disorders

Body dissatisfaction is included in the diagnostic criteria for most eating disorders in specific ways (NHS, 2021; World Health Organisation, 1993), with category B symptoms for Anorexia Nervosa concerning a fear of weight gain or being fat, or behaviour which interferes with weight gain, and category C symptoms including overevaluation of body weight and shape, disturbance of one's body image, or denial of low body weight, but not necessarily all three (American Psychiatric Association, 2022). Eating disorders typically develop in late adolescence and persist throughout adulthood (Rohde et al., 2015). They have the highest risk of relapse (Khalsa et al., 2017) and low treatment/intervention success rates (Smink et al., 2013). They have high comorbidity with other mental health conditions such as anxiety (Swinbourne et al., 2012), depression (Ridout et al., 2021), sleep disorders (Allison et al., 2016; Monterubio et al., 2020), post-traumatic stress disorder (Vanzhula et al., 2019), substance use disorder (Bahji et al., 2019), and have some of the highest suicide rates (Dodd et al., 2018; Rania et al., 2021). This indicates how dangerous eating disorders can be and highlights the importance of targeting interventions before eating disorders can develop. Furthermore, Rohde and colleagues (2015) suggest that interventions should be implemented before 14 years of age, as eating attitudes and body dissatisfaction at this age were most predictive of eating disorder development in late adolescence and early adulthood.

Given that body dissatisfaction and behaviours which stem from body dissatisfaction such as body checking (looking in reflective surfaces to see how the body looks) and body avoidance (avoiding looking at one's body) are directly linked to eating disorder development (Brannan & Petrie, 2008; Menzel et al., 2010; Walker et al., 2018), reducing body dissatisfaction in young people may be key to reducing eating disorder development in adolescence.

Importantly, eating disorder symptoms do not always necessarily evolve into a full eating disorder, and negative eating attitudes and eating disorder symptoms can be detrimental to one's health without meeting the criteria for an eating disorder. It is therefore important to look at eating disorder symptomology throughout adolescence to determine key risk factors and the role that body image plays

in its development, as well as expand our knowledge on the frequency of sub-clinical eating disorder symptoms in this population.

3. Models of body image and eating disorder symptoms

Several models of body image and eating disorders have been created and used to inform theories on the development of body image and its impact on attitudes towards food. Below I present the main theories which underpin the research undertaken throughout the thesis.

3.1 Sociocultural Model

The most thoroughly researched and supported of these is the sociocultural model, also known as the Dual-pathway model, which posits that sociocultural appearance pressure leads to thin-ideal internalisation and thus to body dissatisfaction and an increased risk of eating disorder symptoms. The effect of body dissatisfaction on eating disorder symptoms occurs by two distinct pathways: dietary restraint and depression (Evans et al., 2013; Stice et al., 1996; Stice & Agras, 1998). However, additional risk factors not included in this model have been suggested, such as self-objectification and parental body talk (Perez et al., 2018). The dual-pathway model was originally developed to model the pathway to bulimia (Stice et al., 1996; Stice & Agras, 1998), but has since been prospectively applied to other forms of eating disorders (Holmes et al., 2015; Stice & Van Ryzin, 2019).

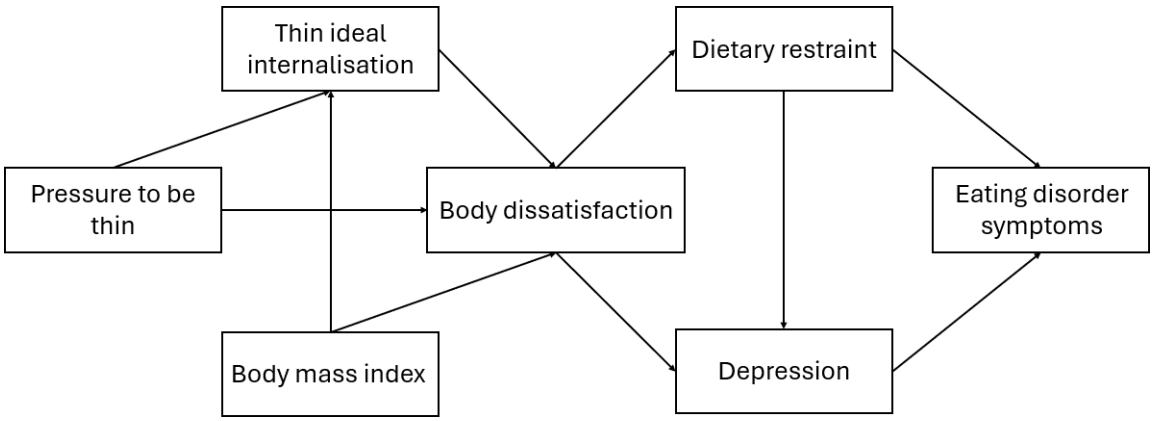


Figure 1-1. Sociocultural Model of Eating Disorder Attitudes, replicated from Evans et al., 2013.

Thin ideal internalisation is a concept originating from research in the West (J. K. Thompson & Stice, 2001) but has been found in most cultures globally, including East Asia (L.-J. Chen et al., 2010; Kim & Lee, 2019; Yamamiya et al., 2016), South East Asia (Shagar et al., 2019), South Asia (Nagar & Virk, 2017; Omori et al., 2017), West Asia (Kakar et al., 2023; Zainal et al., 2020), Central America (Boothroyd et al.,

2016; Vander Wal et al., 2008), and South America and the Caribbean (Lourenço et al., 2021; O'Garo et al., 2020). It posits that an individual internalises an ideal body which has low adiposity and a slim waist with a slightly larger bust and hips. Thinness in this context is associated with many socially desirable values, such as femininity (Hoskin & Taylor, 2019), popularity (S. S. Wang et al., 2006), beauty (Paxton et al., 2005), and high socioeconomic status (Qi & Cui, 2018; Swami, 2015). Internalisation of the thin ideal is thought to occur through three distinct social pathways which are presented in the Tripartite Influence Model below (J. K. Thompson et al., 1999), and through social comparison (Anixiadis et al., 2019; Vartanian & Dey, 2013). Thin ideal internalisation has been shown to predict body dissatisfaction (Paterna et al., 2021), particularly for individuals who are further removed from the thin ideal, such as individuals with higher adiposity (Evans et al., 2013; Stice & Whitenton, 2002).

Body dissatisfaction is a key predictor for disordered eating (Walker et al., 2018), as those who are more dissatisfied with their body are more likely to develop disordered eating behaviours either as comfort and distraction from negative emotions (Rohde et al., 2015), or in order to change their body to be closer to their internalised ideal (Laporta-Herrero et al., 2018). It is prevalent in almost all populations which are studied, with an estimated 26%-40% of children (Sinton & Birch, 2006; Truby & Paxton, 2008), 65%-71% of adolescents (Gonzaga et al., 2023), 64%-72% of young women (Jiménez-Limas et al., 2022), 57%-80% of young men (Dakanalis et al., 2015), and 70% of older individuals (Gagne et al., 2012) reporting being dissatisfied with their body. As body dissatisfaction is shown to predict future onset of eating disorder symptoms from late adolescence onwards (Ferreiro et al., 2014; Lewis-Smith et al., 2020; Rohde et al., 2015), it is imperative that we understand how it develops and is maintained, and what protective factors reduce its likelihood of occurrence. In the sociocultural model, body dissatisfaction is proposed to predict eating disorder symptoms through two main pathways: dietary restraint and depression (Evans et al., 2013).

Dietary restraint is distinct from eating disorders as it involves the process of restraining or intending to restrain one's food intake or food choices in order to lose weight, but not yet at a pathological level. Dietary restraint occurs in children as young as 7-years-old (Evans et al., 2017), who are able to accurately describe why and how you would diet. Research estimates that over 50% of adolescents and young adults report dieting to lose weight (Goldschmidt et al., 2012; Laska et al., 2011; Neumark-Sztainer et al., 2002). Dietary restraint has been shown to be influenced by appearance concern, with young women who have high appearance concern being 2.3 times more likely to diet (Miething et al., 2018), and individuals who diet are more likely to develop eating disorder habits (Goldschmidt et al., 2012).

Depression in this model is proposed to occur due to the combination of body dissatisfaction and increased dietary restraint. One study found that dietary restriction predicted a subsequent increase in depression 1-3 years later (Matta et al., 2020), and that this effect was significantly stronger than the inverse relationship (depression predicting future dietary restriction). However, while depression may be influenced by dietary restraint, it also combines with dietary restraint to predict future onset of eating disorder symptoms (E. Y. Chen et al., 2009; Ricciardelli & McCabe, 2001b), as shown in the sociocultural model (Evans et al., 2013), tripartite influence model (J. K. Thompson et al., 1999), and dual pathway model (Stice et al., 1996; Stice & Agras, 1998). Depression and eating disorders are highly comorbid (Brewerton et al., 2024) and this relationship exists bidirectionally (Christian et al., 2023), however these studies often use clinical assessments to measure these disorders, meaning that there may be effects of subclinical symptoms which have not been explored in the literature. As such, measures of depression should be included when looking at risk factors for the development of eating disorder symptoms in children.

3.2 Tripartite Influence Model

A second complementary proposed model is the Tripartite Influence Model (Fig 1-2) which distinguishes between three main sociocultural factors which are hypothesised to influence the development of body dissatisfaction: parents, peers, and media (J. K. Thompson et al., 1999). This model has been widely researched and supported within the literature and has been shown to be valid across several populations (Hazzard et al., 2019; Huxley et al., 2015; Ivanković et al., 2024; Strübel et al., 2020; Yamamiya et al., 2008), including adolescents (Jarman, Marques, et al., 2021; Roberts et al., 2022; Shroff & Thompson, 2006).

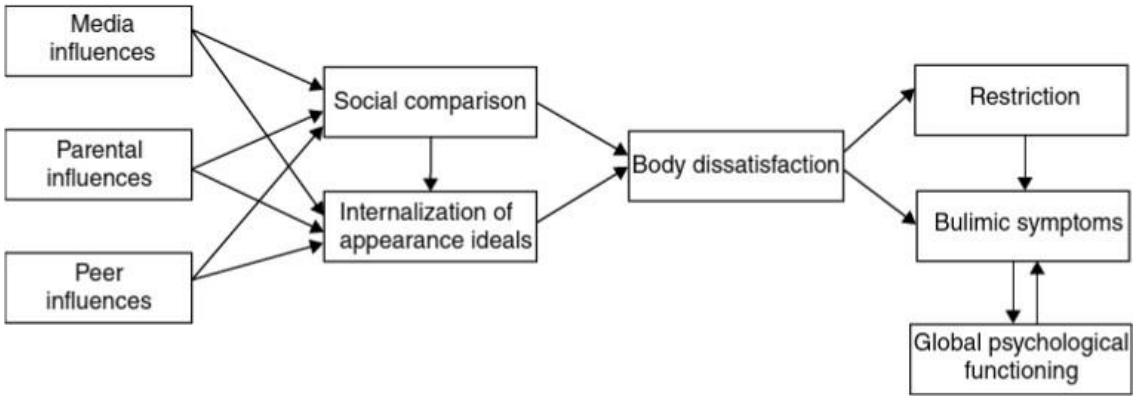


Figure 1-2. Tripartite Influence Model, taken from Thompson et al., 1999.

Peers, family, and the media have been suggested to have differing influences at different stages of life, with family proposed to be one of the main predictors in childhood (J. Mills & Fuller-Tyszkiewicz, 2017), peers and media becoming the most important predictor in adolescence (Shroff & Thompson, 2006), and then a mix of all three throughout adulthood (Hockey et al., 2021; Rivero et al., 2022; Rodgers et al., 2011).

Furthermore, all three sources of pressure have been found to increase thin ideal internalisation and body dissatisfaction through different means. For family pressure, the most reported forms of pressure are comments from parents, particularly mothers, about weight and eating behaviours (Deek et al., 2024; Kichler & Crowther, 2009; Philippi & Leme, 2018), as well as indirect pressure though behaviour modelling (e.g. talking negatively about their own body, restricting their own diet) (Perez et al., 2018). However, some studies have found no effect of mother's drive for thinness or body dissatisfaction on their daughter's body dissatisfaction (Solano-Pinto et al., 2021), indicating that this relationship is in need of further exploration. Siblings have also been found to contribute to family pressure, with sibling teasing and sibling comparison found to predict increased body dissatisfaction (Johnson & Salafia, 2022; Lev-Ari et al., 2014), indicating that measures of family pressure should consider siblings as well as parents.

Pressure from peers can take several routes: peer victimisation and bullying are commonly proposed predictors of body dissatisfaction in adolescents (Philippi & Leme, 2018; H. J. Webb & Zimmer-Gembeck, 2014), while fat talk and social comparison with friends can also cause body dissatisfaction and behaviour change in order to fit in (Kichler & Crowther, 2009; Lawler & Nixon, 2011; Lev-Ari et al., 2014). In adolescents, pressure from peers is often found to be the strongest predictor of body dissatisfaction (Presnell et al., 2004; Shroff & Thompson, 2006), although one study found that increased social network site use predicted increased body dissatisfaction and increased perceived pressure from peers (de Vries et al., 2016).

Finally, media (broadly defined) is salient from a young age and is one of the first proposed causal predictors of thin ideal internalisation in children through toys (Boothroyd et al., 2021; Rice et al., 2016) and cartoons (Harriger et al., 2018). As children grow through childhood and adolescence, the media they consume causes strong internalisation of cultural and gendered ideals, such as magazines aimed at pre-teens which sexualise and objectify them (Gerding Speno & Aubrey, 2018; Graff et al., 2013), or TV shows which show strong gender stereotypes and unattainable idealised bodies (Aley & Hahn, 2020; Fouts & Burggraf, 1999; Northup & Liebler, 2010). In adolescence and early adulthood, social media and advertising have been found to have strong effects on women's thin ideal internalisation and body dissatisfaction

(Aybay & Kara, 2018; Moreno-Domínguez et al., 2019), and men's body dissatisfaction (Blond, 2008; Robl & Mulgrew, 2016), leading many body positive interventions to target media literacy in order to reduce concurrent or future body dissatisfaction (Kurz et al., 2022; Mahon et al., 2023).

3.3 Objectification Theory

Objectification theory (Fig. 1-3) is pertinent not just in body image and eating disorder research, but across mental health research such as in depression (B. A. Jones & Griffiths, 2015; Tiggemann, 2011), or certain types of anxiety (Calogero et al., 2021; Jiao et al., 2022). Objectification in its basic form occurs when one human being views another as an object or tool, e.g. an employer viewing their employee as a tool for working, rather than human beings (D. Choi & DeLong, 2019). In the context of body image research, objectification often refers specifically to sexual objectification, whereby an individual is rated on their sexual attractiveness and the individual attractiveness of their body parts, rather than as a person (D. Choi & DeLong, 2019). With this caveat in mind, objectification theory posits that objectification of bodies is a societal and cultural practise which encourages objectifying behaviours (gazing, comments, harassment) (Calogero, 2012). This is often a gendered practice whereby men objectify women (Galdi et al., 2014; Wright & Tokunaga, 2016), but men can also be objectified (Bernard et al., 2018), and the media (e.g. magazines, social media, advertising) often encourages objectification of bodies (Daniels et al., 2016; Karsay et al., 2018; Santoniccolo et al., 2023), even in pre-adolescents (Rousseau et al., 2018; Slater & Tiggemann, 2016; Starr & Ferguson, 2012).

Objectification from others is proposed to lead to self-objectification, whereby an individual views their own body as an object (Calogero, 2012). This self-objectification has been reported in young adolescent girls (Daniels et al., 2020; Riboli et al., 2022; Tiggemann & Slater, 2015), boys (Slater & Tiggemann, 2010), and adults (Karsay et al., 2018; Tiggemann & Lynch, 2001), indicating that self-objectification occurs at a young age and is evidenced well into adulthood. Furthermore, self-objectification has been suggested to play an important causal role in the development of eating disorder symptoms and depression (B. A. Jones & Griffiths, 2015; Peat & Muehlenkamp, 2011; Tiggemann & Williams, 2012). Additionally, self-objectification is linked to other objectifying practices such as self-sexualisation (Slater & Tiggemann, 2016), which in turn is linked to worsened wellbeing (Du Plooy et al., 2018) and risky behaviours such as risky sex behaviours (Ward et al., 2018) and increased alcohol consumption (Baildon et al., 2021); one study found that internalisation of sexualisation was associated with body dissatisfaction in 6-9-year-old girls (Slater & Tiggemann, 2016).

Once an individual internalises their body an object, objectification theory posits that they will take part in self-surveillance behaviours, such as body monitoring, which is a behaviour linked to body dissatisfaction (Fitzsimmons-Craft et al., 2015; Paulisova & Orosova, 2023). Self-surveillance then is posited to create psychological distress. It elicits negative evaluations of the body, which increases body shame (Moya-Garófano & Moya, 2019; Y. Wang et al., 2020) and weight/shape concern (Jongenelis & Pettigrew, 2020), which are strongly linked to body dissatisfaction and eating disorder symptoms (Cannavò et al., 2024; Fitzsimmons-Craft et al., 2015; Paulisova & Orosova, 2023), and this association is proposed to be stronger in women than men (Moya-Garófano & Moya, 2019). Furthermore, body shame and weight/shape concern have been linked to increased dietary restraint (Jongenelis & Pettigrew, 2020; Raspovic et al., 2023; Troop, 2016) and depression (Fitzsimmons-Craft et al., 2019; Grabe et al., 2007; Hoffmann et al., 2018; Sick et al., 2020).

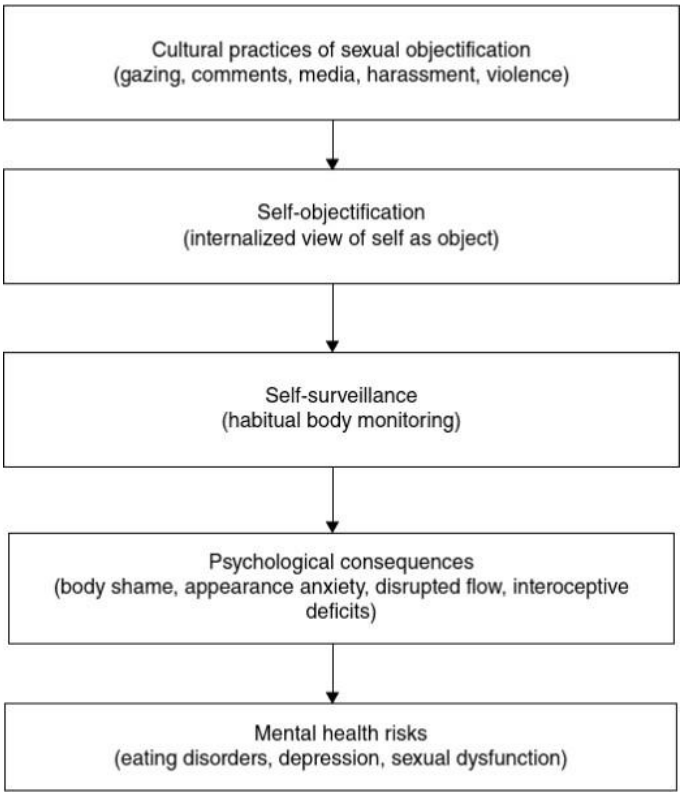


Figure 1-3. Objectification theory, taken from Calogero, 2012.

Objectification theory has been tested across populations and has been found to be a main reason why adolescent girls drop out of sport (Hurst et al., 2024; Slater & Tiggemann, 2011). Furthermore, high internalisation of objectified ideals has been associated with lower cognitive performance (Winn &

Cornelius, 2020), lower self-esteem (Lindner & Tantleff-Dunn, 2017), higher internalisation of gender stereotypes (Galdi et al., 2014), and sexual dysfunction (Tiggemann, 2011). As such, it is imperative that we understand how sources of objectification, such as the media, influence children and adolescents' body image and internalisation of sociocultural ideals.

4. Why is it important to look at body image developmentally?

Knowledge and perception of one's body in sociocultural contexts has been found to develop in children as young as five (Hayes & Tantleff-Dunn, 2010; Pallan et al., 2011; Perez et al., 2018) and evolves throughout childhood and adolescence (Frisén et al., 2015). From young adulthood onwards, body image does appear to remain stable (Roy & Payette, 2012; Tiggemann & McCourt, 2013), with elderly women continuing to exhibit body size and shape dissatisfaction at similar levels to younger women. It is therefore evident that we must consider body image development in the years around puberty. As mentioned above, middle adolescence is the most common age for eating disorders to develop, but children as young as eight have been shown to have a clear understanding of the impact of diet on the body and actively engage in dieting to lose weight (Chung et al., 2013; Lowes & Tiggemann, 2003; Potgieter, 2020). Additionally, children as young as three have been shown to have significant emotional investment in the thin ideal and attribute positive characteristics to thin characters compared to both average and larger avatars as well as preferring thin characters to be friends with (Harriger et al., 2010).

From previous research, we know that perfectionism and eating attitudes at age eight predicts eating disorder symptoms at age twelve (Evans et al., 2017) and Stice and colleagues (2011) have shown that body dissatisfaction at age thirteen predicts development of eating disorder symptoms in adolescence. However, we do not have much information about what happens between the ages of 9 and 12, especially from a pubertal perspective. Given that over the last 150 years the mean age of puberty has been decreasing (Pierce & Hardy, 2012), it is important that we understand how puberty influences body image and eating behaviours over a wide age range to fully capture the developmental perspective.

While there is a growing body of literature which considers the development of body image, it is limited in some important ways. Firstly, there are few longitudinal studies. Of those that exist, Evans (2012) found that perfectionism at age eight was predictive of eating disorder symptoms at age twelve, and that body dissatisfaction was not. Furthermore, Evans and colleagues (2017) found in a separate sample that body dissatisfaction and eating disorder symptoms developed concurrently, and that dietary restraint at age 7 was a strong predictor of eating disorder symptoms at age 12. Other studies have found that body dissatisfaction at age 13 plays a key role in the development of later eating disorder symptoms (Stice et

al., 2011). However, these three studies consider different age groups (Evans, 2012**:** 7-11; Evans et al., 2017: 7-12; Stice et al., 2011: 13-21) on either side of the onset of puberty, and so it is possible that body dissatisfaction only becomes a direct precursor to eating disorder symptoms after puberty. Body dissatisfaction pre-puberty, however, may predict continued body image dissatisfaction post-puberty, which then predicts eating disorder symptoms. As such pre-pubertal body dissatisfaction may still be a distal cause of adolescent eating disorders.

Other longitudinal studies have considered alternative predictors such as socioeconomic status (O'Dea & Caputi, 2001) or bullying (Gattario et al., 2020) during adolescence. O'Dea and Caputi (2001), found that low socioeconomic status was an important risk factor for negative body image, and that body image concerns were present from 6-years old, increasing in older age groups. Gattario and colleagues (2020) found that childhood bullying led to body dissatisfaction in adolescence and eating disorder symptoms in early adulthood, however higher bullying at baseline was associated with already elevated body dissatisfaction. Additionally, neither of these considered intrinsic variables such as body dissatisfaction or thin-ideal internalisation, so it is difficult to compare these findings to other longitudinal studies.

Secondly, while some studies with children have used chronological age as the measurement of child development, there is insufficient research on the influence of puberty on body image. Riboli and colleagues (2022) qualitatively explored feelings surrounding body changes due to puberty. They found that a significant number of their interviewees expressed shame, anxiety, and distress over their 'new' body and reported being deeply unhappy with the changes caused by puberty (e.g., hair growth, breast development, the beginning of menarche). These changes were both in relation to their own perceptions, and also in terms of the importance participants placed on how their body was perceived by others. This importance placed on how the body is viewed led to some participants changing their behaviour to hide the changes (e.g., only wearing baggy clothes) or hide any imperfections associated with puberty (e.g., pimples). Finally, participants reported a change in the function of the body, from a vessel which allowed you to interact with the world, play with peers, and take part in activities, to an object for the observation of others. Given that puberty is commencing at increasingly younger ages (Pierce & Hardy, 2012), and that negative body image and pathological eating behaviours tend to emerge before (Hart et al., 2015; Lacroix et al., 2022; Littleton & Ollendick, 2003) and after puberty respectively (Lewis-Smith et al., 2020; Loth et al., 2014)**,** it is important to consider what role the development of a more adult-like figure and increasing social maturity might play in the progression from body dissatisfaction to eating disorder behaviours.

The first empirical chapter of this thesis intended to include a focus on negative body image development in girls aged 7-16 in order to try and pinpoint the cause and timing of the transition noted above (these results are presented in Appendix A). As shown above, body image begins to develop in childhood and eating disorder behaviours emerge in adolescence. It is unknown, however, what age is most salient for the development of each of these, and therefore it is difficult to determine what age group we should be targeting for interventions which could protect against development of negative body image and eating disorder symptoms. Few studies to date have considered age ranges more than a few years (9-12 – Evans, 2012; 3-5 – Harriger et al., 2010; 1-6, Hart et al., 2015; 3-5 – Hayes & Tantleff-Dunn, 2010; 13-21 – Stice et al., 2011), and due to difference in times of testing and measures used it is difficult to compare across studies to create a broad picture of body image development from pre-pubescent children to post-pubescent adolescents. Furthermore, few studies which have used larger age ranges have considered pubertal development over chronological age for development of body image (10-21 – Gattario et al., 2020; 6-19 – O'Dea & Caputi, 2001). One study which focused on breast development as a marker of puberty in girls did find that girls who were more advanced in puberty showed higher eating disorder pathology and depressive symptoms (Lewis-Smith et al., 2020). Since puberty is a time of great hormonal upheaval and significant changes from a child's body to a more adult-like body, it is important to consider how these hormonal and physical changes interact with shifting social influences to shape the development of body image.

As mentioned above many studies of body image and eating disorders in children and adolescents are cross-sectional and therefore do not capture how body image develops across time. There are some exceptions to this; Evans (2012), Gattario et al. (2020), Lewis-Smith et al. (2020), O'Dea et al. (2001), and Stice et al. (2011) all conducted longitudinal work. However, only one of these considered pubertal variables and each study looked at different predictors for body dissatisfaction (e.g., perfectionism, body dissatisfaction, socioeconomic status, bullying, etc.) Furthermore, the follow-up stages are often a minimum of one year after the first time of data collection. Given the quickly progressing nature of pubertal development, it is important that we consider how body image changes across a shorter period of time, and how commencing, progressing, or finishing puberty influences body image. Previous studies have suggested a temporary block to body representation during pubertal growth spurts so short-term longitudinal work is required to quantify how this might interact with developing body image through puberty (Riboli et al., 2022). Given the mixed results of previous longitudinal studies, it is important to consider what factors contribute or predict the emergence of body image and eating disorder symptoms and what factors are most salient in different developmental stages across childhood and adolescence.

5. Evidence of body related pressures in children and adolescents

A significant body of research emphasises the influence that the three factors in the TIM (family, peers, media) have upon the development of body image in young children. It has been found that caregivers' implicit satisfaction with their child's body size was associated with the child's satisfaction (Wong et al., 2013), whereas mothers' explicit messages to be thinner had no effect on body image (Hendy et al., 2001), suggesting that implicit messages about the body are more salient to children than explicit messages. However, Perez et al. (2018) found that mothers, regardless of whether they were told to or not, expressed more positive messages about their own body when their daughters were present than when they were alone, and that daughters who heard their mothers talking positively about their own bodies were more likely to replicate that behaviour.

For peers, children place more value on what they think their peers perceive about their body than what is explicitly said. Indeed, Hendy et al., (2001) found that verbal messages from peers were not associated with body image, while Dohnt and Tiggemann (2005) found that perception of peer body dissatisfaction was the strongest predictor of own body dissatisfaction in 5- to 8-year-old girls, while peer acceptance, teasing, and likeability were not associated with their body dissatisfaction.

Finally, the media has a strong influence on children's development. Children consume a significant amount of moving media (TV shows, films) and top it up by playing with toys which often resemble characters from media. Two studies have considered the top grossing US films between 1938 and 1998 (Herbozo et al., 2004), and 2004 to 2018 (Harriger et al., 2018). Herbozo and colleagues (2004) found that the majority of children's films contained messages concerning appearance which emphasised cultural body ideals (thinness for females and muscularity for males). Additionally, many higher weight characters were portrayed negatively. Harriger and colleagues (2018) compared their results to the results from Herbozo et al., (2004) and found that there was a significant increase in unhealthy body ideals and negative portrayals of larger or less conventionally attractive characters (e.g., at least one muscular male character; a character having a higher weight being depicted as a problem) in children's films. Additionally, there are many other weight related messages which remain high across time (e.g., females who are physically attractive being associated with positive traits; evil characters being depicted as unattractive). This indicates that appearance related messages have been used in media aimed at children since the 1930s.

A particularly salient form of media is the Disney Princess brand which is generally liked and considered 'safe' by parents (Orenstein, 2012). Coyne et al., (2016) measured Disney Princess engagement

and body image in a large group of children. They found, while Disney Princess engagement had no significant effect on body image at any time, girls who had lower body-esteem at time 1 had increased Disney Princess engagement one year later, suggesting that girls who have lower body esteem may actively seek out appearance related role models. They additionally found that body esteem generally decreased in all children between first measurement and the one year follow up. However, other studies have found that exposure to Disney films which were high in appearance related themes did not influence body dissatisfaction, weight concern, or appearance related play in 3- to 6-year-old girls and found that girls actually perceived themselves as slimmer (Hayes & Tantleff-Dunn, 2010). This suggests that girls who are more vulnerable to body image concerns may seek out role models who fit their appearance ideals which further reinforces and increases their own thin-ideal internalisation and body image dissatisfaction.

Children do not only engage with media through TV, film, and written media. Many children engage with toys which are based on the characters from film and TV. A significant amount of research has explored the effects of toys on children's body image and found that exposure to hyper-thin dolls such as Barbie lead to a significant increase in body dissatisfaction in girls as young as 5-years-old compared to playing with healthy-weight dolls such as Emme or a neutral toy (Dittmar et al., 2006). Furthermore, Boothroyd et al., (2021) found that playing with hyper-thin dolls (Barbie and Monster High) led to 5- to 9-year-old girls' ideal body to become significantly thinner, and that additional play with a healthy-weight doll did not counteract these effects, indicating that effects of playing with hyper-thin dolls are difficult to reduce once they have been enacted.

All of this provides evidence for a clear link between increased media consumption in childhood and later body image dissatisfaction and thin ideal internalisation (Dohnt & Tiggemann, 2006; Roberts et al., 2022; Slater & Tiggemann, 2016), highlighting the importance of sociocultural variables in body image development. These factors indicate that media consumption and appearance related concerns in young children are complicated and require more research.

In recent years, the 'athletic ideal' has been more prevalent in women than ever before, with the rise of fitness media popularity and hashtags such as '#fitspiration' or '#fitspo' (Boepple et al., 2016; Carrotte et al., 2017). This movement has seen a gradual expansion to women's body ideals from just thin to thin and muscular while still maintaining a very low body fat percentage. Research on the effects of these toned bodies on women's body image has shown that the 'fit' ideal body (thin and muscular) produces the same effects as thin-ideal bodies (decreased body satisfaction), while hyper-muscular bodies had no effect on body image (Benton & Karazsia, 2015). This suggests that it is the thin aspect of these

images which influences body image, and that while a muscular ideal body is emerging in women, there are still hard limits on what level of muscularity is considered desirable aesthetically. Furthermore, the fit-ideal is an aesthetic ideal which seems to have the same detrimental effects to body image as the thin-ideal (Benton & Karazsia, 2015), and therefore is distinct from functional body image. Little is known about the prevalence of the athletic ideal in children.

5.1 The influence of adiposity

Body Mass Index (BMI) has been investigated in many previous studies with mixed results. A large body of literature has found that, at all ages, BMI is a significant predictor of body image with higher BMI associated with more negative body image from age 5 through to adulthood (Aimé et al., 2020; Duchin et al., 2014; Fyodorova et al., 2021a; Kops et al., 2019; Paans et al., 2018; J. B. Webb et al., 2014) and lower BMI with more positive body image (J. B. Webb et al., 2014), however there is a smaller body of evidence that there is no effect of BMI on body image in adolescents (Kantanista et al., 2015), or that it acts as a mediator for other variables such as internalisation of Western body ideals or sociocultural pressure where low BMI is internalised as desirable (Yao et al., 2021).

Mixed results for the effects of BMI have been found in most literature in children. Similarly to adults, some studies have found that BMI positively correlates with development of body dissatisfaction while others have found that it interacts with other factors or has no effect at all (Kantanista et al., 2015). Duchin et al. (2015) suggested that body image in childhood also predicted future BMI, finding that girls with high body image dissatisfaction maintained a lower BMI than girls without any initial dissatisfaction. It therefore remains an important factor to measure when considering body image development, especially when considering it alongside sociocultural factors.

BMI has been shown to be a strong predictor of body image in individuals with eating disorders, especially eating disorders with a focus on maintaining a low body weight. Women with anorexia nervosa have been found to be better at judging BMI of thin bodies and their own body and are more sensitive to small changes in BMI than healthy controls (Cornelissen et al., 2017). However, the accuracy of BMI judgements in this group rose dramatically when their own BMI started to increase, indicating that BMI can be an important factor to consider, especially in individuals who are at risk of developing eating disorder behaviours.

6. This Thesis

The overarching research aim of this thesis was to deepen our understanding of body image development in children and adolescents, and how this influenced development of associated conditions such as eating disorder symptoms. Specifically, the aims of the thesis were twofold: to investigate the influence of sociocultural appearance pressure and ideal body internalisation on body image and eating disorder symptom development, and to understand the role of pubertal development. To achieve this, I had originally planned to use a short-term longitudinal design using questionnaires in schools which would explore the risk and protective factors which were prevalent at each stage of puberty. Due to recruitment difficulties (outlined in detail in Chapter 2), different methodological approaches were adopted in subsequent chapters. As such, the overarching research aims of the thesis evolved to include the investigation of research methods which are suitable for working with children, both in age-appropriateness of the measurement tool, and parent acceptance of the research methods and topic. The final thesis therefore had three overarching aims: to investigate the influence of sociocultural appearance pressure and ideal body internalisation on body image and eating disorder symptom development, to understand the role of pubertal development, and to assess the effectiveness of various methodologies for use in sensitive research in youth populations.

This thesis is organised into eight chapters:

Chapter 2 presents the methodological plans I had for this PhD, the challenges that I faced, particularly in recruitment, and the decisions which were taken regarding the various methods used. I outline the original plan for the PhD which was to conduct almost all of the research through schools and why this was changed to a more lab-based approach. I then discuss techniques used in child body image research to date, including figure rating scales, questionnaires and behavioural approaches. I go on to present the rationale behind the VR and eye-tracking studies and why these methods in particular were chosen. Finally, I discuss the qualitative approaches employed in Chapters 4 and 6, and how I use qualitative data to enrich and add deeper meaning to my results. When conducting any type of qualitative research it is important to consider one's perspectives and personal biases towards a topic so I present my own perspectives and the perspectives of my supervisory team who were consulted during qualitative analysis.

Chapter 3 is the first empirical chapter and presents results from analysis of data from the Gateshead Millennium Study which were accessed as a way to support or contradict any preliminary findings from the schools study (the results of which can be found in Appendix A). The main aim of this

chapter was to explore the factors which predict the development of eating disorder symptoms across childhood and adolescence using existing models of eating disorder development. This chapter allows us to investigate the role of puberty in the development of body image and eating disorder symptoms in boys and girls.

The second empirical chapter, Chapter 4, uses an observational behavioural approach and qualitative design to try and understand children's thoughts around body-related ideals and pressures and their relation to gender stereotypes. Using doll play, I explore how children decide which dolls to play with and how doll choice is related to gendered play and internalised gender stereotypes. This chapter allows us to investigate an alternative methodology with young children which was highly approved of by parents and facilitated discussion on sociocultural influences to appearance and their ties to gender stereotypes.

Chapter 5 employs eye-tracking methodology to determine where children look at their own body in a mirror, and how this is influenced when they are told to think about things they like about themselves, as in mirror exposure therapy. This study is the first ever to use eye tracking technology in this way, providing valuable insights into children and adolescents' gaze patterns in relation to their own body. Furthermore, due to the ages of participants, we were able to explore differences between pre-pubertal children (aged 7-10) and peri-/post-pubertal adolescents (13-16). Additionally, we were able to explore the acceptability of eye-tracking methods for both young participants and parents.

Chapter 6 employs virtual reality to determine children's internalisation of the thin ideal when they embody a low, average, or high adiposity body, and how their perception of body size is related to body functionality and body size ideals. This study employs a mixed methods approach in order to understand children's thought processes behind their quantitative answers. This study fits into all three overarching aims of the thesis: it allows us to explore the sociocultural associations and influences that children and adolescents possess regarding different sized bodies; it allows us to look at the influence of puberty as pre-pubertal children (aged 7-10) and peri-/post-pubertal adolescents (13-16) were recruited; and it allows us to determine the acceptability of VR methods for sensitive research with young populations.

Chapter 7 is the final empirical chapter and looks beyond childhood and adolescence to examine body appreciation and sociocultural pressure in women across the lifespan (18-80) and across cultures. This final empirical chapter provides a snapshot into body appreciation and sociocultural pressure past adolescence and provides evidence of the continued experience of sociocultural pressure and body appreciation across adulthood. This study provides insight into the ways in which sociocultural pressures

continue to evolve throughout adulthood and continue to influence body image across the lifespan. Furthermore, it demonstrates the difference between recruiting adults to a questionnaire study about body image compared to children and adolescents, and highlights the philosophical quandary regarding the age at which it is deemed acceptable for researchers to ask questions regarding personal body image.

The final chapter of this thesis (Chapter 8) consists of the general discussion which explores the main findings of this thesis and how each empirical chapter adds to the growing body of literature exploring body image and eating disorder symptom development. This chapter concludes with the key findings of the thesis and suggestions for the future of body image and eating disorder research in children.

Chapter 2: Methodology

The most common method of measuring body image is using questionnaires or figure rating scales. However, these may not be the most valid or reliable methods of measuring body image in children, especially in younger children who may not have a conceptual understanding of their body or food in the same way as adults. As many of the measures of body image which are used in children are simplified versions of adult measures, it is important that we investigate that these methods are appropriate and valid in these populations. In this chapter I will discuss traditional methods, then explore the other methods which are employed in this thesis and examine the evidenced suitability of these methods in children.

1. Traditional methods – figure rating scales and questionnaires

The vast bulk of research on children's body image has been conducted using figure rating scales (FRS; see Gardner & Brown, 2010, and Jayawardena et al., 2021 for reviews). FRS are a way of measuring evaluative and cognitive body dissatisfaction whereby a participant is presented with a series of pictures of an age-appropriate model which vary along the BMI spectrum (these are traditionally 2D silhouettes but recently research has started to use 3D avatars in virtual reality). The participant is asked to choose the figure which most resembles their body and the figure which most resembles the body they wish they had. Good practice is to remind children that they are free to select the same figure for the second choice, or a different one. The difference between these two bodies is sometimes considered to represent the degree of body dissatisfaction.

There are some reasons for their preferential use with children: figure rating scales are easier for children to understand and sometimes more visually engaging than long questionnaires (Gardner & Brown, 2010). Additionally, given most studies on this population have used this type of scale, it makes it easier to compare results across studies. However, while figure rating scales measure discrepancy between ideal body size and shape and how children think they look, they do not consider how children might feel about this discrepancy (Gardner & Brown, 2010) so equating the discrepancy with body dissatisfaction is inaccurate. Furthermore, the body children choose as the most like them may not resemble their actual body, and so FRS may be confounded by body misperception (Gardner et al., 1998; Gardner & Brown, 2010). FRS may therefore be measuring cognitive body image more than evaluative or affective body image. Finally, Yanover and Thompson (2009) argue that these scales are especially unreliable in children

due to their constantly changing bodies, and that if FRS are to be used in young people, they should be age specific.

Less research has been conducted with this population using questionnaires. Questionnaires do not have the specific problems of FRS, as they ask the child directly how they feel about their body and collect information on their self-evaluation and emotional affect regardless of their ideal, actual, or perceived body size and shape. Additionally, they allow us to ask about specific elements of body image individually so we can understand how each element of body image develops independently and at what developmental stage. Self-report questionnaires have shown good reliability for measuring body image (Kling et al., 2019), which is a problem reported for FRS (Gardner & Brown, 2010). However, Kling et al. (2019) did not include measures aimed at children in their review, so the suitability of questionnaires in children has not been adequately addressed in the literature. Smolak (2004) suggests that measures created for use with children do not necessarily target the areas of body image that we intend, such as scales intended to measure weight concerns which do not distinguish between evaluative and affective body image. Furthermore, some studies have found poor internal consistency of these measures with children aged 5-9 (Davison et al., 2003). It may be that, as these measures are developed by researchers and often based on adult measures, that they do not ask body image questions which are salient or relevant to that age group using words or concepts that can be correctly understood by young children. Additionally, the reliability and validity of these measures is often tested in late childhood or early adolescent groups and therefore are not designed for younger children. For example, the body esteem scale for adults and adolescents was tested from 12-years (Mendelson et al., 2001), the body esteem scale was recently validated in 9 year olds (Perez et al., 2023), and the revised body dissatisfaction scale from the eating disorder inventory was found to be a reliable and valid measure for children as young as 8-years old (Wood et al., 1996). Few measures have been used in children under 8-years-old, suggesting that alternative methods may be more suitable in younger age groups, but questionnaires appear to provide a valid and reliable measure of body image from late childhood (Ricciardelli & McCabe, 2001a; Smolak, 2004).

In the current thesis, we employed questionnaires in Chapters 3 (with children) and 7 (with adults). In Chapter 3, questionnaires were administered to children as young as 6 years regarding body dissatisfaction (using a figure rating scale: the Children's Body Image Scale; Truby & Paxton, 2002) and dietary restraint (using a questionnaire: Dutch Eating Behaviour Questionnaire child version; van Strien & Oosterveld, 2008). Both of these were considered reliable and valid measures for use with these age

groups and indicated adequate reliability in our sample. We furthermore used questionnaires in the intended research for Chapter 3 (Appendix A) which showed adequate internal consistency even in the youngest children (7-years) indicating that while questionnaires are not ideal for use in this age group, they do allow us to measure children and adolescents' body image and eating attitudes in a valid and reliable way.

Finally, questionnaires were used in Chapter 7 to measure body image and sociocultural pressures in adults cross-culturally. We found acceptable internal consistency for most of the measures across age and culture. In this sample, the thin ideal internalisation scale indicated adequate reliability (α = .67) in Black Nigerian women. This was the lowest across scales, age, and culture, but is in line with other research in African populations which have found slightly low Cronbach's alphas (L. Williams et al., 2023).

Together, these provide evidence for the use of questionnaires in body image and eating disorder research across age and cross-culturally. However, due to recruitment difficulties with schools (outlined at the end of this chapter) questionnaires may not be an ideal measurement tool for this topic in children due to parental concerns regarding the content of questionnaires.

2. Doll play

Doll play has been used to explore body image in young children (<6) where questionnaires and FRSs may not be age appropriate and has been found to be a good method of investigating sociocultural appearance internalisation (Dittmar, 2012; Rice et al., 2016). Using doll play to study children's body image is comparatively cheap compared to alternative methods such as eye-tracking and virtual reality (VR), where the equipment is expensive and requires extensive training to use. It enables us to explore children's body ideals through a forced choice design where children have a selection of dolls to play with and allows us to determine how higher internalisation of sociocultural ideals (shown by choosing the adult thin or muscular doll) then predicts gendered play.

Several studies have used dolls to investigate young children's body image, both by using the dolls as a tool to frame questions around (Harriger et al., 2010; Worobey & Worobey, 2014) and as a condition by which children's body image is manipulated (Anschutz & Engels, 2010; Boothroyd et al., 2021; Dittmar et al., 2006). For example, Dittmar et al. (2006) had children look at images of Barbie (an idealised thin doll), Emme (a larger bodied doll), or no doll and measured their body dissatisfaction before and after exposure using the Children's Figure Rating Scale (CBIS) (Tiggemann & Wilson-Barrett, 1998). Boothroyd et al. (2021) used a similar design but with physical dolls, asking participants to play with ultra-thin dolls (Barbie, Monster High), realistic sized dolls (Lottie, Dora the Explorer) or with cars as a control condition.

Together, these studies demonstrated how ultra-thin dolls influence young girls' body image and ideals, and how long the damage may last after very short exposure. However, neither of these studies investigated the effects of additional factors, such as doll clothing, perceived social desirability of the doll, or perceived femininity of the doll. Boothroyd et al. (2021) dressed the dolls differently to one another, with Barbie and Monster High dolls in a riding outfit and a basketball kit, and Dora and Lottie in a skirted swimsuit and a riding outfit, meaning the doll clothing may have influenced children's relatability with the doll. Given that gender stereotypes are strong and rigid at this age (Kanka et al., 2019), it is important to consider how perceived social desirability and femininity of the doll may influence children's body image and ideals.

Furthermore, Barbie and Monster High may be more familiar to the children than Dora or Lottie. Dora is a popular children's show, and therefore she is not most often seen as a 3D physical doll, but rather a colourful 2D animation. Lottie is a less popular doll than both Barbie and Monster High as shown by best-selling toy lists on retailer's websites such as Amazon (https://www.amazon.co.uk/Best-Sellers-Dolls/zgbs/kids/26900715031) where Barbie and Monster High Dolls represent 3 of the top 5 dolls, and Lottie does not feature in the top 100. While some studies have shown there were no effects of doll familiarity on children's perceptions of the doll, this was shown either when all the dolls were familiar or all the dolls were unfamiliar, and this effect may have been different if the dolls' familiarity were mixed within conditions (e.g. Barbie and an unfamiliar doll). As such, perceived social desirability of Barbie through her many careers, movies, and fashions, and to a lesser extent Monster High Dolls, may have been more relatable and desirable to children than Dora and Lottie, and this may have influenced the results.

Further studies have used dolls as a measurement tool of body image, thin ideal internalisation, and gender stereotype internalisation. This is a potentially effective and child-friendly way of measuring these, which overcomes the issues with FRS and questionnaires presented above. Harriger et al. (2010) and Worobey & Worobey (2014) asked young girls to choose the doll which they thought represented a descriptive word, showing that from a young age, girls associated ultra-thin dolls with positive aspects of femininity, beauty, health, and other desirable traits, while they most commonly associated negative adjectives with larger bodied dolls. In another study, Harriger et al. (2019) used an original Barbie, short Barbie, tall Barbie, and curvy Barbie in a similar set up. However, all of these studies used pre-determined 'positive' and 'negative' traits so children did not have the freedom to assign their own descriptors to the dolls. Furthermore, these traits were very often stereotypically feminine descriptors which were either positive or negative, such as around cleanliness (clean/messy), kindness (kind/nice/mean), popularity (has

lots of friends/has no friends), and activity (active/lazy). Few of the traits were stereotypically masculine (aggressive, strong, adventurous) so it may be that, while they associated thinness with femininity, children do not necessarily associate large bodied women with negative feminine traits, but rather gender neutral or masculine traits. Alternatively, children may not naturally assign these traits to dolls and rather think of the doll as a vessel through which to create and interact with imaginary scenarios. As such, in Chapter 4 of this thesis we allowed children to think about and describe the dolls as they did naturally, rather than in a forced choice design.

There are some limitations to this method which it is important to bear in mind when designing a study involving dolls. First of all, dolls are a stereotypically feminine toy (Endendijk et al., 2014; Murnen, 2018) and a study involving dolls may be perceived as 'uncool' or 'girly' to boys which may be a barrier to participation for them. Additionally, even plus sized dolls such as Emme (US size 16), and curvy Barbie (US size 12) are often considered 'healthy weights' and still maintain an idealised waist-hip ratio (Emme: 0.68; Curvy Barbie: 0.69 – ideal waist hip ratio is somewhere between 0.6 and 0.8; Singh et al., 2010), meaning they are still idealised in some senses. Despite these limitations, previous studies have found significant differences between ultra-thin and curvy dolls (Harriger et al., 2019; Worobey & Worobey, 2014), indicating that even idealised larger bodies are considered less desirable than idealised ultra-thin bodies. This provides evidence for their suitability in body image research with young children.

In the fourth chapter of this thesis, I use doll play to investigate children's thoughts around dolls in a way which encourages children to express their own thoughts rather than using pre-designated words. Furthermore, I try to explicitly observe children's internalised gender stereotypes through language and play style. I attempt to reduce the effects of external factors such as doll social desirability by having all of the dolls wearing a neutral outfit which was sewn by me. The outfits were designed to show off the dolls' bodies in an age-appropriate manner while still being fashionable and not outdated. Finally, I used dolls which were unfamiliar to the children to avoid any familiarity effects. As such, all of the dolls were brunettes and not from any of the most popular doll brands (e.g. Barbie, Monster High, Rainbow High, Emme, etc.). Finally, to avoid priming children with body image as a topic and given the nature of the data collection situation (a large event held at Durham University over the summer holidays), I did not collect any information on the children's personal body image or sociocultural ideals.

3. Eye-tracking

Previously, eye-tracking technology necessitated a stable head position with little to no movement of the individual's surroundings. This was not ideal for own body eye-tracking as the head-mounted

trackers were bulky and would hide much of the individual's body, and screen mounted trackers require participants to be looking at a screen (Picanço & Tonneau, 2018). As such, previous studies which have used eye-tracking to assess where children look on a body have used images on paper or on a computer screen, meaning the bodies are seen from third-person perspective, and are much smaller than actual-size bodies. Using new free worn eye-tracking technology which fits onto a pair of glasses means that I was able to have children look at their own body in a mirror to see what they look at.

Some of the studies which have employed eye tracking methods with children have compared children to parents to determine if the way that a child looks at their body is influenced by their parents' gaze patterns, or to compare how children look at their own body compared to the body of a peer (Arkenau et al., 2022; Bauer, Schneider, Waldorf, Adolph, et al., 2017). This method has allowed us to further our understanding of how we perceive our bodies compared to the bodies of others, but it is often through body scans and pictures which may not illicit the same types of looking as when looking at one's own body in real time. Furthermore, allowing participants to look at their own body in real time allows us to reduce boredom and response bias and increase ecological validity, as seeing one's body in a mirror is not as 'unusual' as seeing a picture of oneself standing in a standardised pose.

Of course, as with all methods, eye-tracking has some limitations which must be considered. First, eye-trackers have become highly sophisticated, and the technology has advanced exponentially in the last decade. However, eye-trackers remain vulnerable to some simple mistakes during data processing, such as dark lashes or makeup being mistaken for pupils, partially occluded pupils, or glare from external light sources which reflect off the pupil (Carter & Luke, 2020). With these issues in mind, I began each session by showing the child how the eye-tracker worked and asking them to look at different points in the room as a game to both check the accuracy of the tracker and to allow the child time to get used to it before recording started. The strengths of eye-tracking greatly outweigh the limitations, as it is the only method which allows us to directly measure visual biases. Additionally, the previous limitations of eye trackers, such as their bulk or the extensive training required to use them (Holmqvist et al., 2011), were not present with the eye-trackers which were used in the current thesis.

In this thesis, we used free worn eye-tracking glasses which allow free movement of the head and body and do not require calibration. I directed participants to stand or sit in front of a mirror and look at themselves for 15-seconds. This was deemed long enough for them to have time to explore the view before them, while also short enough that they would not lose focus on the task. They repeated each condition four times, so we had a total of one minute of mirror looking time per participant. Furthermore,

participants were not told the purpose of the study and were not given any direct instructions on where to look when looking towards the mirror. In the final condition for each participant, they were asked to think about things that they liked about themselves, as no study with children or adolescents to date has investigated how gaze patterns may change when one looks at one's body while having positive thoughts about themselves. Given that mirror looking tasks are common in body dissatisfaction and eating disorder interventions (Butler & Heimberg, 2020; Griffen et al., 2018; Trentowska et al., 2014), especially directed looking and guided positive thinking (Hildebrandt et al., 2012; Luethcke et al., 2011), it is important that we understand how gaze patterns differ (if at all) based on the guided thoughts of the individual.

4. Virtual Reality

VR is an increasingly common feature of modern-day life (Statista, 2024), with VR technology becoming cheaper, more accessible, and having a wider range of purposes, such as gaming, socialising, education, and more (S. Thompson, 2024). Children are being increasingly exposed to VR in everyday life and many children report having access to a VR set either at home or at a friend/family member's house. Furthermore, the potential uses of VR in education contexts are currently being explored, especially in STEM (Liou & Chang, 2018; R. Liu et al., 2020; Yildirim et al., 2020), social sciences (Riner et al., 2022; Yildirim et al., 2020) and history (Villena Taranilla et al., 2022). As such, VR, while a relatively novel tool for researchers, is a familiar and exciting apparatus for children. There are notable strengths in VR as a method for measuring body image and sociocultural pressures; it allows us to give participants bodies which are closer or further from the thin ideal, and has been shown to manipulate participants' own perceptions of their body (Keizer et al., 2016; Normand et al., 2011), including children (Keenaghan et al., 2022). It is also interesting and novel for children and many parents expressed their interest in VR as a method of measuring body image over questionnaires which some parents felt might trigger some distressing thoughts or behaviours.

In body image and eating disorder research, VR is an emerging method in adult samples (Clus et al., 2018), but few studies have used VR to measure body image in children and adolescents (Bioulac et al., 2018; Blanco et al., 2024). Using VR in combination with motion capture technology allows us to manipulate an individual's body size and shape in a realistic and personal manner, and this has been shown to be an effective and ecologically valid method in adult studies (Parsons, 2015).

Many adult studies, especially around clinical levels of eating disorders (e.g. Anorexia Nervosa, Bulimia Nervosa) or body dissatisfaction (e.g. Body Dysmorphic Disorder) have used VR as a tool to explore individuals' body perceptions (Neyret et al., 2020; Wolf et al., 2020) as well as a resource for novel

treatments (Ferrer-García & Gutiérrez-Maldonado, 2012; Keizer et al., 2016; Porras-García, Ferrer Garcia, et al., 2019). In a review of the use of VR in eating disorder treatments, Ferrer-García & Gutiérrez-Maldonado (2012) found that the VR environment incited similar levels of anxiety and depression as in-vivo exposure in perceived stressful environments for these individuals. Other reviews which examine the efficacy of VR in eating disorder treatments have found generally similar success (Clus et al., 2018; Riva et al., 2021; Turbyne et al., 2021), indicating that VR is a useful and realistic tool for exposing individuals to everyday situations while remaining inside the lab.

Many studies use VR as a tool to create life-sized 3D models seen from third-person perceptive for participants to interact with (Fisher et al., 2020), thereby allowing participants to increase their exposure to larger bodies which in turn increases their perception of an 'average' sized body to a more realistic size than the ultra-thin ideal (Irvine et al., 2020). Other studies have used VR to allow participants to embody a different sized body from an egocentric perceptive (Ferrer et al., 2018). This Full Body Illusion (FBI) can be used to expose participants with eating disorders to undesired (i.e. large sized) bodies. A systematic review of this technique suggests that not enough rigorous evidence exists to determine with any certainty the effects of VR interventions on body dissatisfaction (Turbyne et al., 2021), but they do indicate that VR is a useful tool for manipulating one's body size estimations, and therefore that VR FBIs are a valid research tool.

Much less research has been conducted on children's body image in VR; however, it is commonly used with children for other research purposes, such as exploring motor development, education, or autism research (Bellani et al., 2011; Di Natale et al., 2020; Page et al., 2017; Ryan & Newbutt, 2018). One large systematic review has shown that VR is a promising tool for mental health assessment and therapy across a range of mental health conditions from ADHD to dementia to eating disorders (Wiebe et al., 2022); however, they point out that significantly fewer studies have looked at child or adolescent compared to adult populations, highlighting this as a large gap in the literature.

In this thesis, VR was used in Chapter 6 to determine how children think about different sized bodies both functionally and aesthetically. This was intended to explore potential age and gender differences in responses, with younger children and boys expected to talk about the bodies in a more functional manner and adolescents and girls to discuss the aesthetics of the body. Furthermore, we wanted to measure children and adolescents' thin ideal internalisation and desire for a smaller body using a potentially more valid method than questionnaires or FRS.

5. Qualitative interviews

One method which is not often employed with pre-pubertal samples is qualitative interviews. Body image studies which have employed these methods have often interviewed adolescents with a lowest age of 10 (Bell, 2019; Bell et al., 2021; Frisén & Holmqvist, 2010; Riboli et al., 2022), while qualitative methods with younger children have tended to use highly structured interviews with closed questions after which a numerical based analysis such as content analysis is applied (Dohnt & Tiggemann, 2006). A few studies have employed semi-structured interviews and focus groups with pre-adolescent children, and have found that, as long as the interview questions and concepts discussed are done so in an age-appropriate way, rich data can be drawn using qualitative methods in young children (e.g. Tatangelo & Ricciardelli, 2013).

In both chapters which use this method, I manually coded the transcripts and sorted codes into topics, then themes and subthemes. Due to the lack of research in this area with children, especially children as young as 4-years-old, I used an inductive approach to the coding process so that important themes in the data would not be overlooked. I furthermore used a critical realism epistemological approach to the analysis. Critical realism posits that real world behaviours and events are caused by and understood through the individual's unique perspectives and is informed by their personal beliefs and experiences (Bhaskar, 2016). In particular, it focusses on three key areas: experiences (perceptions of things by an individual), causes (things that cause events), and events (thing that happen in the world) (Fryer & Navarrete, 2024). Additionally, it relies on the existence of an external reality, rather than multiple realities which are subject specific as in constructivism; as I *rely* on the existence of a shared sociocultural ideal which is internalised at a young age, critical realism is the most fitting guiding epistemology. In the research contained within this thesis, both quantitative and qualitative, I attempt to measure individuals' experiences of their body, how these experiences are 'caused' by an individuals' sociocultural environment, and how these experiences and causes act as risk or protective factors for eating disorder symptoms. Therefore, due to the assumption of a shared external reality and the idea that experiences, causes, and events are related (Öğütle, 2023), the methods and analysis included in this thesis are guided by critical realism.

In this thesis I employ qualitative interviews in two different ways – long-form and short-form. In Chapter 4 I use long-form interviews where children were asked several questions and were asked to expand their answers as much as possible. These interview transcripts range from 2 minutes 42 seconds to 22 minutes 39 seconds, with a mean time of 9 minutes 1 second. Children completed these interviews

while playing with a doll of their choice to act as a distractor to the main aims of the study, an aid to discussing body image and sociocultural factors in a way in which children could conceptualise and understand, and a companion to the interviews to help understand the deeper meaning of children's answers. One benefit of this method was that parents were enthusiastic about the study and felt that the topic was being presented and discussed in a subtle and child-friendly manner.

The second qualitative interviews involved fewer questions and shorter answers while the child was in the VR environment in an avatar body (Chapter 6). The aim of these questions was to quickly and efficiently add meaning to the children's quantitative answers to understand the thought processes involved in deciding whether a body was good or bad. The interviews and subsequent transcripts were similar in length, with the shortest being 45 seconds and the longest being 2 minutes 47 seconds; the mean interview length was 1 minute 33 seconds. Due to the short nature of these interviews, we employed content analysis to assess based on existing theory some similarities and differences between answers based on age, gender, and VR body. We then employed a reflexive thematic analysis on the expanded answers to explore children's thoughts about different sized bodies.

5.1 My perspectives

In qualitative analysis it is important to think about one's perspectives and biases which may influence interpretation of the data. First and foremost, I have approached the analysis of the data within this thesis with a grounded knowledge of body image and eating disorder theories. I have tried as much as possible to look at the data from each angle, as a body image and eating disorder researcher, as a psychologist, as a feminist, and as a person who grew up in a society which values thinness and femininity. When analysing the interviews, I tried to develop themes and subthemes based on the content of the data, but I appreciate that I am driven by the theories proposed in the literature which I am familiar with. Mainly, I use feminist theory (e.g. Bordo, 2003), sociocultural theory (e.g. J. K. Thompson et al., 1999), eating disorder theory (e.g. Stice & Agras, 1998), and knowledge of body image development across the lifespan and its various facets (e.g. body dissatisfaction, body appreciation, functional body image). I maintained a full view of the data throughout the process: I conducted all of the interviews contained within this thesis myself, I wrote all of the transcripts and checked them to ensure they were correct while making notes, and finally I coalesced them into topics, themes and subthemes. During this process, I consulted the literature often, especially for topics of which I had not previously completed research, such as gender stereotypes and their development in childhood.

I did, however, also allow myself to be guided to a certain extent by my own life experiences. As a

child I had a whole corner of my room dedicated to Barbie, her friends, and her accessories. Bearing in mind this section of my childhood took place in the early 2000s, there were no larger-bodied Barbies, and the extent of the diversity was that some of them were brunettes as opposed to blondes. As such, as a child I was heavily exposed to the ultra-thin ideal, and while my mother made sure I had all the career Barbies, I also had all of the traditional gender stereotypical accessories (kitchen, baby and pram, etc.). Furthermore, not only did I own many, many Barbies, but they were my favourite toy as a child, and my mother remembers week-long scenarios which covered half of the floor of my bedroom which she was absolutely forbidden from tidying. All this to say, I am extremely familiar with the play style and thoughts which occur during play with Barbie. However, as Mattel has diversified the range of bodies, skin colours, hair colours and textures, and accessories, children may be less inclined to internalise the thin-ideal and feminine ideal to the same extent as older generations.

It is important to note that I did not complete these analyses in isolation, and after I had compiled the initial topic codes, I consulted my supervisors Prof. Lynda Boothroyd and Dr Elizabeth Evans. Both supervisors are experts in body image and disordered eating who have years of experience in the field, but both are also mothers who understand the different social context in which children grow up compared to 20 or more years ago. Furthermore, both are staunch feminists and had knowledge of feminist theory from sociological, anthropological, and psychological perspectives. As a feminist raised within a family who endorse some gender stereotypical values (e.g. women do the cooking/cleaning) I had to find my own path to feminism which is based largely in my own thoughts and beliefs about the world and less in official feminist theory. As such, the insights and expertise which my supervisors were able to bring was invaluable in this thesis.

6. Recruitment approaches

In the current thesis, four distinct recruitment approaches were taken: recruitment of children and adolescents through schools; recruitment of children and adolescents directly through parents; a cohort study; and recruitment of adults through online means and community advertisements. Three of these four methods (through schools, cohorts, and online) were recruiting for the studies presented in Chapters 3 and 7 and the results in Appendix A, while recruitment directly through parents was employed for the behaviour doll play study (Chapter 4), eye tracking study (Chapter 5), and VR study (Chapter 6). These recruitment methods are discussed below in reference to the effort required, success rates, and reasons for non-participation.

This array of methodological techniques arose from the necessity to adapt the way in which we

were measuring sociocultural risk, body image, puberty, and eating disorder risk in children. Initially, the plan for the thesis was to conduct three studies, first a longitudinal study in schools (the results of which can be found in Appendix A). The second planned study was a VR study using built in eye trackers where participants who were identified as high or low risk for eating disorders in study one would customise an avatar along body fat and muscularity spectrums to represent their current and ideal bodies. They would then have the opportunity to embody these avatars as well as a third 'random' avatar which would be created to match their real measurements. A minute of free looking would proceed the avatar customisation so we could determine where participants were looking on their real, perceived, and ideal body. The final planned study would use the results from studies one and two to create and pilot an intervention aimed at whichever age group it would be most effective for, determined by the results of study one. The intervention would consist of an adapted guided mirror task, although the adaptations would be based on the results from study two. After recruitment difficulties in study one and technical difficulties with the creation of study two delayed the project by almost two years, I decided to adapt the methods used to be more acceptable to parents and easier for the technical team to create.

Some concerns around the use of body image and eating attitude questionnaires has been raised by parents and researchers regarding potential harm caused to children who fill them out (Damiano et al., 2020; Jarman, Slater, et al., 2021). This concern is evidenced by the difficulties around recruitment for the intended empirical research for Chapter 3 which was a short-term longitudinal study completed in schools looking at 3-month changes in body image and eating disorder symptoms across pubertal development. We found that there were several barriers to participation, the first of which was the schools themselves. I contacted (by email and follow up phone call) schools across the North East of England, Central Scotland, and the London Metropolitan Area using both a database of schools through the Psychology Department of Durham University and personal contacts (my friends, friends of my friends, and contacts of colleagues within the department). I had also contacted leaders of local youth groups, such as the Girl Guides, Scouts, Girls' Brigade, and community centres but did not hear back from any of them. We can see from Figure 2-1 that only 8% of schools contacted were interested in the study and wanted to know more. Of those, 45% went on to participate in the first wave of data collection and 80% of those also completed the second wave of data collection.

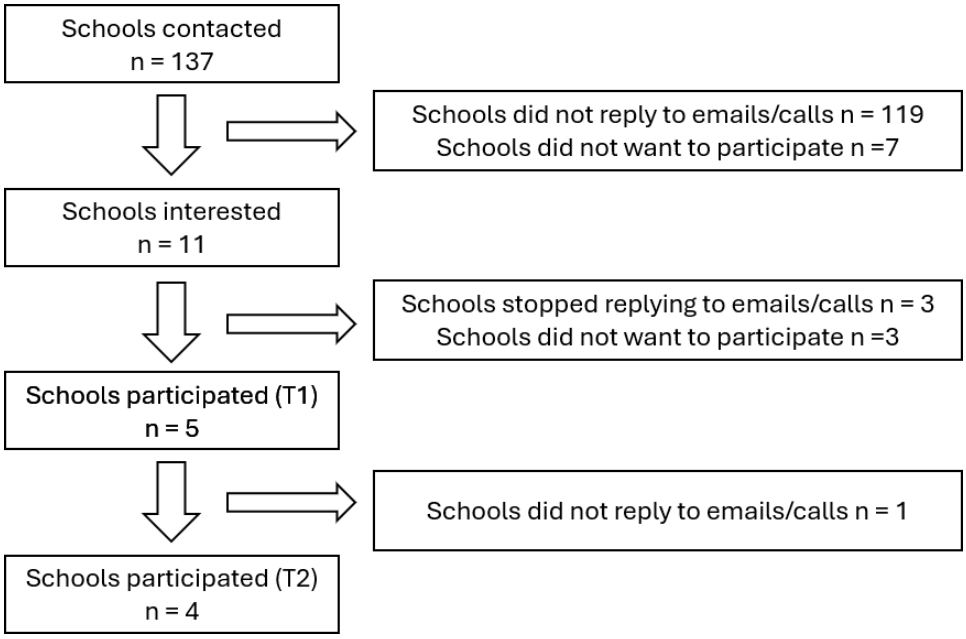


Figure 2-1. Flowchart of school participation

Although no data were systematically collected on reasons for non-participation, in most cases the school receptionist would take a message, the school would never get in touch, and any further attempts at contact would result in the same outcome. Some schools outright did not want to participate, with the most cited reasons being not enough time/resources or worry about parent reactions to the study topic. Of the schools who showed interest, I met with the school contact to discuss the study aims, protocol, and safeguards. The schools that did not want to participate at this stage either stopped picking up my calls or replying to my emails or informed me they had decided not to take part – again mainly due to the study topic. Finally, one school did not participate in the second wave of data collection due to a significant change in the senior leadership team (SLT).

As can be seen, there are significant challenges which arise when working with schools which were not as prevalent even 10 years ago (e.g. Evans, 2012). The most common rebuttals stemmed from the research topic (body image and disordered eating), and the time/resources needed to run the study. In the last decade, schools have been under increasing pressure to provide additional support for children, from breakfast clubs to mental health support and after school activities, and this increase in responsibilities is felt from teachers to the SLT. As such, taking the time to meet and organise researchers coming into the school, as well as the time taken out of class for the children to participate in the study was deemed too costly for many schools.

For the schools who did agree to participate, 538 consent forms were sent to parents, but only 13.9% were returned. Of those, 84% of children participated in the first wave of data collection, and 63% in the second wave (See Fig 2-2). Attrition from first to second wave was always due to school factors (e.g. did not arrange/agree time 2 visit with the researcher, or children were not available on the day of testing); no children declined to participate in the study.

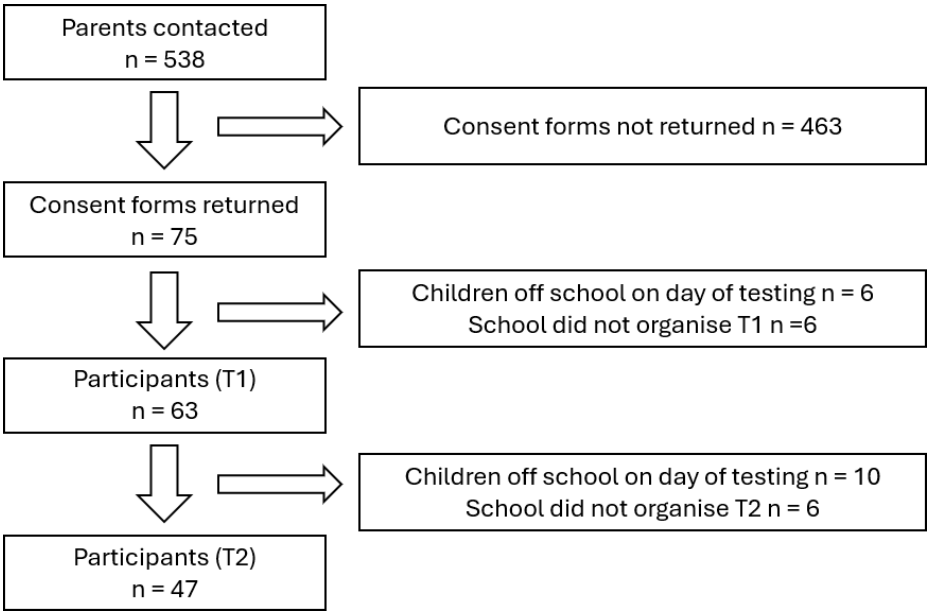


Figure 2-2. Flowchart of parent recruitment through schools. T1 refers to the first data collection time during the short-term longitudinal study. T2 refers to the second data collection time 3 months later.

This clearly shows that the first barrier to body image and disordered eating research in schools is the schools themselves, and the second barrier is the parents. We tried to alleviate schools' and parents' concerns and increase participation in several ways: we first of all offered paper and online consent forms to all schools, and three of the schools who participated in both time points used both. We secondly created an FAQ document which explained the aims and importance of the research being conducted and debunked common myths around body image research and its impact on children. We offered book vouchers to the school as well as a sticker/pen as a reward for each participant and made time to give talks in the schools to teachers, parents, or students on topics related to body image and disordered eating. Finally, we ensured that all of the materials that we prepared for teachers and parents passed a readability checker for ease of understanding, avoided using jargon and 'academic' terms, and tried to make the process of signing up as easy and quick as possible.

No data were gathered on reasons for non-consent by parents, but school contacts did sometimes

provide feedback to the lead researcher on comments some parents had made. These included discontent with the topic (especially disordered eating) and not wanting to answer certain questionnaires (especially parents of children under 12-years-old who had to fill out the pubertal development scale). As such, Chapters 4-6 of this thesis use alternative indirect methods of exploring body image in children such as eye-tracking, VR, and doll play, which may be more acceptable to parents, more enjoyable for children, and still provide rich data to answer our research questions.

In subsequent studies, I adapted the recruitment strategy to recruit parents directly using the Durham University Family Database which is a voluntary database for families across the North East of England, consisting of over 1800 children. For the data included in Chapters 5 and 6, participants were recruited through the database. Approximately 400 emails were sent to parents of eligible children and 13.5% of parents signed their child up (see Fig 2-3). A further 4% of parents got in touch regarding the study, to ask more about the study but did not sign their child up (n=6, 1.5%), to highlight ethical concerns (n=2, 0.5%), to ask to be removed from the database as they had moved away (n=3, 0.75%), or to inform me that their child struggled with a body image issue and could not participate (n=5, 1.25%). Of those who signed up, 78% attended sessions. The main reasons for cancelling were: no show (13%), cancelled without providing a reason (5%), or medical emergency (4%).

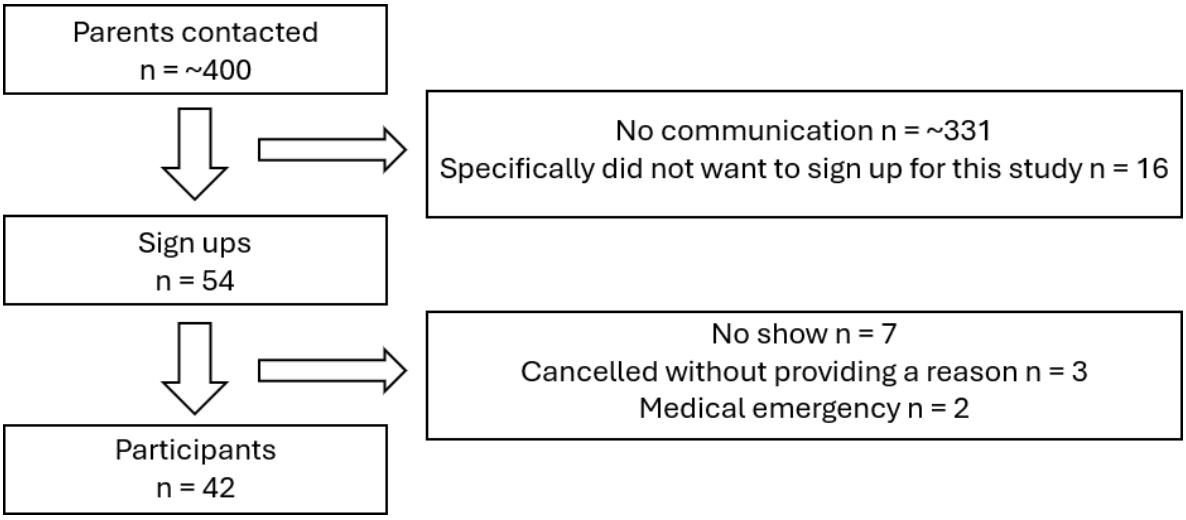


Figure 2-3. Flowchart of parent recruitment through database

We also attended the Junior Scientist event, a three-day event organised during the school summer holidays by the Durham University psychology department. Parents sign their children up and complete a general consent form for them to participate in the research studies being run (approximately 8-10 different studies covering a range of topics). In the year that we attended, 163 children attended. We recruited 33 participants, 20% of the overall available sample.

Finally, the research presented in Chapter 3 is from the Gateshead Millennium cohort. The original cohort included 1029 participants which represented 82% of the invited infants. By the data collection wave at age 15, 362 adolescents were still participating, representing 35.2% of the original participants. This suggests that cohort data may be an incredibly effective method of collecting large amount of data but attrition was still high with almost two thirds of participants having dropped out.

This evidences the extreme difficulty in recruiting children and adolescents for body image research. Both going through schools and emailing parents directly resulted in similar percentages of responses and eventual participation. Recruiting through parents was, however, significantly quicker, with the whole process from the initial email to having completed testing taking around 1 month per child, while going through schools took anywhere from 6 months to 2 years. As such, while recruiting parents directly may not have yielded more participants in this instance, it seems it may be a more time efficient method of recruitment for child body image and disordered eating studies.

In comparison, the research presented in Chapter 7 of this thesis aimed to recruit adults throughout the lifespan and across cultures to an online questionnaire study. In all three cultural groups

(Western, Nigerian, Chinese) samples were skewed towards the bottom end with most participants aged 18-30. Recruitment difficulties have been found in recruitment of older samples similarly to children, but the suggested barriers to participation are significantly different. While parents and schools are the main gatekeepers to child and adolescent research participation, participants over 30 often are not aware of ongoing research and are happy to take part when they find out about it. Additionally, adults, especially those with young children and/or full-time jobs are incredibly busy and may not have the time or the emotional and mental energy to complete a series of questionnaires. We were, however, still able to recruit a large sample, especially in Westen countries, suggesting that recruitment of adults to online questionnaires studies is, in my experience, somewhat easier than recruitment of children and adolescents.

Chapter 3: Risk factors for eating disorder symptoms at 15 years of age: a 9-year longitudinal cohort study

Abstract

Eating disorders (EDs) are typically diagnosed in the later stages of puberty, but risk factors for EDs are present in pre-pubertal children. This longitudinal, population-based birth cohort study aimed to examine prospective predictors of eating disorder symptoms in 15-year-olds. Specifically, we sought to test a new model of disordered eating aetiology in this group. Participants in the Gateshead Millennium Study birth cohort (n = 326; 187 girls and 175 boys) completed self-report questionnaires assessing eating disorder symptoms and risk factors at ages 7, 9, 12, and 15 years. Measures included body image, depressive symptoms, and pubertal development; we also measured BMI at each age. The data were fitted to a new model of eating disorder symptom development to help us understand the role of puberty, adiposity, body dissatisfaction/esteem, depression, and previous eating disorder symptoms. We found that previous eating disorder symptoms were the strongest predictor of eating disorder symptoms at 15, and that depression prospectively predicted eating disorder symptoms in girls. We furthermore found that depressive symptoms at 12 partially mediated the relationship between body esteem at 12 and eating disorder symptoms at 15 in girls. Puberty played a role in predicting concurrent eating disorder symptoms at 12 in girls but not boys. Overall, our findings support the roles of pubertal development, body esteem, and depressive symptoms in the pathogenesis of eating disorder symptoms across puberty. They demonstrate different pathways to eating disorder symptoms in girls and boys. These findings highlight the benefit of longitudinal cohort studies in this field and provide insight into the role of puberty in the development of body image and eating disorder symptoms, the second overarching aim of this thesis.

1. Introduction

Eating disorders tend to develop in adolescence, with incidence increasing drastically from age 10-12 to age 13-16 (Cybulski et al., 2021). Therefore, research efforts to elucidate the causes of disordered eating have typically included samples aged around 12 years, by which time pubertal development is generally already in its middle-late stages (L. Bond et al., 2006) and eating disorder symptoms are relatively prevalent (Croll et al., 2002; Stice et al., 2013). Specifically, anywhere between 2.6 and 22.4% of early adolescents have a full syndrome eating disorder (López-Gil et al., 2023), but between 12.3 and 56.9% report subclinical levels of eating disorder symptoms (Dias et al., 2023). Eating disorder symptoms encompass eating- and weight-related maladaptive behaviours and cognitions which are characteristic of full-syndrome eating disorders but typically less severe, frequent, and/or impairing. Understanding the developmental predecessors of eating disorder symptoms is important, as they are associated with weight gain, depression, anxiety, and full-syndrome eating disorders in later adolescence (Hahn et al., 2023; Landstedt et al., 2018), which are in turn associated with mental ill-health in adulthood (Linardon et al., 2021; Wade et al., 2012).

A range of factors have been implicated in the pathogenesis of disordered eating over the last four decades, including (epi)genetic, biological, sociocultural, and economic variables. In a review of the biopsychosocial predictors of eating disorders, Culbert et al. (2015) highlighted a research gap for prospective studies beginning substantially before adolescence and examining factors which influence the development of eating disorder symptoms prior to and across the course of puberty. A more recent review of eating disorder risk factors (Barakat et al., 2023) similarly concluded that prospective research is needed to examine relationships amongst risk factors from a developmental perspective. The current study addressed this gap by tracking eating disorder symptoms and putative predictors across eight years in children aged 7 years at baseline, with follow up measurements every 2 to 3 years until age 15.

1.1 Predictors of eating disorder symptoms from childhood to adolescence

Existing longitudinal developmental evidence from non-clinical populations is relatively scarce and has primarily involved samples of mid- to late-adolescent girls living in the USA. Findings with these groups indicate that higher adiposity leads to subsequent body dissatisfaction (Presnell et al., 2004), which in turn predicts disordered eating symptoms through the mediating influence of negative affect (Ferreiro et al., 2014; Stice et al., 2011), typically operationalised as depressive symptoms. Pubertal development is concurrently associated with higher adiposity (Silventoinen et al., 2022) but it may also longitudinally predict eating disorder symptoms for girls through psychosocial, genetic, and endocrine mechanisms

independent of BMI (Klump, 2013). These relationships, which constitute an adapted version of the Dual Pathway model of disordered eating (Lewis-Smith et al., 2020; Stice et al., 1996) are illustrated in Figure 3-1.

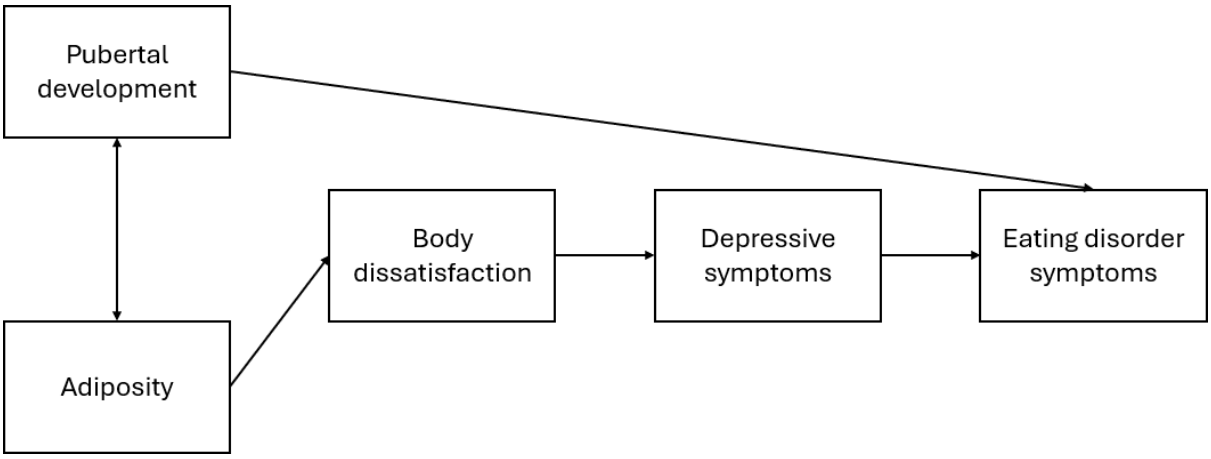


Figure 3-1. Hypothesised relationships amongst eating disorder symptom risk factors

The Dual Pathway Model was originally used to predict the development of bulimic symptoms in adulthood but it has since been prospectively applied to other forms of disordered eating in adults and adolescents (Holmes et al., 2015; Stice & Van Ryzin, 2019), and, cross-sectionally, to eating disorder symptoms in children (Evans et al., 2013; Vander Wal et al., 2008). It proposes that elevated adiposity leads to body dissatisfaction – the negative subjective evaluation of one's physical body and/or appearance - because individuals with higher weights experience a greater discrepancy between their current body and the societally-promoted appearance ideal. This prospective association is well-documented in adults and adolescents and is somewhat stronger in women than men (Cruz-Sáez et al., 2020; Cybulski et al., 2021; Myers & Crowther, 2009), but there is less evidence of it in children. However, a recent large observational cohort study (Blundell et al., 2024) demonstrated that increased BMI z-score at age 7 predicted body dissatisfaction at age 11; as seen in adults, the association was significantly stronger in girls than boys. These findings underscore the relevance and importance of examining factors in developmental pathways for disordered eating well before the onset of puberty.

Turning next to the prospective associations amongst body dissatisfaction, depressive symptoms, and eating disorder symptoms, the Dual Pathway model proposes that body dissatisfaction gives rise to global negative self-evaluations, underpinning the development of depressive symptoms. These may precipitate eating disorder symptoms in several ways, for example via shared tendencies towards

ruminative thinking (Nolen-Hoeksema et al., 2007; Skinner et al., 2012), or feelings of shame or guilt about one's body or eating behaviour (Presnell et al., 2009). Maladaptive eating behaviours may additionally be used to regulate overwhelming negative emotions (Evans et al., 2013). In children, Lewis-Smith et al. (2020) used an adapted dual pathway model and similarly found that pre-adolescent body dissatisfaction and depression mediated the relationship between childhood adiposity and future eating disorder symptoms. Blundell et al. (2024) found that body dissatisfaction at age 11 partially mediated the association between adiposity at 7 years and depressive symptoms at 14, supporting the causal pathways illustrated in Fig 3-1. The magnitude of associations in both studies was again stronger in girls than boys.

Peer-to-peer differences in pubertal development may particularly influence the development of eating disorder symptoms in girls (Vo et al., 2021). Adolescents who are either more or less advanced than their peers report heightened body dissatisfaction in boys and girls (Dantas et al., 2017; Thériault et al., 2019), depression in girls (van Rijn et al., 2023) and disordered eating symptoms in girls and boys (Le Grange et al., 2014). Despite puberty being an important factor in body image (Gatti et al., 2014; Riboli et al., 2022), previous longitudinal studies of eating disorder risk have seldom considered its role in conjunction with other risk factors.

1.2 Persistence of eating disorder symptoms across time

There is now substantial evidence that eating disorder symptoms are persistent across time in adolescents and adults, and growing evidence that this also applies to children (McClelland et al., 2020; Sanzari et al., 2023). Furthermore, one large systematic review of longitudinal studies of eating disorder development across childhood and adolescence suggests that early eating difficulties, dietary restriction, fasting, body dissatisfaction, weight and shape concerns, and other psychiatric symptoms (e.g., depression and anxiety) strongly predict future onset of non-clinical eating disorder symptoms (McClelland et al., 2020). This inherent stability does not argue against the need to identify other predictors of disordered eating from childhood to preadolescence – rather, it argues for the importance of detecting early symptoms of disordered eating when designing preventative approaches (Le et al., 2017).

Despite a growing body of longitudinal research into eating disorder risk factors, it remains unclear at what age specific factors become prospectively predictive. For example, body dissatisfaction has not been found to be a prospective predictor of increased eating disorder symptoms in several studies with younger children (Evans et al., 2017; Ferreiro et al., 2012; Rohde et al., 2015). Studies with older children (e.g., Sharpe et al., 2018) show a more reliable effect of body dissatisfaction as an emerging predictor around 13, however some studies have found it emerges slightly earlier, around 9 years (Gardner et al.,

2000). Few studies have measured depression before the age of 10, but there is evidence of its' role in adolescence (Ferreiro et al., 2012; Lewis-Smith et al., 2020; K. Murray et al., 2018) which persists into adulthood (Puccio et al., 2017). Finally, dietary restraint has been found to predict disordered eating through adolescence and adulthood (Kelly et al., 2015; Schaumberg et al., 2016; Stice & Van Ryzin, 2019), and is prevalent in youth before the average age of onset of disordered eating (Damiano et al., 2015), so may act as a good early indicator of eating disorder risk. To conclude, there is a clear need for research over longer timespans, measuring multiple risk factors alongside eating disorder symptoms, to clarify the age(s) at which specific factors cease to be merely cross-sectional correlates of disordered eating and become prospective risk factors.

1.3 Previous studies with the current birth cohort (Gateshead Millennium Study Cohort)

Two previous papers report earlier eating disorder symptom predictive data with this cohort at ages 9 and 12 respectively (Evans et al., 2017; Parkinson et al., 2012) A cohort profile has also been published (Parkinson et al., 2011) alongside a wide range of other outputs (see the website, GMS). Our previous studies showed that dietary restraint measured at 7 longitudinally predicted eating disorder symptoms at age 12, but that body dissatisfaction and depressive symptoms at 12 showed within time but not prospective associations with eating disorder symptoms. BMI did not directly predict eating disorder symptoms at any age. The current paper builds upon these previous publications, integrating data from all points of measurement to test a theoretical longitudinal model of eating disorder symptom aetiology. This further wave of data collection when participants were 15 years old presented a further opportunity to establish when – if at all – prospective relationships between variables emerged.

1.4 Current Study

The aim of the current study was to establish predictors of eating disorder symptoms in adolescents at age 15, drawing on data from 7, 9, and 12 years of age. We furthermore wanted to explore prospective predictors of body esteem and depression at 15 as these have been shown to be important predictors for current and future disordered eating symptoms. As such, we tested a new model of eating disorder symptom development from age 7-15 (Fig 3-2) separately for girls and boys.

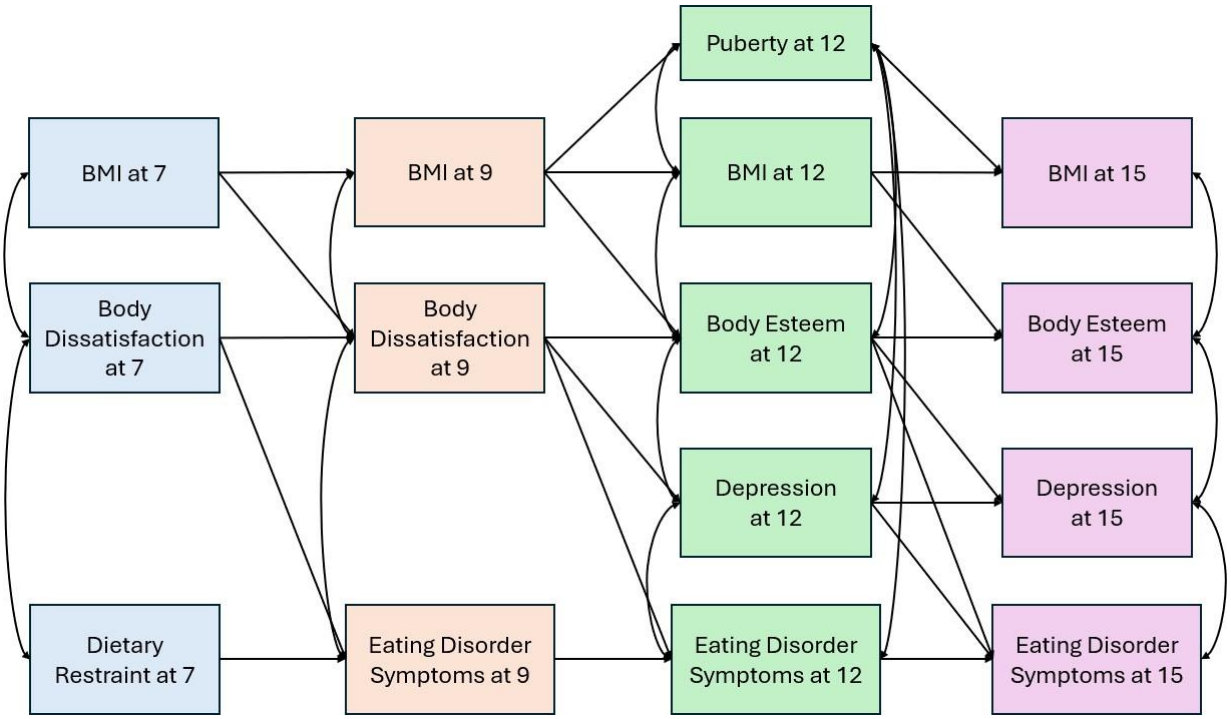


Figure 3-2. Proposed Model of Eating Disorder Symptom development from age 7-15. Straight arrows indicate prospective effects while curved arrows indicate covariation. Blue boxes indicate variables at age 7, orange boxes indicate variables at age 9, green boxes indicate variables at age 12, and pink boxes indicate variables at age 15.

Based on this literature review we developed four hypotheses. Due to the relationship between adiposity and body dissatisfaction/esteem, the first hypothesis was that higher BMI would predict higher body dissatisfaction or lower body esteem at the subsequent time point. Body dissatisfaction/esteem have been shown to be longitudinally predictive of eating disorder symptoms from early adolescence, so the second hypothesis was that higher body dissatisfaction or lower body esteem would directly predict increased depressive and eating disorder symptoms at the subsequent time point. Given that depressive symptoms have been shown to predict future eating disorder symptoms, the third hypothesis was that higher depression at 12 would predict increased disordered eating symptoms at 15. Finally, due to its association with higher adiposity and psychosocial, endocrine and genetic mechanisms in girls, we hypothesised that puberty would be a significant covariate of eating disorder symptoms for girls but not boys.

2. Methods

2.1 Participants

The study involved participants in the Gateshead Millennium Study (GMS) birth cohort. We

invited mothers of all infants born in 35 pre-specified weeks (June 1999 - May 2000) resident in Gateshead, an urban district in northeast England, to permit their infant(s) to join a longitudinal study of feeding and growth (Parkinson et al., 2007). 1029 infants (82% of those invited) joined the study. Mothers were primarily from the white ethnic majority group (98%) (Parkinson et al., 2010), which represented the ethnic composition of the region at the time. Full cohort details are published elsewhere (Parkinson et al., 2007, 2010).

We have followed up this cohort at intervals since recruitment. At each follow-up assessment, all children whose families had not previously asked to leave the study were eligible to participate. For the purposes of the present study, assessments of the children were taken at three follow ups: 6–8 years referred to as 7 years in this paper (median 7.4, range 6.4–8.4; n=609); 8–10 years referred to as 9 years (median 9.3, range 8.4–10.2; n=589); 11–13 years referred to as 12 years (median 12.5 range 11.6–13.3; n=525); and 15–16 years referred to as 15 years (median 15.2 range 14.5–16.2; n=362). The mean interval between the 7- and 9-year assessments was 1.9 years (*SD* = 0.2 years), the mean interval between the 9- and 12-year assessments was 3.2 years (*SD* = 0.3 years), and the mean interval between the 12- and 15-year assessments was 2.7 years *(SD* = 0.3 years). Mothers gave written consent for their own participation and for the child to participate in the study, and children/adolescents were also asked to provide assent from age 9 onwards.

Ethical approval was granted by Gateshead and South Tyneside Local Research Ethics Committee (7 year follow up) and by Newcastle University Research Ethics Committee (9-year, 12-year, and 15-year follow ups).

2.2 Measures

2.2.1 Body image

Different, age-appropriate measures of body image were used at different measurement timepoints, described below. A pictorial figure-choice scale, designed for preadolescents, was used at 7 and 9 years. A questionnaire for adolescents was used at 12 and 15 years.

i) The Children's Body Image Scale (CBIS) (Truby & Paxton, 2002, 2008) is a figure rating scale validated with children aged 7 to 12 as a measure of perceived and preferred body shape/size (Truby & Paxton, 2002). Children completed this scale at 7 years and 9 years. It consists of seven photographic images of boys and seven of girls ranging from very low to very high body mass index (representing the following BMI centiles: 3rd, 10th, 25th, 50th, 75th, 90th and 97th). Children view the images of either boys or girls depending on their gender. They select the image that looks most like them (perceived figure) and

the image they would like to look like (preferred figure). A directional discrepancy score between the two images can be calculated as an index of body dissatisfaction: images are numbered 1-7, from lowest to highest adiposity, and the perceived figure score is subtracted from the preferred figure score to produce a directional discrepancy score. A negative score indicates a preference for a smaller figure, and a positive score indicates a preference for a larger figure. The CBIS has good test-retest reliability (r = 0.7) (Truby & Paxton, 2008) and construct validity in boys and girls aged 7-11-years (Truby & Paxton, 2002).

ii) The Impact of Weight on Quality of Life-Kids (IWQOL-Kids) (Kolotkin et al., 2006) measures self-reported weight-specific quality of life for adolescents aged 11-19. We used the 9-item body esteem subscale at 12 and 15 years to assess body satisfaction. Participants indicate how frequently they experience an impact of weight on self-perceptions and appearance satisfaction using a Likert scale from 1 (always) to 5 (never). The subscale is a valid and reliable measure of body esteem (internal consistency: α = 0.95) (Kolotkin et al., 2006). Lower scores on the IWQOL-Kids indicate higher body esteem. In the current sample, the internal consistency of this subscale was α = 0.93 at 12-years and α = 0.96 at 15- years.

2.2.2 Eating disorder symptoms and dietary restraint

At the age 7 data collection, dietary restraint was measured as a proxy for eating disorder symptoms because the ChEAT (used at ages 9 and 12) and the EAT-26 (used at age 15) are unsuitable for children aged 6 or below.

iii) The 7-item restraint subscale of the Dutch Eating Behaviour Questionnaire child version (DEBQ- C) (van Strien & Oosterveld, 2008) was used to assess dietary restraint at 7 years. It consists of seven items which ask the participant to rate how often they eat reduced amounts of food in order to lose or maintain weight, to which they respond 'no', 'sometimes', or 'yes'. Higher scores on this scale indicate higher dietary restraint. This scale has shown high reliability and validity in boys and girls aged 7-12 (van Strien & Oosterveld, 2008). In the current sample, the internal consistency of this subscale was α = .60.

iv)The 23-item Children's Eating Attitudes Test (ChEAT) (Maloney et al., 1988) was used to assess eating disorder symptoms (Garner et al., 1982; Garner & Garfinkel, 1979) at 9 and 12 years. Participants

indicate how frequently they experience each symptom using a Likert scale from 1 (never) to 6 (always). Responses are scored 1, 2, or 3 for the three most symptomatic answers, with the three least symptomatic being scored 0. Scores are calculated by summing the answers, meaning that higher scores indicate more disordered eating symptomology. The ChEAT demonstrates good test-retest reliability (r = 0.8) and internal consistency (α = 0.9) (Maloney et al., 1988; Smolak & Levine, 1994) and is suitable for children from age 7. In the current sample, the ChEAT showed good internal consistency (α at 9 years = .83; 12 years = .85).

v) The 26 item Eating Attitudes Test (EAT-26) (Garner & Garfinkel, 1979) was used to assess eating disorder symptoms at 15-years. The EAT is virtually identical to the ChEAT, with only minor linguistic differences. It is scored in the same way as the ChEAT and demonstrates good reliability and internal consistency (Garner & Garfinkel, 1979; Ocker et al., 2007). In the current sample it showed good internal consistency (α = 0.88).

2.2.3 Depressive Symptoms

The 10-item Child Depression Inventory – Short Form (CDI-S) (Kovacs, 1992) was used to assess depressive symptoms at 12 and 15 years. Each item is made up of three statements regarding the participants' feelings over the preceding two weeks which are scored from 0 to 2. The total score is the sum of the ten items, with higher scores indicating greater depressive symptomology. The CDI has been found to be a valid (girls internal consistency α = .87; boys α = .84) and reliable (girls *r* = .74; boys *r* = .77) measure of depression with children aged 8-16 (Smucker et al., 1986). In the current study, the CDIs was completed at ages 12 and 15 with internal consistencies of α = .77 at age 12, and α = .89 at age 15.

2.2.4 Pubertal development

The 5-item Pubertal Development Scale (PDS) (Petersen et al., 1988) was used to measure pubertal development at age 12 and 15. Items ask about physical signs of pubertal maturation, and the last two are gender specific. Participants report whether the pubertal function has not started, barely begun, is underway, or is complete. Scores are calculated by averaging scores for all five questions with higher scores indicating the child is further through puberty. Scores can then be split into pre-, early-, middle-, and late-pubertal categories. The PDS has shown to have high internal consistency and reliability in both boys and girls across childhood and adolescence (Koopman-Verhoeff et al., 2020).

2.2.5 Adiposity (body measurements)

Weight and height were measured at each age using equipment bought from Chasmors, London. Weight was measured to 0.1kg using Tanita scales TBF-300MA, and height was measured to 0.1cm with

the head in the Frankfurt plane using a Leicester portable height measure. Measurements were taken a minimum of twice, and until two consecutive values within 0.1kg/0.1cm were taken and the mean of these two values was used. Body mass index (BMI) was calculated as kg/m^2 as a proxy for adiposity. It constitutes an acceptable and pragmatic index of total body fat and percentage of body weight as fat in child and adolescent samples (Pietrobelli et al., 1998).

2.2.6 Socio-economic status

Socio-economic status was measured using family's postcode at birth, which was transformed into the Townsend deprivation score (Townsend et al., 1989). Attrition was slightly higher in lower SES groups, but the overall distribution of SES remained broadly similar because children from lower SES families were purposefully over-recruited at baseline.

2.3 Procedure

The data were collected by researchers trained in anthropometry and the other study procedures. At each follow up the children were visited in schools, or at home, to collect anthropometric and questionnaire data. If necessary, the researchers helped the children with comprehension of the questionnaires, using a standardised study assessment protocol.

2.4 Statistical Analysis

Analyses were conducted on all cases where eating disorder symptom score at 15 years was recorded. In total, 362 adolescents were measured in the 15-year follow-up, and eating disorder symptom scores were available for all of these. BMI scores had already been calculated and were z-scored for age using the UK90 reference data set (Cole et al., 1995).

During analysis, anthropometric and scale data were not normally distributed, so the median and interquartile range was used to summarise the data, and Mann-Whitney U tests were used to compare scores between boys and girls. Correlations between values were calculated separately for boys and girls using Spearman's Rho with a significance threshold of $p<.005$ to correct for multiple comparisons. Path analysis was used to determine the relationship between across-time and within-time correlates of eating disorder symptoms at 15 for the boys and girls separately. We used R Studio (RStudio Team, 2023) to analyse the data, using the Tidyverse (Wickham et al., 2019), rstatix (Kassambara, 2023), lavaan (Rosseel, 2012), and semPlots (Epskamp, 2022) packages.

3. Results

3.1 Descriptive statistics

Disordered eating symptom data were collected for 362 adolescents (175 boys and 187 girls) at the 15-year follow up; 32.9% were 14 years old, 64.4% were 15 years old and 2.8% were 16 years old. Sample descriptives are shown by sex assigned at birth at each follow up assessment in Table 3-1. The proportion of complete data for each variable ranged from 81-86% at age 7, 80-92% at age 9, 94% at age 12 and from 98-100% at age 15.

Girls had significantly higher depressive symptom scores than boys at ages 12 and 15, and significantly higher body dissatisfaction scores at 9, 12, and 15 years old. There was no significant difference in dietary restraint/eating disorder scores between boys and girls at 7, 9, and 12 years of age, but girls had significantly higher scores at age 15. Girls were significantly more advanced in pubertal development than boys at ages 12 and 15.

Table 3-1. Median values for main variables and sex differences (n = 362).

	Boys (n = 175)		Girls (n = 187)			
	n (%)	Median (IQR)	n (%)	Median (IQR)	Z	p
7 years:						
BMI	147 (84.0)	15.9 (2.5)	162 (86.6)	16.4 (2.7)	-1.9	.060
BMI z-score	147 (84.0)	0.2 (0.5)	162 (86.6)	0.3 (0.8)	-0.9	.355
Dietary restraint	143 (81.7)	2.0 (0.6)	159 (85.0)	2.1 (0.6)	-0.1	.941
Body dissatisfaction	146 (83.4)	0.0 (1)	156 (83.4)	-1.0 (2)	-1.9	.053
9 years:						
BMI	152 (86.9)	16.9 (2.8)	173 (92.5)	17.8 (3.0)	-2.8	**.005**
BMI z-score	152 (86.9)	0.4 (0.8)	173 (92.5)	0.5 (1.0)	-1.0	.339
Eating disorder symptoms	141 (80.6)	13.0 (12.0)	171 (91.4)	10.0 (11.0)	-2.7	.008
Body dissatisfaction	152 (86.9)	0.0 (1)	172 (92.0)	-1.0 (1.0)	-3.1	**.002**
12 years:						
BMI	160 (91.4)	19.2 (4.2)	176 (94.1)	20.3 (4.6)	-2.7	.007
BMI z-score	160 (91.4)	0.6 (1.3)	176 (94.1)	0.7 (1.3)	-0.4	.681
Eating disorder symptoms	160 (91.4)	6.5 (6.0)	176 (94.1)	6.0 (9.0)	-0.2	.804
Depressive symptoms	160 (91.4)	1.0 (2.0)	176 (94.1)	2.0 (3.3)	-3.8	**<.001**
Body esteem	160 (91.4)	100.0 (5.6)	176 (94.1)	91.7 (25.7)	-5.5	**<.001**
Puberty	160 (91.4)	2.0 (0.8)	176 (94.1)	2.3 (0.9)	-4.3	**<.001**
15 years:						
BMI	173 (98.9)	20.4 (4.5)	183 (97.9)	22.3 (5.1)	-4.1	**<.001**
BMI z-score	173 (98.9)	0.4 (1.0)	183 (97.9)	0.8 (1.5)	-2.3	.021
Eating disorder symptoms	175 (100.0)	4.0 (4)	187 (100.0)	7.0 (9.0)	-5.2	**<.001**
Depressive symptoms	175 (100.0)	1.0 (2.0)	187 (100.0)	3.0 (6.0)	-7.2	**<.001**
Body esteem	175 (100.0)	100.0 (5.6)	187 (100.0)	83.3 (38.9)	-8.5	**<.001**
Puberty	174 (99.4)	3.0 (1.8)	186 (99.5)	3.9 (1.0)	-10.4	**<.001**

Boldface shows p<.005. IQR, interquartile range; BMI, Body Mass Index; n, number of participants whose data was available for the specified variable.

Zero-order non-parametric correlations (Spearman's rho) for each variable at ages 7, 9, 12, and 15 are reported in Table 3-2. For boys, eating disorder symptoms at 15 were negatively associated with body image at 15, and positively associated with depressive symptoms. For girls, eating disorder symptoms at 15 were correlated positively with BMI at 7, disordered eating at 9, BMI, depressive symptoms and

disordered eating at 12, and depressive symptoms and puberty at 15, while body esteem at 12 and body esteem at 15 correlated negatively.

Table 3-2. Correlations among eating disorder symptoms at 15 years of age and other key variables for boys and girls.

		7y			9y			12y					15y				
		BMI	Dietary restraint	Body dissatisfaction	BMI	Eating disorder symptoms	Body dissatisfaction	BMI	Eating disorder symptoms	Body esteem	Depressive symptoms	Puberty	BMI	Eating disorder symptoms	Body esteem	Depressive symptoms	Puberty
7y	BMI	-	.08	**-.35**	**.88**	.09	**-.43**	**.75**	.09	**-.35**	.15	**.23**	**.67**	**.23**	**-.28**	.09	**.25**
	Dietary restraint	.10	-	-.11	.09	.05	-.02	.21	-.00	.00	-.01	.05	.08	.08	-.00	-.07	.07
	Body dissatisfaction	**-.34**	-.06	-	**-.42**	.02	.18	**-.31**	.05	-.01	-.03	-.19	**-.32**	-.00	.18	-.06	-.14
9y	BMI	**.91**	.18	-.24	-	.03	**-.47**	**.84**	.13	**-.38**	.11	**.25**	**.72**	.15	**-.32**	.10	**.25**
	Eating disorder symptoms	-.05	.12	.12	-.03	-	-.21	.16	**.37**	-.21	**.33**	.01	.17	**.32**	-.09	.19	-.06
	Body dissatisfaction	**-.36**	-.10	.21	**-.40**	-.18	-	**-.41**	-.07	.16	-.07	-.16	**-.43**	-.20	**.24**	-.07	-.15
12y	BMI	**.78**	.15	-.19	**.84**	.11	**-.39**	-	**.23**	**-.41**	.12	**.33**	**.84**	**.22**	**-.38**	.13	**.31**
	Eating disorder symptoms	.09	.20	.01	.14	**.34**	-.08	.18	-	**-.56**	**.56**	.18	**.23**	**.51**	**-.37**	**.29**	.14
	Body esteem	-.22	-.11	-.01	**-.27**	-.15	.20	**-.35**	-.20	-	**-.63**	**-.31**	**-.39**	**-.42**	**.64**	**-.43**	**-.30**
	Depressive symptoms	.09	.06	-.03	.06	**.25**	-.15	.04	.12	**-.44**	-	**.22**	.09	**.40**	**-.48**	**.52**	.14
	Puberty	**.24**	.06	-.22	**.29**	.06	-.22	**.23**	.03	-.15	.10	-	**.23**	.19	**-.23**	.12	**.56**
15y	BMI	**.72**	.20	-.18	**.78**	.06	**-.38**	**.85**	.14	**-.29**	.06	.22	-	.17	**-.36**	.08	**.23**
	Eating disorder symptoms	-.04	-.11	-.09	-.04	.18	.05	.04	.21	-.17	.17	.00	.01	-	**-.56**	**.41**	**.26**
	Body esteem	-.18	-.09	.08	**-.23**	-.08	.07	**-.28**	-.16	**.46**	**-.38**	-.12	**-.27**	**-.34**	-	**-.63**	**-.32**
	Depressive symptoms	.04	-.01	-.01	.11	.13	-.12	.03	.11	**-.33**	**.38**	.12	.02	**.26**	**-.45**	-	.17
	Puberty	.13	.06	-.12	.12	-.10	.06	.19	.12	-.02	-.00	**.35**	.20	.10	-.06	.01	-

Correlations are Spearman's rho. Coefficients for boys are shown below the diagonal, and coefficients for girls are shown above the diagonal. Boldface signifies p<.005.

3.2 Path analysis for eating disorder symptoms at 15 years old in girls

3.2.1 Fit Indices

Goodness-of-fit indices were reported for each model. As suggested by Hu and Bentler (1999) and Iacobucci (2010) we included: the X^2 and its corresponding *df*; the standardised root mean square residual (SRMR); the comparative fit index (CFI); the Tucker-Lewis Index (TLI); and the root mean squared error of approximation (RMSEA). For X^2, a non-significant X^2 value ($p>.05$), for CFI and TLI a value of >0.95, for SRMR a value of <0.08, and for RMSEA a value of <0.06 would indicate good model fit.

The full models that we tested were intended to explore both significant and non-significant paths in the longitudinal development of eating disorder symptoms from childhood to middle adolescence. As such, the models were over-fitted and goodness of fit measures were not expected to be ideal.

3.2.2 Model Comparison

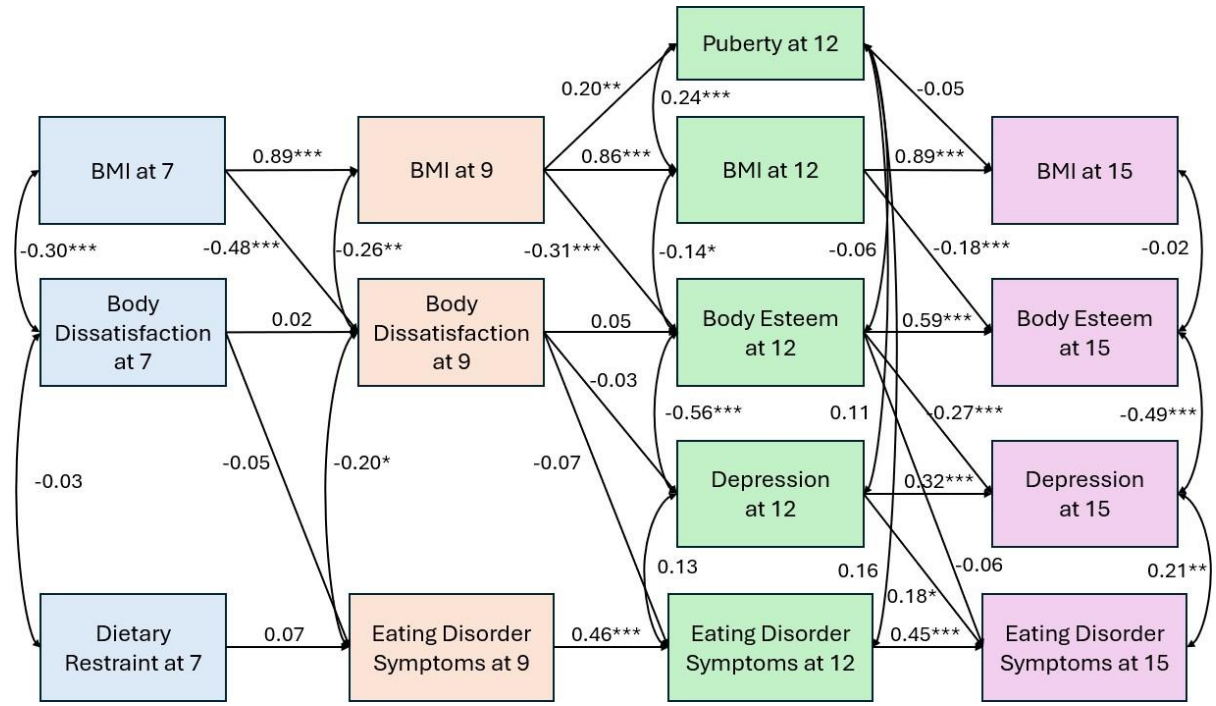
Table 3-3 shows the fit indices for each model. Model 1 shows the full model for girls using data from ages 7-15. The fit indices for Model 1 (Fig 3-3 Panel A) indicated that the model was not an optimal fit for the data as the X^2 was significant, and the SRMR, TLI, CFI, and RMSEA are not within acceptable ranges. Model 2 (Fig 3-3 Panel B) consisted of Model 1 with paths where p was >.100 were removed. This remained a suboptimal fit for the data.

Table 3-3. Fit indices for the two models in girls.

	X^2	***df***	**p-value (Chi-Squared)**	**SRMR**	**CFI**	**TLI**	**RMSEA**
Model 1	287.28	70	<.001	0.131	0.855	0.787	0.129
Model 2	284.79	69	<.001	0.148	0.857	0.811	0.129

Notes. SRMR = standardised root mean square residual; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation. Model 1 = original model; Model 2 = Model 1 with paths where p>.100 removed.

A



B

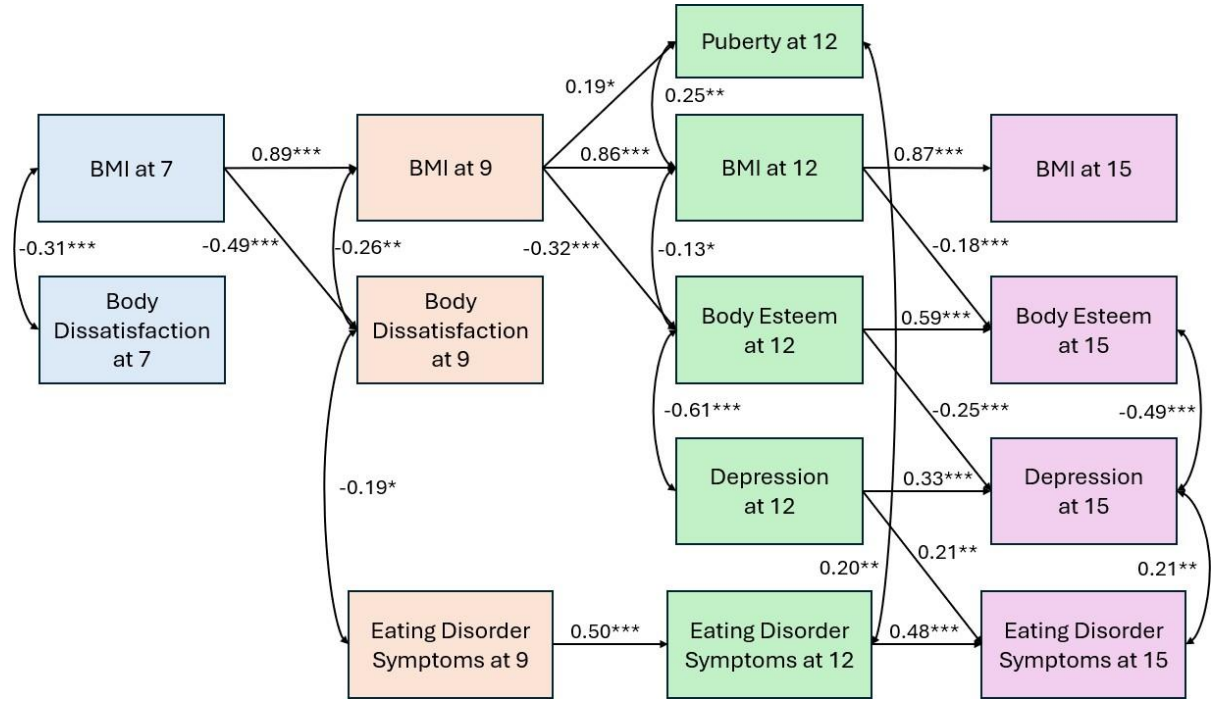


*Figure 3-3. Path analysis models of associations between dietary restraint, BMI, body esteem/dissatisfaction, puberty, and depression (depressive symptoms) on disordered eating symptoms in girls across ages 7, 9, 12 and 15. Coefficients presented are standardised linear regression coefficients. *p<.05, **p<.01, ***p<.001. All variables from each age are colour coded for*

ease of understanding: Blue = Age 7; Orange = Age 9; Green = Age 12; Pink = Age 15. Panel A shows Model 1; Panel B shows Model 2.

Therefore, in the final model (Model 2), we found that higher BMI at 7 significantly predicted increased BMI and higher body dissatisfaction at 9, and covaried negatively with body dissatisfaction at 7 (indicating more desire for a thinner body). At 9 years, BMI predicted more advanced puberty, increased BMI, and decreased body esteem at 12 and covaried negatively with body dissatisfaction at 9 (indicating more desire for a thinner body). Furthermore, eating disorder symptoms at 9 significantly predicted increased eating disorder symptoms at 12. At 12 years, higher BMI predicted higher BMI and decreased body esteem at 15; higher body esteem scores at 12 predicted higher body esteem scores and lower depression scores at 15; higher depression scores at 12 predicted higher depression scores and more eating disorder symptoms at 15; and higher eating disorder symptom scores at 12 predicted higher disordered eating symptom scores at 15. Furthermore at 12, puberty covaried positively with BMI, which covaried negatively with body esteem, which in turn covaried negatively with depression. Depression positively covaried with eating disorder symptoms although not significantly so. At 15 years, only body esteem covaried negatively with depression.

3.3 Depressive symptoms as a mediator of the relationship between body esteem and disordered eating symptoms in girls

Due to the hypothesised mediation effects of depressive symptoms at 12 between body esteem at 12 and disordered eating at 15 in girls, a mediation analysis was conducted with depression at 12 as the mediator. A Sobel test indicated a significant mediation effect ($z = -3.22$, $p = .001$), suggesting that depression at 12 significantly mediated the relationship between body esteem at 12 years and eating disorder symptoms at 15 years in girls (see Fig 3-4).

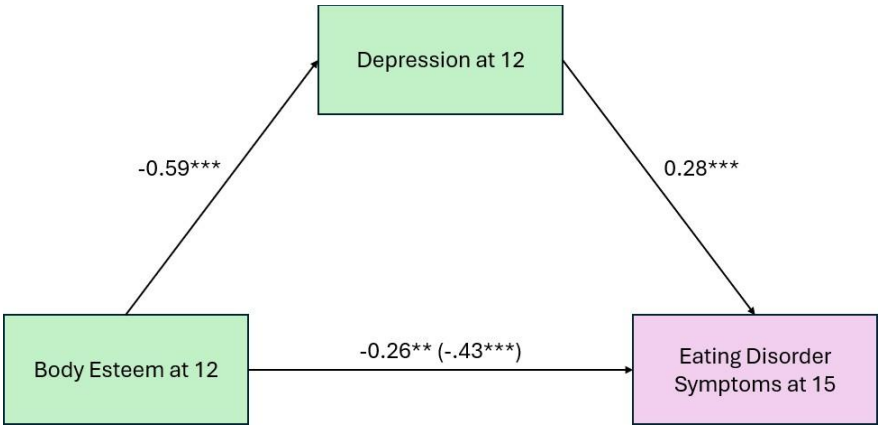


*Figure 3-4. Mediation model showing the relationship between body esteem at 12 and eating disorder symptoms at 15 with the depression at 12 as the mediator. Coefficients presented are standardised linear regression coefficients. Coefficients in parentheses represent the direct, unmediated effect. *p<.05, **p<.01, ***p<.001.*

3.4 Path analysis for eating disorder symptoms at 15 years old in boys

Goodness-of-fit indices were calculated in the same way as for the girls.

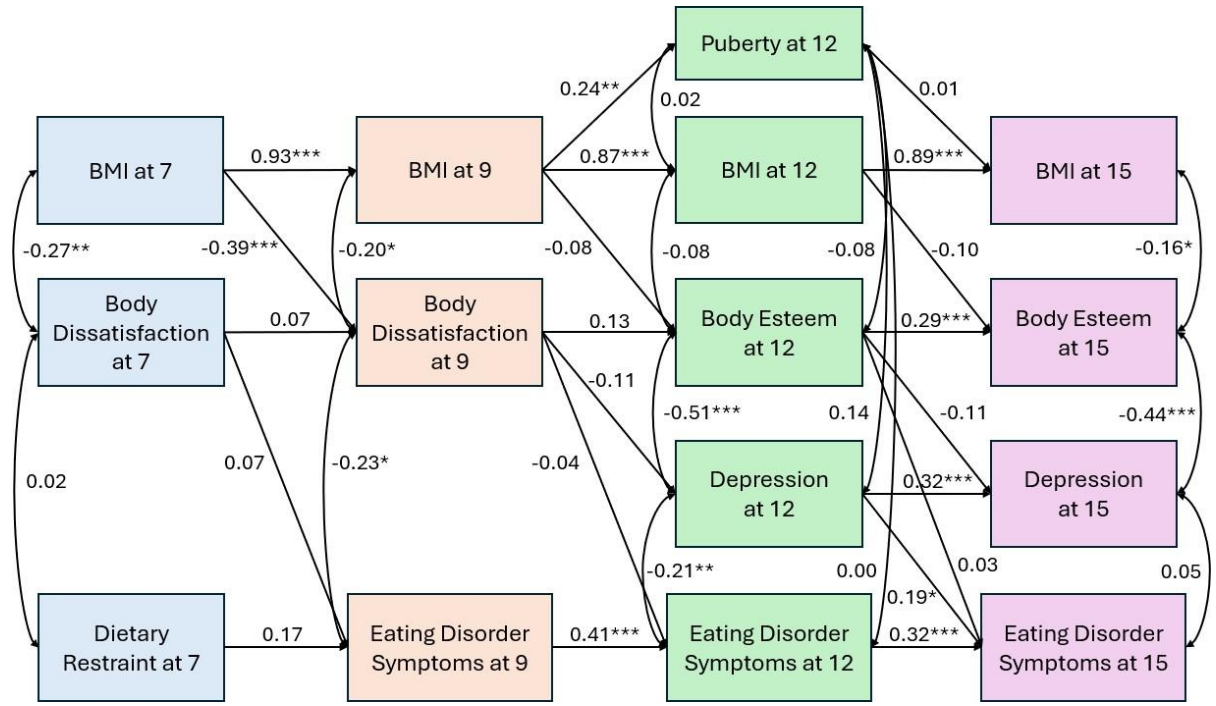
Table 3-4 shows the fit indices for each model. Model 3 (Fig 3-5 Panel A) shows the full model for boys using data from ages 7-15. The fit indices for Model 3 indicated that the model was not an optimal fit for the data as the X^2 was significant, and the SRMR, TLI, CFI, and RMSEA are not within acceptable ranges. Model 4 (Fig 3-5 Panel B) consisted of Model 3 with the paths where p was above .100 were removed and was a better though not perfect fit for the data as CFI was within the acceptable range (CFI >.95), and TLI and RMSEA are very close to optimal range (TLI >.95; RMSEA <.06).

Table 3-4. Fit indices for the two models in boys.

	X^2	***df***	**p-value (Chi-Squared)**	**SRMR**	**CFI**	**TLI**	**RMSEA**
Model 3	165.75	70	<.001	0.092	0.910	0.867	0.088
Model 4	148.74	87	<.001	0.091	0.935	0.921	0.070

Notes. SRMR = standardised root mean square residual; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation. Model 3 = original model; Model 4 = Model 3 with paths where p>.100 removed.

A



B

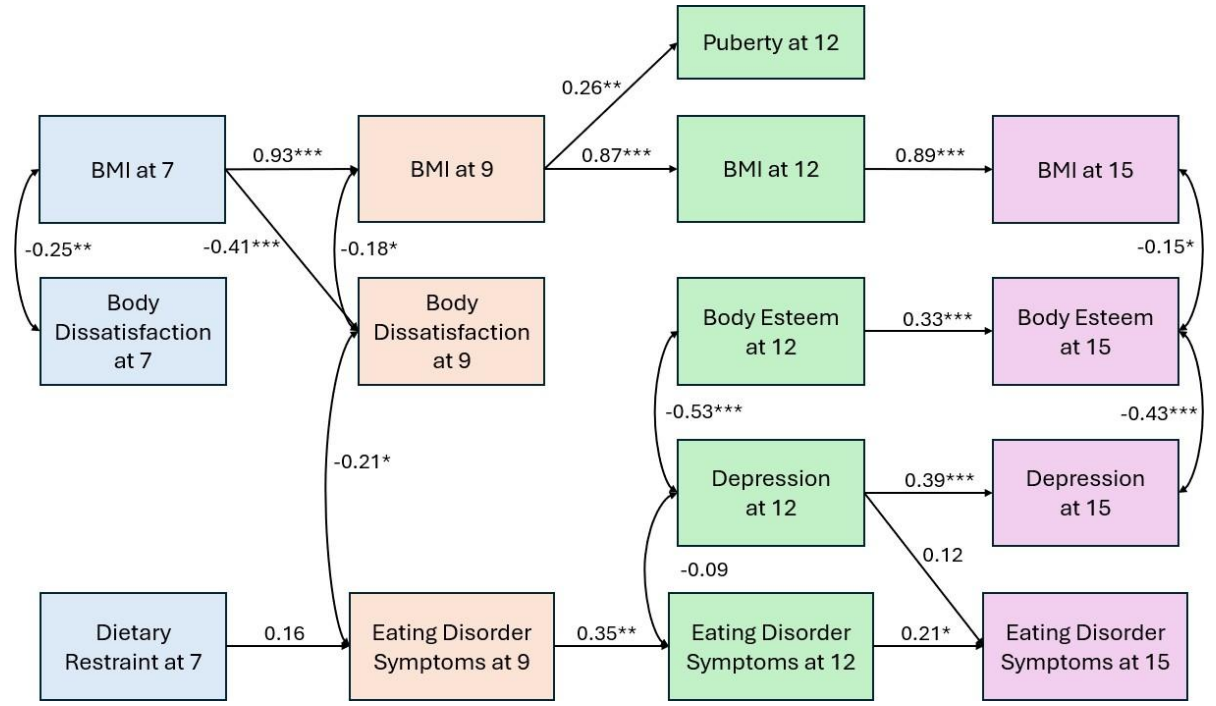


*Figure 3-5. Path analysis models of associations between dietary restraint, BMI, body esteem/dissatisfaction, puberty, and depression on disordered eating symptoms in boys across ages 7, 9, 12 and 15. Coefficients presented are standardised linear regression coefficients. *p<.05, **p<.01, ***p<.001. Panel A shows Model 3; Panel B shows Model 4.*

Therefore, in the final model (Model 4), we found that higher BMI at 7 significantly predicted increased BMI and higher body dissatisfaction at 9, and covaried negatively with body dissatisfaction at 7 (indicating more desire for a thinner body). At 9 years, BMI predicted more advanced puberty and increased BMI, and covaried negatively with body dissatisfaction at 9 (indicating more desire for a thinner body). High body dissatisfaction at 9 was non-significantly predictive of higher depression at 12, and significantly covaried with higher eating disorder symptoms at 9. Furthermore, more eating disorder symptoms at 9 significantly predicted increased eating disorder symptoms at 12. At 12 years, higher BMI predicted higher BMI at 15; higher body esteem scores at 12 predicted higher body esteem scores at 15; higher depression scores at 12 predicted higher depression scores and non-significantly predicted more eating disorder symptoms at 15; and higher eating disorder symptoms at 12 non-significantly predicted higher disordered eating symptoms at 15. Furthermore at 12, body esteem covaried negatively with depression. At 15 years, BMI negatively covaried with body esteem, which covaried negatively with depression, which in turn covaried positively with disordered eating symptoms.

4. Discussion

The aim of this study was to examine longitudinal predictors of eating disorder symptoms in a cohort of 15-year-olds using data gathered previously at ages 7, 9, and 12 years. We examined the extent to which a theoretical model of eating disorder symptom development reflected the prospective and within-time relationships observed in the data.

The first hypothesis was that higher BMI would predict higher body dissatisfaction or lower body esteem at the following time point. We found that this hypothesis was supported at each age in girls, but only for BMI at 7 which predicted body dissatisfaction at age 9 in boys. This finding is in line with previous research which has found that adiposity is a stronger predictor of body dissatisfaction in girls than boys (Blundell et al., 2024). This is theorised to be due to the differing body size ideals for boys and girls, where the ideal of girls is thinness while the ideal for boys emphasises muscularity (S. B. Murray et al., 2017). This is somewhat supported by the literature with early adolescent boys where their reported role models were all athletes, in particular football players, while girls reported more models, pop stars, and actresses as role models (Tatangelo & Ricciardelli, 2017).

The second hypothesis was that higher body dissatisfaction or lower body esteem would predict increased depressive and eating disorder symptoms at the next time point. In girls, we found that the relationship between body esteem at age 12 and eating disorder symptoms at age 15 was

partially mediated by depression at 12. At younger ages we did not find a significant relationship between girls' body dissatisfaction and dietary restraint or future eating disorder symptoms, however boys' and girls' body dissatisfaction at 9 was related to eating disorder symptoms at 9. This finding partially replicates what has been found previously: that body esteem emerges as a predictor for current disordered eating in pre-adolescence (K. L. Allen et al., 2008; Forrester-Knauss et al., 2012) but does not become a longitudinal predictor until middle-adolescence and adulthood (Ferreiro et al., 2012; M. Martini et al., 2023; Rohde et al., 2015; Stice & Shaw, 2002). Furthermore, had we included a measure of dietary restraint past 7-years old, we may have found more robust predictive effects of pre- pubescent body dissatisfaction as previous studies have found that body dissatisfaction in pre-adolescents significantly predicted future dietary restraint but not disordered eating symptoms (K. L. Allen et al., 2008; Forrester-Knauss et al., 2012).

Alternatively, research has found that body esteem is prone to fluctuations throughout adolescence (Lacroix et al., 2023; Morin et al., 2017; Nelson et al., 2018; S. B. Wang et al., 2019) and does not stabilise until early adulthood (Lacroix et al., 2023). Body esteem is suggested to follow distinct pathways, with some research suggesting low, moderate and high esteem pathways are somewhat stable through middle-late adolescence (Lacroix et al., 2022; S. B. Wang et al., 2019) while others suggest it is only stable in high body esteem trajectories (Morin et al., 2017; Nelson et al., 2018). Additionally, it has been found to be influenced by a host of external variables such as appearance-related teasing (Lacroix et al., 2022), quality of inter-personal relationships (Morin et al., 2017), and general self- esteem (S. B. Wang et al., 2019), so it could be argued that body esteem, particularly moderate-low body esteem, is too variable to be a consistent longitudinal predictor until it stabilises in late adolescence and early adulthood.

The third hypothesis was that higher depression at 12 would predict increased disordered eating symptoms at 15. The Dual Pathway Model (Stice et al., 1996; Stice & Agras, 1998) posits that body dissatisfaction predicts disordered eating via increased depression; the current data were concordant with this and found that depression at 12 partially mediated the relationship between body esteem at 12 and disordered eating symptoms at 15 in girls. Interestingly for the boys, depression at 12 did not significantly predict concurrent disordered eating but was close to predicting future disordered eating. Understanding the mechanisms behind this pathway may be key to understanding disordered eating development in boys. One study suggested that boys use eating as a means of 'self-soothing' their depressive symptoms (Lewis-Smith et al., 2020) while others have found that external factors such as social support play a key role in the relationship between depressive symptoms and

disordered eating (Ferreiro et al., 2012). Both suggestions are supported in the original Dual Pathway Model (Stice et al., 1996) where perceived sociocultural pressure predicted both body dissatisfaction and dietary restraint, and disordered eating was suggested to be a way of coping with negative affect.

Finally, we hypothesised that puberty would be a significant covariate of eating disorder symptoms for girls but not boys. This hypothesis was fully supported by the results, with girls who were further along in puberty at 12 reporting higher eating disorder symptoms at 12. This is in accord with previous literature which has found that girls who are more advanced in pubertal development have higher eating disorder symptoms (Le Grange et al., 2014; Vo et al., 2021). We did not however find that pubertal development was related to within time body dissatisfaction or depression in either boys or girls. This is not in keeping with the literature which has found these relationships (Dantas et al., 2017; Thériault et al., 2019; van Rijn et al., 2023), however some of these proposed relationships, such as between body dissatisfaction and puberty, were found to be non-significant when BMI was included in the model (Dantas et al., 2017); as such, our model may indicate that covariates of body dissatisfaction and depression explain any variance caused by pubertal development.

Looking at the model as a whole, the strongest predictor of disordered eating symptoms at 15 in girls and boys was eating disorder symptoms at 12. This is in line with previous GMS publications (Evans et al., 2017) and other research (Abebe et al., 2014; Neumark-Sztainer et al., 2007) which have found that eating disorder symptoms tend to be stable across time.

Although we did not directly test sex differences, our results suggest there may be some key differences in the pathways that predict outcomes at 15. At age 15, we found that in girls body esteem covaried with depression which covaried with eating disorder symptoms, and for boys, BMI covaried with body esteem which covaried with depression. As these variables are so strongly related, it is important to consider what their prospective predictors are in addition to the prospective predictors of eating disorder symptoms. Our finding that BMI significantly influenced future body esteem in girls at each age but only from 7-9-years in boys is somewhat in line with previous literature which suggests that heavier weight predicts more weight-related teasing, which is a stronger predictor of body dissatisfaction in girls but not boys (Jendrzyca & Warschburger, 2016). However, previous literature has also found a direct effect of weight status on future body dissatisfaction and disordered eating in boys (Lewis-Smith et al., 2020) which was not replicated in the current study. The influence of puberty on BMI in girls could alternatively be representative of a bi-directional relationship between weight and puberty. In girls, those who were heavier have been found to experience the onset of puberty sooner

than those who are lighter (Brix et al., 2020; Li et al., 2017). Therefore, those who are heavier and experience puberty earlier (which will also increase weight further) may feel different to their peers and/or experience weight-related bullying (Côté et al., 2020) which could negatively influence body eating disorder symptoms, as suggested in our model.

We furthermore found that each variable at 12 years old autocorrelated with itself at 15 for both girls and boys, but only prospectively predicted another variable (BMI ➔ body esteem; body esteem ➔ depression; depression ➔ eating disorder symptoms) in girls. This suggests that eating disorder symptoms in boys may be driven in part by variables not included in the current study.

Compared to previous studies using the GMS cohort, we found that dietary restraint at 7 was not a significant prospective predictor of eating disorder symptoms at 9 or 12, as reported previously (Evans et al., 2017; Parkinson et al., 2012) but was not a significant predictor in the current model (although there was a trend towards significance in boys). This may be a consequence of the reduced sample size over time. All of the other relationships which were tested in the current model remained significant, adding support for the previous findings using this cohort.

Interestingly, we found no direct predictive effects of body dissatisfaction or esteem on eating disorder symptoms at any age for boys or girls. In girls, this lack of significant relationship in the whole model is explained by the partial mediation effect of depression, which is what we expected based on previous models (Lewis-Smith et al., 2020; Stice et al., 1996; Stice & Agras, 1998), but this relationship is not evidenced in boys. This could be due in part to the method of measuring body dissatisfaction at ages 7 and 9, as boys may have been equally likely to choose a smaller or a bigger figure due to the muscular *and* lean masculine ideals (McLean et al., 2018).

In the models we present, the 7- and 9-year-old data is not particularly longitudinally salient, with only BMI at 9 in girls predicting variables other than itself. This may indicate that development of risk factors at 7- or 9-years-old may be more important when considering maintenance of those risk factors which then become risk factors for disordered eating around age 12. That is to say, predictors of eating disorders in pre-pubertal periods are important because they predict concurrent risk rather than future risk.

4.1 Limitations and directions for future research

While this study contributes to our understanding of the development of disordered eating through childhood and adolescence, there are several limitations which must be taken into

consideration. First, measures were not consistent across time; body dissatisfaction was measured at age 7 and 9 using the CBIS while body esteem was measured at ages 12 and 15 using the IWQOL-Kids. Disordered eating was only measured from age 9 onwards, with dietary restraint measured at the 7-year time point. Depression and puberty were not measured before the 12-year time point, making it impossible to track when depression becomes a longitudinally significant predictor of future disordered eating.

Some known predictors of disordered eating and body image were not included in the study, such as sociocultural pressures, family and peer relationships, or internalisation of body ideals, meaning that we may be missing some key pathways in the development of disordered eating. Future research should consider how sociocultural factors interact with the variables included in our models to predict disordered eating across childhood and adolescence.

By 15-years-old, sample attrition was high, with only 35.8% of the original sample remaining. Since we split the sample by gender, this meant our sample size for the final models was fairly small and this can influence the suitability of structural equation modelling (Devlieger & Rosseel, 2017). However, with a relatively simple model such as ours, and almost 200 participants per sample, the model should be robust enough for the purposes of the current study.

4.2 Conclusions

In conclusion, we investigated pathways to disordered eating at 15 separately in boys and girls. Our results allow us to consider the full pathway of eating disorder development and showed differing pathways by gender for the development and maintenance of disordered eating. Our study adds to the growing body of literature investigating how disordered eating attitudes develop throughout childhood and adolescence, and what factors may increase risk of eating disorder development.

Chapter 4: It's a doll's world: How children's internalised sociocultural ideals influence doll choice and gendered play

Abstract

Thin ideal internalisation has been evidenced in children from as early as 3-years-old, and gender stereotypes are thought to strengthen through infancy to reach peak rigidity around 6-years-old. Doll play is an easy, cheap, and child friendly way of assessing sociocultural attitudes towards bodies and gender stereotypes in young children. The current study therefore aimed to use doll play to investigate the interactions between thin ideal internalisation and gender stereotypes, using interviews and recording of child play. 32 participants aged 4-10 years old were recruited to take part in short (~10 minute) interviews while they played with a doll of their choice from a range of healthy child-like dolls, and both realistic and ultra-thin or muscular adult-like dolls. Three themes were developed from the interviews: Children's judgements and biases about different sized dolls; Social expectations of age and gender; and Exploring life through play. Through these themes we see key links between thin ideal internalisation and internalised gender stereotypes in children as young as 4 years old, but only for play with adult-like dolls. This study allowed us to explore young children's internalisation of sociocultural appearance ideals in a parent-approved manner, providing key insights into how sociocultural ideals are internalised and manifest behaviours at a young age. This study therefore links to both the first (investigate how sociocultural ideals influence body image development) and third (assess methodologies for studying body image and eating disorder risk which are age appropriate and approved of by parents) overarching aims of the thesis.

1. Introduction

Body image is believed to develop during adolescence, but children as young as 5-years-old have expressed dissatisfaction with their body (Hayes & Tantleff-Dunn, 2010; Pallan et al., 2011; Perez et al., 2018), and between 20-70% of children under 6-years-old report being dissatisfied with their body (Tatangelo et al., 2016). A key factor in this early development may be internalisation of the thin-ideal body, which has been found in children as young as 3-years-old (Harriger et al., 2010). Given the difficulties highlighted in the introduction of this thesis and reiterated in Chapter 2 around conducting body image studies in a young population using questionnaires, we aimed to qualitatively explore 4-11-year-old children's thoughts on different sized dolls in an ecologically valid setting. We also wanted to determine if doll choice influenced play style in young children. Previous studies have shown that girls who played with Barbie reported perceiving fewer career options (Sherman & Zurbriggen, 2014), and content analyses have found that traditional gender stereotypes are clear and defined in toys, costumes, books, cards, and adverts aimed at children (Boyd & Murnen, 2017; Murnen et al., 2016; Pownall & Heflick, 2023; Valtorta et al., 2023) but no studies have looked directly at the link between doll play and gendered play behaviours.

Toy ownership is high, particularly in Western children. In 2021, retail sales for dolls in the United States of America was approximately 3.78 billion US dollars (*Toys*, n.d.), and studies have reported between 59-88% of children own at least one doll (Anschutz & Engels, 2010; Sherman & Zurbriggen, 2014; Worobey & Worobey, 2014), with Worobey and Worobey's (2014) sample owning an average of 5 Barbie dolls each. It is therefore important that we understand how children interact with them, and what thought process lies behind the decision to play with one doll over another.

1.1 Dolls' influence on children's body image

The effect of doll play on children is not fully understood, and studies to date have found conflicting results. Dittmar, Halliwell and Ive (2006) found that looking at pictures of Barbie in a story book resulted in a significant decrease in 5-7-year-old girls' body image compared to girls who read a book with pictures of Emme, or girls who read a book with no pictures. The authors suggest that Barbie acts as an aspirational role model, and that young girls who interact with Barbie will have increased thin-ideal internalisation. However, Barbie as an aspirational role model does not fully explain this effect; Jellinek et al. (2016) found that doll familiarity (Barbie vs an unfamiliar doll) did not change the results that girls who played with the thin dolls desired a thinner body compared to those who played with the full-figured doll.

Contrary to these, Anschutz and Engels (2010) found no differences in 6-10-year-old girls' body image after 10 minutes of play between girls who played with an ultra-thin doll and girls who played with an average sized doll or no doll. They did however find that girls who played with the average sized doll ate more during a subsequent taste test than girls who played with the thinner doll, indicating that playing with ultra-thin dolls may subconsciously influence eating behaviours, particularly eating restriction. It may be that playing with dolls and looking at pictures of dolls may differentially influence girls' body image and eating behaviours, but this seems unlikely, as Rice et al. (2016) found increased thin-ideal internalisation whether girls saw pictures of Barbie, saw a physical Barbie, or played with a physical Barbie compared to those who played with My Little Pony.

More recently, Boothroyd et al., (2021) found that five minutes of play with ultra-thin dolls such as Barbie reduced 5-9-year-old girls' ideal body size, while this effect was not seen when children played with realistic sized dolls. Given each study has used different dolls as the not-thin condition (Dittmar et al.: pictures of Emme; Jellinek et al.: Tracy Turnblad/unfamiliar full-figured doll; Anschutz and Engels: physical Emme; Boothroyd et al.: Lottie/Dora the Explorer), there may be something else driving this association, such as doll age or clothing as these also changed between studies.

Interestingly, Dittmar and colleagues (2006) found that the older girls in their sample (7-8-years-old) reported increased desire to have a thin adult body after exposure to the book with pictures of Emme, suggesting that thin-ideal internalisation may already be strong by 7-8-years-old, and pictures of Emme could in fact produce a 'fear of being fat' rather than reducing thin-ideal internalisation. Indeed, Boothroyd and colleagues (2021) found that a further play session with a realistic doll did not return thin-ideal internalisation levels to baseline, suggesting that young children are highly susceptible to the thin-ideal and that once it takes root it is difficult to reverse.

1.2 Gendered play in childhood

A further concerning element of doll play which has emerged in the literature is the clear gender stereotyping of content aimed at young children. Infants as young as 18-months-old show clear preferences for gender-stereotyped toys (Serbin et al., 2001), and by 24-months, girls can differentiate between stereotypically feminine and masculine activities and choose an appropriate gender doll to enact them (Poulin-Dubois et al., 2002). Gender stereotypes are then reinforced throughout childhood and adolescence through advertising (Valtorta et al., 2023), visual media (Gonzalez et al., 2020), peers (Killen et al., 2001), parents (Endendijk et al., 2014; McFadden et al., 2021), educators (Newall et al., 2018), toys (Boyd & Murnen, 2017), clothing (Murnen et al., 2016), and books (Hacin-Beyazoglu et al.,

2024; Pownall & Heflick, 2023), and may be difficult to reverse once internalised (B. J. Bond, 2016), as with thin-ideal internalisation. Additionally, many of these are also involved in the strengthening of the thin- ideal, and therefore the two may be intrinsically linked.

Studies which have investigated thin-ideal internalisation in young participants have often used a forced choice design where children have to point to the figure/doll which they think corresponds to a descriptor word (e.g. "Point to the doll you think is/has ___."; example taken from Harriger et al., 2010), however, these words are often stereotypically feminine words (e.g. cute, quiet, nice, happy, puts toys away, has friends; examples taken from Harriger et al., 2010 and Worobey & Worobey, 2014), and the negatively valenced words are opposites (e.g. ugly, loud, mean, sad, no friends; examples taken from Harriger et al., 2010) or stereotypically negative (e.g. gets sick, tired, eats most; examples taken from Worobey & Worobey, 2014). As such, in our study we aimed to allow the children to describe the dolls freely so they could choose to use stereotypically feminine *or* masculine descriptors.

Gender stereotypes in children peak around age 6, then decrease again until age 12, after which they become more flexible (Kanka et al., 2019). It is important to note that the age at which gender stereotypes peak appears to be one of the most salient periods for the development of thin-ideal internalisation. To date, no studies have investigated a possible link between these two and how internalisation of gender stereotypes may influence body ideals, so we aimed to see if there was a link between choosing a thin doll and gender stereotypical play.

1.3 Current Study

In the current study we employed a qualitative method to explore children's thoughts and play behaviours. The study aimed to examine children's decision making process behind choosing a doll to play with, children's positive and negative thoughts towards dolls, and children's subsequent play style.

2. Methods

2.1 Participants

We recruited 33 participants aged 4-10 years (M = 6.15, SD = 1.75) from an event held at Durham University for children over the summer. Of our sample, 9 were male and 24 were female, 32 participants identified as White, and one preferred not to say. 16 participants reported they had dolls at home (Barbie, LOLs, Monster High, Generations), 9 reported they did not, and 10 did not say. One participant had a diagnosis of dyslexia.

Notably, significantly fewer boys participated in this study than girls. Despite there being a large number of boys attending the event (48%), many did not want to participate in this study. This was a self-selection process where children would choose what studies to complete, and many boys stated that they didn't want to play with dolls, or that dolls were for girls. Girls taking part in this event had the opposite reaction and were generally eager to participate. The boys who did participate in our study were slightly younger (M = 5.56, SD = 1.33) on average than age of boys who attended (M = 7.18, SD = 2.14), possibly indicating that older boys' gender stereotypes are stronger.

2.2 Stimuli

Children could choose from seven dolls: an adult male muscular doll (AMM), an adult male high weight doll (AMHW), an adult male low weight doll (AMLW), an adult female high weight doll (AFHW), an adult female low weight doll (AFLW), a child female doll (CF), or a child male doll (CM) who were of average weight (See *Fig 4-1*). Two dolls had to be replaced during the course of testing due to breakages: the adult female low weight doll, and the adult male muscular doll.

Figure 4-1. Dolls used in the study after breakages. From left to right: Adult male muscular (AMM), adult male high weight (AMHW), adult male low weight (AMLW), adult female high weight (AFHW), adult female low weight (AFLW), child female (CF), child male (CM).

Once children had chosen a doll, we offered them doll props to play with. These included: a horse, a kitchen set, a doll baby in a pram, a car, or a gymnastics set.

Video recordings were captured using the camera on an HP laptop which was angled to ensure we captured how the child was playing with the doll, and audio was recorded using a Google Pixel 7 placed near the child.

2.3 Procedure

Children were recruited from the Junior Scientist event run by Durham University psychology department for children to attend during the school summer holidays. Parents signed a consent form when they signed their child up and entered in their child's demographic information. On the day, children would choose what studies they were interested in doing and gain tokens for participation that they could spend on fun activities such as face painting or VR archery.

Participants were told that the study was investigating children's choice of doll and play style. Children were presented with all of the dolls (the order of presentation was different each time) and asked to choose one to play with and one they really wouldn't want to play with. All of the dolls were wearing matching clothing and the female dolls had the same hairstyle to prevent any bias. Once children had chosen a doll, the other dolls were moved out of sight and the researcher asked the child questions as they played with the doll (see Table 4-1). The researcher encouraged children to expand on their answers as much as possible. Children sometimes chose to play with several dolls from the start or requested another doll during play to facilitate their play. When the play came to a natural conclusion, the researcher would end the study and thank them for their time. They were then given a token and a small gift of thanks. Interviews lasted between 2 minutes 46 seconds and 22 minutes 39 seconds (mean = 9 minutes 1 second).

Table 4-1. Interview questions

Q1. What doll would you like to play with?
Q2. Why that doll? What do you like about that doll? What do you think about the way (s)he looks?
Q3. Is there any of the dolls you really don't like or wouldn't want to play with?
Q4. Why don't you like that one? What don't you like? (dolls are cleared away after this question)
Q5. What do you want to play with? (doll prop toys are presented)
Q6. Why do you think the doll would be good at this activity?
Q7. What do you think this doll would be like if s(he) were a real person?
Q8. If you could change anything about the doll, what would you change?
Q9. Do you have any dolls at home? If yes, how many and what kind?

Some children struggled particularly with Q7. As a result, if they were unsure, they would be prompted with some options which were: nice, mean, sporty, and funny. All children were asked to expand on their answer to question 7 whether they responded with or without these additional prompts.

2.4 Data Analysis

We used a qualitative design employing reflective thematic analysis (Braun & Clarke, 2012, 2020) and videos were used to ascertain which doll children were referring to. The play/interview sessions were recorded, transcribed and anonymised by assigning participant numbers and removing any potentially identifiable information. Braun and Clarke's (2012, 2020) thematic analysis methods were then employed. Inductive methods were used as there is no existing theory regarding the link between sociocultural body ideals and gender stereotypes and the format of the interviews and analysis was fully exploratory. We manually coded themes and quotes based on the latent meaning of children's responses to capture the thoughts and decision processes behind children's doll choice and play style.

I am a social and developmental psychologist with a background in body image and was already familiar with the data as I conducted the interviews and took notes during sessions. I re-familiarised myself with the data by transcribing the interviews and re-reading the transcripts several times while taking further notes. I then developed codes, drawing on my own perspective which was mainly informed by my knowledge and experience in sociocultural gender stereotypes and

development, sociocultural body image frameworks, and feminist theory, as well as extensive experience of my own doll play as a child. I furthermore employed a critical realist approach, using children's physical doll choice, play style, and answers to understand how children think about and experience body image, body ideals, and gender stereotypes. A thematic map containing themes and subthemes was then produced (see *Fig 4-2*). Transcripts were then re-read with reference to the videos, and quotes were noted to ensure nothing was missed. The last author (LB), who is a mother and has extensive experience in the body image field, then checked the themes and aided in their interpretation and write up.

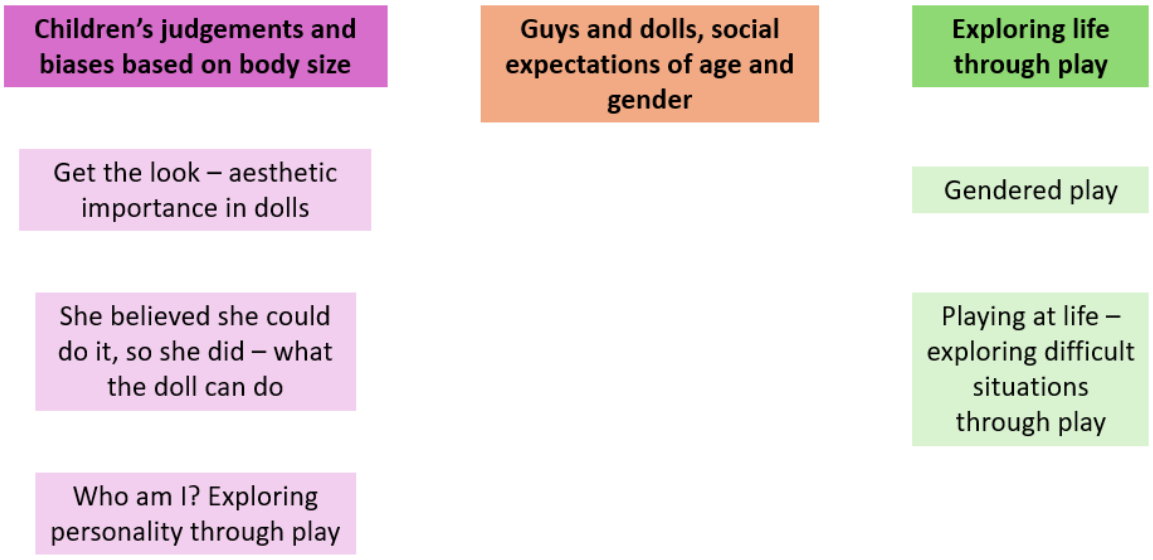


Figure 4-2. Thematic map with colour coded themes and sub-themes

3. Results

Quantitative results are shown in Table 4-2, disaggregated by gender. Favourite and least favourite doll choice specifically counts the first doll chosen, or multiples if groups of dolls were chosen (usually for the least favourite doll, e.g. all boy dolls, all adult dolls). For girls, the adult female low weight doll and the child female doll were the most popular first choices, and the adult male high weight and child male were most often chosen as the least favourite dolls, while the pattern was less clear for boys.

Table 4-2. Frequency of first choice favourite and least favourite doll by gender.

	Favourite doll		Least favourite doll	
Doll	Girls (N=24)	Boys (N=9)	Girls (N=24)	Boys (N=9)
Adult female low weight (AFLW)	11	2	2	2
Adult female high weight (AFHW)	3	0	3	2
Adult male low weight (AMLW)	0	2	7	2
Adult male high weight (AMHW)	0	1	10	2
Adult male muscular (AMM)	0	3	8	2
Child female (CF)	10	0	1	2
Child male (CM)	0	1	10	3

Inductive thematic analysis was used to identify three key themes which were evidenced across participants. In the quotes provided, children are referred to by their participant number to preserve their anonymity. Gender and age of the child are also noted after their participant number to provide context. The doll the child is referring to is denoted after their age and gender in line with the codes presented in the stimuli section.

3.1 Theme 1: Children's judgements and biases of different sized dolls

A cluster of subthemes was oriented around children's physical and functional descriptions of the dolls as a means of justifying which dolls they liked or disliked. This theme was evidenced throughout interviews as children described their reasoning for choosing a particular doll, or what they didn't like/would change about a doll. Children generally preferred the adult female low weight doll and the child female doll, and talked more positively about these dolls' aesthetics and function than other dolls. Key elements of the doll that children identified were clothes, hair, skin tone, and eye colour, with fewer comments on weight and overall look of the doll. Further comments were centred around what children thought the dolls would be like if they were real, and reasons they might be good at certain activities. Children generally assigned more positive and feminine terms to the adult female low weight and child female dolls than the male dolls or the adult female high weight doll.

3.1.1 Subtheme: Get the look, aesthetic importance in dolls

Many children commented positively on elements of the doll which would have been easy to change, such as their clothing ("I like her top" – P1, F8, AFLW; "I like her outfit" – P5, F6, AFHW) or hairstyle (I like how she's got, like, a little fringe" – P8, F10, AFLW; "Cause she's got, got brown hair" – P26, F4, AFHW; "She's got the high ponytail, which is pretty nice" – P31, F8, AFLW). Note: as all dolls were dressed the same, and all female dolls had brown hair in a ponytail, this comment likely reflects either a preference for how these clothes/style looked on this doll versus another, or instead an attempt to justify preferring the slim adult doll without acknowledging the actual difference between the dolls chosen versus not chosen.

Male dolls were subject to more negative than positive comments in this category, with only one positive comment about a male doll ("I like their outfits…the hair" – P23, F5, CF/CM) while four separate negative comments were made about male dolls ranging from their hair ("I would actually like it if he had a bit more short hair" – P2, F5, CM), to their expression and overall appearance ("Because it's a little bit, well, it's too serious" – P4, F8, AMHW; "Because they look like they're about to go into the jungle" – P19, F6, AMHW/CM). Negative comments about female dolls were generally about their hair ("Maybe braid her hair" – P1, F8, AFLW; "I would put her hair in a different hairstyle" – P5, F6, AFHW) or their clothes ("[I'd change her clothes] to, to pants…and a dressing gown" – P26, F4, AFHW; "[I would change] her clothes…a ballerina's" – P28, F4, AFLW).

Children also considered more permanent aesthetic elements of the doll when considering what they did or didn't like about it. Children remarked on the doll's skin tone, commenting that it was similar to theirs ("she's light [skinned], she's like mine" – P9, F4, CF; "I like what colour it is…it's, it's almost the same colour as my skin" – P20, M7, AMHW), the doll's eye colour ("I like the colour of her eyes" – P7, F5, CF; "Because it's cute. And she has, like, star sparkles in her eyes" – P14, F7, CF), and the doll's overall look ("I like the way she looks" – P12, F5, CF; "and [I like] their faces" – P23, F5, CF/CM; "I think she looks really nice too. Yeah…she just looks pretty" – P31, F8, AFLW). One child did comment on the doll's size:

> It's [AFLW] the same size as that one [AMLW] and littler than that one [AMM]. And that one [AMHW] is bigger than this one [AFLW]. And these two [AMHW/AFHW] are bigger than this one [AFLW] – P18, F6, AFLW

These types of comment were also used negatively to describe some of the dolls. Skin tone ("[I don't like her] because, 'cause its got a tan" – P26, F4, AFLW; "Some of them aren't like, the same

colour as my skin" – P21, M5, AMLW/AFLW/AMM), eyes ("It's creepy…the eyes" – P5, F6, CM; "Because I don't really like the, the way their eyes are done" – P20, M7, CF/CM; "[I would change] probably the eye colour…probably blue" – P31, F8, AFLW), and overall look ("I don't like the look of him" – P3, F5, AMHW; "Just because it's not, they're not beautiful" – P25, F6, CM) were cited as reason the child did not like the doll, or elements of the doll the child would change. Body size was also cited, specifically for the larger dolls ("Because they have big tummies" – P30, F8, AFHW/ AMHW), and having a larger tummy was associated with dangers during physical exercise:

> Because they like, they, that one has a bigger tummy and it could get caught on a bar or something and it, and it could cause hurting like – P30 F8, AFHW/AMHW

Alternatively, some children referred to aesthetic elements of the doll to explain why they might be good at one activity or another. In particular, hair being tied up ("Because her hair's tied up" – P1, F8, AFLW; "Because she's got, like, the ponytail. So then it's not in the way…because of the, em, ponytail" – P31, F8, AFLW) and wearing the right clothing ("it looks like she has a leotard on" – P9, F4, CF; "Cause her clothes look like she rides in them" – P12, 5F, CF; "Because she has the, like, clothing and stuff on" – P19, F6, CF) were noted as being important reasons that the doll could complete an activity, while one child mentioned it being a hot day due to the doll's clothing:

> It would be a hot day cause she's wearing a crop top – P22, F6, AFLW

Children also identified facial expression as important, especially when completing traditionally feminine activities, such as being a good mum ("Cause, like, she's got a smile on her face" – P3, F5, AFLW) or doing gymnastics ("Because he's smiling" – P24, M8, AMM), and two children considered the overall look of the doll when thinking about why the doll would be good at an activity ("And she looks good" – P25, F6, CF; "Hmm, her face, it just looks like a wrestling face" – P29, F8, AFHW).

Overall, children's main comments were focused around clothing, hair, eyes, overall look, and the physical doll. The most popular dolls among girls (AFLW/CF) received the most positive comments regarding their clothing, hairstyle, and overall look, with the least popular dolls (AMHW/CM) receiving the most negative comments. For boys, two of the boys commented on the dolls' looks, one regarding skin tone of the dolls both positively and negatively, and one commenting negatively on the child dolls' eyes.

3.1.2 Subtheme: She believed she could do it, so she did.

Children commonly commented on the dolls' abilities in relation to their physical features, such as their height ("Tall enough [for gymnastics]" – P18, F6, AFLW; "Because he's very tall" – P20, M7, AMLW). For the male dolls in particular, children commented on their strength ("Cause he looks very strong" – P20, M7, AMLW), their speed ("and very quick" P20, 7M, AMLW; "Because he can walk fast" – P24, M8, AMM) or described them as good at traditionally masculine activities ("Football." – P27, M6, AMM; "He would probably just be able to do a front flip still" – P24, M8, AMM).

This was mirrored in comments made about the female dolls, where girls commented on their flexibility ("Because if it was a real girl and she looks like pretty flexible already" – P14, F7, CF; "her flexibility" – P29, F8, CF; "Yeah, because they can do a split" – P30, F8, AFLW/CF), or assigned them traditionally feminine activities such as gymnastics ("I think she'd be good at gymnastics" – P8, F10, AFLW; "She'd be a good gymnaster" – P9, F4, CF; "[she'd be good at] doing cartwheels on the beam" – P23, F5, CF), cooking ("Still be a chef. That's all I think. A really good cook too" – P22, F6, AFLW), dancing ("a ballerina…a good ballerina" – P28, F4, AFLW), taking care of a baby ("Because she plays with her" – P28, F4, AFLW), or a combination ("Well, like baking and sporting, yeah…probably like running sports and stuff like that" – P31, F8, AFLW). Only one girl commented on the athletic abilities of the adult female high weight doll, and assigned her a more traditionally masculine role:

> This one is probably good at wrestling – P29, F8, AFHW

Some children considered how much the dolls might have practiced ("cause she's done it before" – P10, F4, CF) to get good at an activity, or thought about the doll's abilities in relation to how other dolls might do:

> Like, if she was in a gymnastics competition, I think she would come like a third…there'll be other people before her. Cause, well, she's like the smallest girl out of all those barbie things over there. – P14, F7, CF

The final element of the doll that children commented on was aspects of the physical doll, such as the way the doll's limbs moved ("Cause her legs are bendy" – P8, F10, AFLW; "I just like when you can put her leg up. Yeah, but when I, when you put her leg up you just like, like, move her body down" – P14, F7, CF; "The bendable arms and the bendable legs" – P31, F8, AFLW) or in comparison to dolls they had at home ("They [dolls at home] can't move as much as this one can" – P14, F7, CF; "I really like these types of dolls and not, and I don't really get to play with these types of dolls normally"

– P19, F6, CF; “Cause I haven’t got many of the child dolls” – P23, F5, CF) which was exclusively said about the child dolls.

Children also used their at home experience to base their choices on. Some children remarked that they wanted to complete the study because it meant they got to play with dolls (“Because I like dolls” – P28, F4, AFLW), or play with a specific item as it was better than what they had at home:

> She’s better than some of her sturdier, she’s better than some of my more stable dolls. I mean, I don’t really have stable dolls because, um, she wouldn’t, my dolls that went on [the horse] wouldn’t go forward, she wouldn’t hold this [the reins]. She wouldn’t put her feet in there [the stirrups]. She was just too, a bit too small and big at the same time. – P19, F6, CF

While some children chose not to play with certain dolls because they did not think they would play with it at home:

> It’s not got as much, like, um, like, arms…and plus, I just don’t really think you would play with it that often – P31, F8, CM

3.1.3 Subtheme: Who am I? Exploring personality through play

This subtheme was developed from answers to Q7 (What do you think this doll would be like if s(he) were a real person?). Some children struggled with this question, so prompts were provided (as detailed in the methods) to help them. If children chose a prompted word they were then asked to elaborate on why they chose that word. 11 of the children used one of the prompted words to describe the doll, specifically, the adult female low weight doll was described as nice four times (P8F10, P17F6, P18F6, P32F9) and as mean once (P33M5); the child female doll was described as nice once (P11F10) and sporty once (P12F5); the adult male muscular doll was described as funny twice (P13M4, P24M8) and sporty once (P27M6); and the adult male low weight doll was described as sporty once (P20M7). It is important to note that children were prompted with three positively valanced words (nice, sporty, funny) and only one negatively valanced word (mean) so children who chose prompted responses may have been influenced somewhat by the descriptors provided.

Many children did describe the dolls in similar ways unprompted (“Nice to care about” P2, F5, AFLW; “nice” – P23, F5, CF; “I think she’ll be very kind” – P19, F6, CF) and tended to assign positive descriptors to the adult female low weight and child female dolls (“I think she’d be kind of brave…fearless…I think she’d be kind” – P4, F8, CF; “Because she, she is the best” – P25, F6, CF;

"kind…helpful…maybe like [enjoy] family time" – P30, F8, AFLW/CF). Additionally, some children described all female dolls positively ("happy, confident women" – P29, F8), and as determined ("Cause she wants to" – P26, F4, AFHW; "This one will be eager to try everything" – P29, F8, CF). This matched what is seen in the first subtheme, where the low weight adult doll and child female doll received mainly positive descriptors while the high weight adult doll received either neutral or negative comments. Part of the reason for this may be the low number of participants who chose the high weight adult doll to play with, so less comments were made overall about this doll. Particularly of interest though, is that one participant described the high weight doll positively in relation to her weight, insinuating she'd be better at giving hugs or providing comfort ("Like a teddy bear" – P26, F4, AFHW) while another assigned negatively valenced traits to her:

> I think she would be like, probably like a go out person…dress up…parties…feel like she might be a bit fussy – P5, F6, AFHW

In terms of the male dolls, only one child assigned personality traits to a male doll unprompted:

> He'd be cool…because he would, because he wouldn't be like a normal person…because everyone would be there, because everyone would be wearing, because everyone's mouth would be open, but his mouth would just be shut – P20, M7, AMHW

The low number of comments about the male dolls is likely due to the low number of participants who chose to play with those dolls, and the difficulties boys faced during imaginative play sessions as most of them were unused to playing with dolls. It is worth noting that of the boys who did comment, they chose stereotypically masculine aligned traits, such as 'funny', 'sporty' and 'cool' to describe the male dolls. The low number of children, particularly girls, who chose to play with a male doll may additionally be due to the stereotypical gender of dolls which children are exposed to. Female dolls make up the majority of the doll industry, and are potentially preferentially purchased and played with outside of the study, meaning children may have chosen female dolls due to familiarity with their own toys.

3.2 Theme 2: Guys and dolls, social expectations of age and gender

The second theme concerned children commenting on the doll's social status and expectations based on age and gender. Children seemed to hint in theme 1 that they preferred dolls which were similar to them, and this becomes more apparent in this theme, especially for girls who chose to play

with the child female doll, and for all children regarding doll gender. Furthermore, children appeared to choose dolls which were of the appropriate age or gender for themselves to play with, or for an activity they want to do with the dolls, although as few boys participated in this study it is difficult to definitively conclude this would be the case for all boys.

The age of the doll appeared to be important both in initial doll choice, and for subsequent play. Some children seemed to choose to play with child dolls specifically because they matched the age of the child ("Well, cause she's a little girl" – P4, F8, CF; "Because it's a kid and I like kids" – P10, F4, CF), or because they didn't want to play with 'grown-ups' ("I wouldn't want to play with any of the grown- ups" – P10, F4), while others specifically wanted to play with the adult dolls ("Cause it's [AFLW] bigger than them two [CF/CM]" – P18, F6, AFLW; "Cause she is a grown-up" – P28, F4, AFLW) or didn't want to play with children ("Because it's a little one" – P24, M8, CM).

Some children did ask to play with an adult doll at the start of, or mid-way through the play session ("Oh, she needs a grown-up!" – P10, F4, CF) as they needed a grown-up for the play:

> She's [CF] gonna go to, the, can somebody, somebody has to be with the baby….Daddy and Mummy…and then she [AFLW] will, she will be home…taking care of the baby. – P25, F6, CF/AFLW

While some children requested a child doll to act as a child for the grown-up they had chosen ("I'm going to get a kid that can ride…I want the girl" – P28, F4, CF). Finally, some children used the grown-ups when the children wouldn't be realistically old enough for some activities ("She's not old enough [for the balance beam] yet" – P10, F4, CF).

Doll gender was potentially an important factor in children's doll choice, with no girls choosing to play with male dolls, and only two boys choosing to play with a female doll. Girls tended to be more direct in their wording ("Cause they're boys" – P9, F4; "Because I, I don't like boys" – P18, F6; "But also, I don't like any man ones, I don't like men" – P30, F8) and one girl made a direct comparison between the child female and child male dolls:

> And if it was a boy, like a real boy, and I don't think it would be as good as this girl.
> – P14, F7, CF/CM

Contrary to this, boys tended to focus on the dolls being boys ("Because, uh, because I like boys, because I, they're very cool because I like boys" – P13, M4; "Because, um, it's a boy" – P24, M8, AMM; "I normally play with boys" – P27, M6, AMM). Only one girl commented on the female dolls in this way ("It's just I like to play with girls all the time" – P29, F8).

Furthermore, girls reported owning mainly female dolls at home, either not mentioning male dolls at all, or that male dolls were in the minority ("Lots of Barbies but only one Ken" – P28, F4) while boys reported not owning any dolls ("No…not really my kind of thing" – P24, M8), weren't sure ("I don't know, [to parent] do I?" – P20, M7), or didn't answer the question (N=6).

During play, many children assigned family roles and structures to the dolls they had chosen, or requested more dolls to assign these roles to. The most common pairing was a mother-daughter pairing, involving either (or both) of the adult female dolls and the child female doll ("Because she's a mum" – P3, F5, AFLW; "Yeah so it's, it's two mums, a daughter and a baby" – P29, F8, AFLW/AFHW/CF; "Maybe because they, hm. Maybe because they're a family" – P30, F8, AFLW/CF), but some children did create heteronormative nuclear families ("Cause they look like mummies and daddies" – P7, F5, AFLW/AMM/CF; "They'll be a like a family" P25, F6, AFLW/AMM/CF/CM).

Children who created families often used traditional family structures to inform their play. Generally children used the adult female low weight doll as the mother, and described her as caring and nurturing. Her role was often as a person to care for the baby ("She's sitting in the back of the car…with the baby" – P3, F5, AFLW), and fathers were often out of the scene at work ("Cause the dad's at work" – P3, F5; "At uh, Mum's shop, haberdashery…he, it's an emergency, I think" – P30, F8). Even when there were two mothers, the adult female low weight doll was given the stereotypically feminine role, while the adult female high weight doll took on the stereotypically masculine breadwinning role:

> This one [AFLW] will have to take more care [of the baby] because she's [AFHW] at the wrestling studio and she's [AFLW] always here – P29, F8, AFLW/AFHW

3.3 Theme 3: Exploring life through play

Our final theme centred around how the children played with their dolls, and patterns in doll chosen and type of play carried out. In general, children who chose to play with the adult female low weight doll tended to choose passive feminine activities (taking care of a baby, cooking), children who chose to play with the adult female high weight or the male dolls had no overarching pattern to their play (play styles were generally even across these dolls), and children who chose to play with the child female doll tended to play in an active gender neutral way (horse riding), with active feminine activities (gymnastics) the second most popular play style for this doll.

3.3.1 Subtheme: Gendered play

The majority of children participated in gender stereotypical play with their dolls, with only

two clear instances of gender counter-stereotypical play across all participants. One child played with all three adult male dolls in the kitchen, and had them wash their dishes afterwards ("he's got to wash that" – P13, M4), while another child stated that if they could change anything about the doll it would be to teach her to drive ("like, she can drive a car" – P17, F6, AFLW) indicating that they did not consider women to be able to drive as standard.

The most common gender stereotype was the adult female dolls (particularly the adult female low weight doll) being mothers. Often, children would play with the adult female doll as the mother of the baby ("Uh oh, she needs to look after the baby" – P2, F5, AFLW; "Because she's a mum" – P3, F5, AFLW), doing activities with/for the baby ("Take the baby out for a walk" – P1, F8, AFLW; "The mum's going to push it [the pram]" – P10, F4, AFHW; "She's gonna bake biscuits for her [baby]" – P17, F6, AFLW), or as a mother/mentor to the child female doll ("I'll help you with this see, she's learning" – P30, F8, AFLW/CF).

Aside from motherhood, the adult female dolls were often said to be partaking in stereotypically feminine activities, such as shopping ("She's been going shopping" – P1, F8, AFLW; "Maybe they could go to the shops" – P17, F6, AFLW), or cooking for others ("She's gonna make something else while she's waiting [for Ken]" – P1, F8, AFLW; "She's having a party and these [cookies] are for all her friends" – P22, F6, AFLW; "[She's making cookies] for her family" – P32, F9, AFLW).

Children also conducted gender stereotypical play with the child dolls. In particular, the child female doll was a caretaker for the baby ("I think she'd be good at looking after the baby best" – P23, F5, CF), and when playing with both male and female child dolls, one child had the child female cleaning up after the child male doll:

> She's also gonna put some of the [kitchen] things away so that…so I'll put the bowl inside, and I'll put that in here. And, the pan was here, these need to be cooked again [after the child male cooked them], they're still a bit cold. And now she's gonna sit there, and, put the rest of the stuff away – P23, F5, CF/CM

Finally, one child who played with all three adult male dolls played with the kitchen, but framed it as working ("They're gonna work" – P13, M4) rather than cooking for others as the female dolls were usually portrayed.

3.3.2 Subtheme: Playing at life; realistic and unrealistic play styles to explore difficult situations.

Children sometimes used the dolls and accessories to play out life course events which may

cause difficult or negative emotions, such as death. Both realistic (a family member being found dead, having an emotional conversation) and unrealistic (putting a baby in the oven, running a baby over with a car) were employed by children to explore these emotions.

Most children conducted imaginative play where they did things they wish they could do in real life (e.g. gymnastics, horse riding), but some children used the dolls to explore emotionally complex scenarios. One child explored the concept of death through play, where the child female doll found her aunt and uncle deceased:

> Where's the, Uncle [AMM] and Auntie [AFHW] have passed away. They're dead...Oh. Let me see if my sisters, my babies. Ooh yeah. Shh. My baby's sleeping. Yeah. Okay, what happened here? Ohh they've died [crying noises] "What happened?", "Uncle and Auntie have died" *gasp* "Lemme see!" *gasp* "Look at, now let's quickly, wake Mummy [AFLW] and Daddy [AMLW] up. – P25, F6, CF/CM

Another child explored a mother-daughter relationship where the mother and daughter were close, using physical contact and having discussions about their emotions, which the child expressed that she did not like to do:

> **P1F8:** And sometimes they sit down…I don't do that much cause I don't like letting my feelings out…Sometimes see, see they would sit there and hmm, stand up, stand up and sit down. She'd [AFLW] pick her [CF] up and whooo [spin her around]…And she [AFLW] loves lifting her [CF] up, putting her on here [gymnastics beam]. "Mommy, mommy, lift me up", "with me, okay?"
>
> **Researcher:** So do you think she likes letting her feelings out to her mum?
>
> **P1F8:** Yeah. I don't cause like, they make me cry.

While other children participated in particularly violent or neglectful play with the dolls. One child had the mother abandon the baby to go shopping:

> Bye!...See you in ten minutes. Ten minutes later…She's been going shopping – P1, F8, AFLW

And then commented that they were planning to have the mother 'kill' the baby had the play session not ended:

> I was about to throw the baby in the oven – P1, F8, AFLW

While another child had the adult male muscular doll go on a crime spree and then run over the baby with the car:

> Ohh, the baby's gonna get run over…drive away, he drive away with the baby, oh…got got the baby…[he stole] the baby's bed…he's taking [stealing] the gym things now…driving and – ahhh! [runs over the baby with the car] – P13, M4, AMM

4. Discussion

This study sought to explore children's thoughts about different dolls and doll play styles in an ecologically valid setting. We found that many children's choice of doll was driven by the doll's clothes, hair (particularly hairstyle), eyes and skin tone. Several children commented that they had chosen a doll because it resembled them in some way, or because it was not a doll which they had at home. Children's reasoning that they wanted to play with a doll due to clothing or hairstyle was unexpected, as all of the dolls wore the same clothes and had the same hairstyle (brown hair in a high ponytail). Furthermore, efforts were taken to ensure dolls had matching eye colour (brown), and skin tones as close as possible to one another (lightly tanned Caucasian). A possible reason for this clothing preference might be a subconscious manifestation of the thin ideal, where children state they prefer one doll's outfit over another because they have internalised that thin bodies are more attractive and prefer the outfit on a slimmer body. Previous research has found that children have an internalised thin ideal from an early age (Brown & Slaughter, 2011) and has found that 6-8-year-old girls' body satisfaction *increases* when exposed to thin characters on TV if they have a strong internalised thin ideal (Anschutz et al., 2012). This may suggest that girls who already have a strong internalisation of the thin ideal (potentially through play with ultra-thin dolls at home (Boothroyd et al., 2021; Rice et al., 2016), as many of our sample stated they enjoyed) may seek out ultra-thin role models through visual media and dolls.

Regarding clothing, the above theory that clothing preference may be a manifestation of the internalised thin ideal is somewhat supported in the children's interviews, where four children mentioned the adult female low weight doll's clothes and five mentioned the child female doll's clothes as reasons that they liked that doll over others, while only one child said this about the adult female high weight doll. Alternatively, clothing and hairstyle may be superficial elements of the doll which the children felt was appropriate to comment on, rather than the body size of the doll. In a systematic review, de Lenne and colleagues (2023) found that model size generally did not affect advertising outcomes from adolescence onwards, however the limited number of studies which have looked at

effects of model size on children's advertising have found that thin models are effective in promoting 'healthy' snacks (Castonguay et al., 2022), or that large models promoting 'unhealthy' snacks encourages children to subsequently choose a 'healthier' snack (De Jans et al., 2022). This suggests that, while model size does not seem to have an effect on adult retail habits, it may be an important factor for children which influences their perceptions of aesthetic elements such as clothing and hairstyle.

Very few children commented directly on the doll's body size, and these comments were mainly in keeping with societal ideals. The adult high weight dolls were disliked in some cases due to having 'big tummies' while the adult female low weight doll and the child female doll were better dolls because they were skinnier than other dolls. This also applied to play style, with one child stating she couldn't play with the high weight dolls because they might get hurt if they tried to do gymnastics. The low number of comments on body size may not be due to a lack of consideration of doll body size however, it may be that children did not feel it was appropriate or 'nice' to comment on someone's weight. Indeed, some children hesitated or seemed reluctant to vocalise their reasons for preferring one doll over another, and in one case where the child did comment on body size, the parent (who was seated behind the child) acted uncomfortably, cringing at their child's words. In support of this, Puhl (2020) conducted a systematic review of quantitative and qualitative studies examining the words which are used to talk about weight. The review found that parents and adolescents did not like using words such as 'fat' or 'overweight' and preferred health related terminology. It could therefore be that in today's society, it is considered rude to comment on people's body size, and so children avoid vocalising their thoughts on body size, even for dolls, in order to conform to societal etiquette.

Almost all children demonstrated strong gender stereotypical play behaviours. Children who chose to play with the adult female low weight doll tended to play her as a mother, in the kitchen, or as a teacher, while children who chose the child female doll or adult female high weight doll were more likely to conduct gender neutral or active play, such as riding a horse or doing gymnastics (which was especially common for the child doll). If the male dolls were chosen for play, girls tended to use them as props for family play (i.e., as a father, brother or uncle) while boys tended to conduct more masculine play such as driving in the car or working in the kitchen (as opposed to cooking for family). Even when children created non-traditional families (single parent, same sex parents), they tended to impose gender stereotypical roles, such as the adult female high weight doll taking on the stereotypically masculine role in the family. This supports previous literature which found that by 6-years-old (the mean age of our sample) children have strong and rigid perceptions of gender

stereotypes (Killen et al., 2001; Serbin et al., 2001) and tend to conform to these. Play style may additionally have been influenced by participants' own meta-theories of societal roles, i.e. children have a concept of societal norms and standards by which people behave and their gender stereotypical play style may have arisen from a subconscious desire to conform to their own developing meta-theories of societal norms. As such, gender stereotyped play may have been an indication of a set of internalised societal norms and standards which children strive to develop their understanding of and ability to conform to through mediums such as doll play.

Finally, when given freedom to choose descriptive words, some children did stick to feminine-coded terms, especially for the adult female low weight doll, but often used counterstereotype words or gender-neutral descriptors to describe the adult female high weight and child female dolls. This shows that children may not necessarily assign negative descriptors to high-weight figures, but rather view them as more gender neutral or masculine than the low weight dolls. This would support the theory that gender stereotypes are heavily linked with thin-ideal internalisation in young children, especially when considering adult figures. Notably, children did not show the same gender neutrality or counterstereotypical thoughts when discussing the male dolls, with most of the descriptive words assigned to them being stereotypically masculine adjectives, such as 'cool', 'strong' or 'quick'.

4.1 Limitations and strengths

This study is the first to examine children's decision-making process behind choosing a doll to play with in an ecologically valid setting, and without using a forced choice design. Children were asked questions while they played with dolls, which may have encouraged more candid answers than if they had been interviewed in a more formal setting.

We note however, that although we did not push the children to answer questions in any specific way, some children had trouble thinking of descriptive words, were too shy to speak, or seemed to edit their answers to be socially acceptable, rather than necessarily exactly what they thought. As such, at times the researcher had to provide some options which, while the researcher tried to ensure there were gender stereotypical, gender neutral and gender counter-stereotypical suggestions, was not always the case as children would interrupt.

A further limitation is that we did not provide any active masculine option to play with. This was due to lack of availability of appropriately sized masculine doll props, such as a football and goal, or a shooting range, meaning the only 'masculine' toy available was a car which we considered a 'passive' activity. Future research should endeavour to provide options across the gendered spectrum,

in both props for play and descriptive words provided, and toy companies should ensure they are creating a diverse range of toys for children.

4.2 Directions for Future Research

Future research should investigate the strength of internalised gender stereotypes in both boys and girls. From our qualitative study, it would seem that even by age 4 both boys and girls have deep rooted and complex ideas of gender stereotypes and may use play to explore these. For girls, doll play seemed to be a familiar and fun method of exploring these themes while boys seemed unwilling to participate in this type of play. This is in keeping with boys having entrenched gender bias against dolls, as they are considered a 'girl toy'. This stereotype is perpetuated by peers and by media through marketing. Therefore, future research should also work to find an appropriate method to replicate this in boys which is not viewed as 'uncool' or 'girly'.

The link between internalisation of gender stereotypes and internalisation of the thin ideal should be explored more in young children. This link had been identified in adult populations, with thinness being associated with femininity, but this is the first study to explore this link in children. Given that ages 6-7 seems to be a key stage in both the development of gender stereotypes and thin-ideal internalisation, it is imperative that more research focuses on this link and the potential intervention initiatives which may arise from it.

4.3 Conclusion

In this qualitative study we explored children's thoughts and beliefs surrounding the body and gender stereotypes through interviews conducted during free play with dolls. We found that children seemed to link feminine gender stereotype and thinness, however this link was not as obvious in play with the child-like doll. We theorise that gender stereotypes and thin-ideal internalisation become entwined at an early age and that this link may be more salient for adult figures than child figures.

Chapter 5: Mirror, mirror on the wall: What do children look at in the mirror?

Abstract

Eye tracking studies with adults have shown that individuals with high body satisfaction look more towards own body parts which they rate as attractive while the inverse relationship exists in body dissatisfied adults. However, no studies to date have considered where children look on their own body, if or how this is influenced by body (dis)satisfaction, or if this gaze pattern changes when asked to think about elements they like about themselves. We recruited 40 children (aged 7-10) and adolescents (aged 13-16) to participate in an eye tracking study where they were tasked with looking at their body with no instruction, followed by self-positive instruction. Results indicate that children look more towards their chest and stomach while adolescents fixate on their chest and head. Looking patterns were not influenced by overall body (dis)satisfaction or individual body part satisfaction. There was minimal change in gaze patterns between neutral and positive conditions, with only the adolescent boys and child girls increasing and decreasing their gaze towards the lower legs respectively. Finally, body avoidance as a protective mechanism against body dissatisfaction may develop during puberty. Results are discussed from a developmental perspective and in comparison to previous adult literature. This study aimed to explore the role of puberty in the way we look at our own body, and the acceptability and feasibility of eye-tracking as a method to measure body image, the second and third overarching aims of this thesis.

1. Introduction

Research using mirror gaze tasks has found that women with higher body dissatisfaction and/or eating disorders spend more time looking in mirrors, and are more likely to focus on negatively rated parts of the body than controls with low body dissatisfaction (Farrell et al., 2004; Gutierrez-Maldonado et al., 2022; Tuschen-Caffier et al., 2015). In a large systematic review, Nikodijevic et al. (2018) found that individuals with eating disorders were more likely to practice both body checking (continuously analysing one's body size and shape e.g. through weighing or inspecting one's body in a mirror) and body avoidance (avoiding reflective surfaces where the body can be seen, e.g. avoiding windows, covering mirrors) than healthy controls, and that in sub-clinical populations, body checking and body avoidance were associated with increased eating disorder symptoms. Furthermore, research suggests that this relationship is causal (Mendoza-Medialdea et al., 2023). However, it should be noted that across current literature, eye-tracking studies among non-clinical populations (especially where the participants look at their own body in a mirror) are rare. Additionally, no published studies to date have considered how children look at their own body in a mirror. Given that gaze patterns appear to be an indicator of body dissatisfaction, and that body dissatisfaction develops during puberty, it is important to determine if these gaze patterns are present pre-pubertally or if they develop concurrently with body dissatisfaction.

1.1 Gaze patterns and body (dis)satisfaction

Studies using eye-tracking technology have generally been conducted using a screen with a 3D image or a 2D picture on a sheet of paper. A systematic review and meta-analysis of eye-tracking studies in non-clinical body dissatisfaction research found that across studies, women who reported high body dissatisfaction had an attentional bias towards lower adiposity bodies than high adiposity bodies (House et al., 2023). Other studies which have been conducted in adult sub-clinical populations have found that body dissatisfied individuals look longer at particularly low and high adiposity bodies (Gao et al., 2014; Pinhas et al., 2014; Stott et al., 2021) and have trouble disengaging their attention from low adiposity bodies (Misener & Libben, 2020). In relation to body avoidance (avoiding looking at one's body), some studies have suggested that body dissatisfied individuals practise body avoidance as a defence mechanism to avoid maladaptive thoughts about one's own body (Mendoza-Medialdea et al., 2023).

A large body of evidence has found that women with high body dissatisfaction and eating disorder symptoms have attentional biases towards specific personally rated 'unattractive' body parts

on their own body, but 'attractive' body parts on others' bodies, which is not evidenced in controls with low body dissatisfaction or eating disorder symptoms (Bauer, Schneider, Waldorf, Braks, et al., 2017; Greenberg et al., 2014; Jansen et al., 2005; Kerr-Gaffney et al., 2019; Tuschen-Caffier et al., 2015). Furthermore, in one study, individuals with an eating disorder and healthy controls did not differ in which body parts they rated negatively or positively, with the stomach and thighs being the most common disliked body parts (Tuschen-Caffier et al., 2015). This suggests that while healthy controls experience body dissatisfaction, there is a significant difference in the extent to which dissatisfaction with body parts is salient in subconscious processes such as gaze patterns. Furthermore, individuals with eating disorders have been found to seek out negatively rated body parts after low mood is induced while healthy controls avoided negatively rated body parts in this condition (Svaldi et al., 2016). Additionally, when individuals with low body dissatisfaction and eating disorder symptoms were told to look at self-described 'unattractive' body parts, body dissatisfaction increased (Smeets et al., 2011), and looking at idealised thin bodies in on paper or in virtual reality increased body dissatisfaction and body avoidance (Gutierrez-Maldonado et al., 2024; Mendoza-Medialdea et al., 2023). These suggest that gaze patterns are an important facilitator of body dissatisfaction and may highlight a circular pattern – body dissatisfied individuals seek out negatively rated body parts, looking at these parts increases body dissatisfaction. As such, it is important that we understand at what age these maladaptive gaze patterns develop.

There is significantly less research in adolescents, and no research into children's body related visual biases. Furthermore, the majority of research in this age group is completed with clinical groups, rather than in sub-clinical or healthy groups. In contrast to the research with adults, some studies have suggested that adolescents with an eating disorder and healthy controls both demonstrate an attentional bias towards negatively rated body parts (Bauer, Schneider, Waldorf, Braks, et al., 2017), but that adolescents with eating disorders additionally attend more to unclothed body parts (Horndasch et al., 2012). Given that most adolescent research is exclusively with girls, this is somewhat in line with research which has found that women are more likely to attend to weight-related body parts than men (Porras-García et al., 2018; Porras-García, Ferrer-Garcia, et al., 2019). Additionally, Bauer et al. (2017) suggest that adolescent girls are more likely to monitor their body as appearance is highly salient at this age and the rapidly changing and developing adolescent body may facilitate an increase in body checking behaviours.

1.2 Guided mirror task for positive body image

Mirror exposure therapy is an optional element of cognitive behavioural therapy for eating

disorders (CBT-E). Individuals are directed to stand in front of a mirror and describe their body using non-judgemental language with a therapist present to ensure individuals follow instructions ('guided mirror exposure therapy') (Griffen et al., 2018). In alternative techniques, individuals stand in front of a mirror and vocalise thoughts and emotions as they occur ('pure mirror exposure therapy'), stand in front of a mirror without talking, or mirror exposure is completed as homework without a therapist present (Griffen et al., 2018; Moreno-Domínguez et al., 2012).

Mirror exposure therapy has been shown to be effective in decreasing body dissatisfaction in clinical (Butler & Heimberg, 2020; Krohmer et al., 2022) and sub-clinical (Jansen et al., 2016; Tanck et al., 2021) adult samples. Research into specific mirror exposure techniques have produced mixed results. Some studies have found that pure mirror exposure therapy leads to the largest decreases in body dissatisfaction (Díaz-Ferrer et al., 2015; Moreno-Domínguez et al., 2012), but other techniques also show improvements in body image outcomes (Butler & Heimberg, 2020; Griffen et al., 2018). In guided exposure therapy, the effect of directing gaze towards positively or negatively rated body parts has been assessed and demonstrated mixed results. In some studies, guiding gaze towards positively rated body parts was found to increase self-esteem (Tanck et al., 2021) and promote more positive emotions (Jansen et al., 2016). Conversely, focussing on negatively rated body parts was found to induce negative mood (Jansen et al., 2016; Tanck et al., 2021) but may be more effective in decreasing long term body avoidance and increasing attractiveness ratings of disliked body parts (Jansen et al., 2016). One recent study found that a focus on body functionality in mirror exposure therapy was effective in increasing body satisfaction up to 11-months after therapy (Walker et al., 2018), indicating differing effectiveness of different body related foci.

Only one study has used eye tracking during a mirror exposure therapy style task, where participants were directed to look at positively rated body parts while standing in front of a mirror. Although body satisfaction was found to increase, no changes in visual attention were found (Glashouwer et al., 2016). However, this study only included a focus on positively rated body parts, so effectiveness of alternative mirror exposure tasks on changing visual attention is unknown.

1.3 Current Study

The aim of the current study was to determine what children look at when they look at their own body in a mirror, and how this is influenced by age, gender, and own body (dis)satisfaction. We therefore had four hypotheses. First, we aimed to determine whether children who were more dissatisfied with their body spent longer looking at body parts they reported disliking than those who

were satisfied with their body and vice versa. We hypothesised that participants who had higher body satisfaction would look more at body parts that they liked than those they didn't (H1) and that participants who had lower body satisfaction would look more at body parts that they disliked than those they liked (H2). We then tested if and how gaze patterns changed when participants were specifically told to think about elements that they liked about themselves, hypothesising that participants would look more at body parts they rated positively in the positive condition than in the neutral condition (H3). Finally, we hypothesised that participants with lower body satisfaction would practise body avoidance (looking on the mirror but off the body or at the room around the mirror) more than participants with higher body satisfaction (H4).

2. Methods

2.1 Ethics

Ethical approval was attained from Durham University Psychology Department Ethics Committee. Parents of eligible children who had signed up to the Durham University Families Database, a volunteer database for parents in the County Durham area, were emailed with brief information about the study and a sign-up link. Parents who signed their child up were invited to attend Durham University where they read the full information sheet and signed a consent form. The study was explained verbally to the child, and they signed an assent to participate form to indicate they were happy to take part. A debrief sheet was given to the parent once their child had completed the study, and children were verbally debriefed and received a pen and a sticker for taking part.

2.2 Participants

We recruited 42 children but two children had to be excluded from data analysis due to errors with the eye-trackers, leaving a sample of 40 participants (21 male, 19 female) aged 7-16 (M = 9.93, SD = 2.80) from the North East of England, United Kingdom. Children were recruited through a volunteer participant pool and exclusion criteria ensured all participants had normal or corrected to normal vision and did not have any sensory processing difficulties or motor impairments which would affect their ability to take part in a VR experiment which was running concurrently to this. Two participants reported they were Autistic, and one reported having ADHD. All participants were White, except one who reported Black ethnicity.

For this study, participants were split into two age groups. The child group (18 male, 11 female) were aged 7-10 (M = 8.38, SD = 1.21). The adolescent group (3 male, 8 female) were aged 13-16 (M = 14.00, SD = 1.10).

2.3 Conditions

Each participant experienced all four conditions. Only the 'neutral standing' and 'positive standing' are used in the current analysis. The 'neutral standing', 'neutral sitting', and 'mirror turned away' conditions were completed in a randomised order and the 'positive standing' condition was always completed last to avoid it influencing behaviour in the other conditions. Each condition lasted 1 minute in total, consisting of 15 second trials broken up by 15 seconds of a distractor game intended to reduce fatigue and boredom.

2.3.1 Neutral Standing

Participants stood in front of the mirror with their hands by their sides (see Fig 1. Panel A) while the mirror faced towards them. They were given no instructions on where to look. Participants spent 15 seconds looking in the mirror then 15 seconds playing the distractor game until 1 minute of looking time had been completed.

2.3.2 Neutral Sitting

Participants sat in a chair with no arms in front of the mirror with their hands resting by their sides on the chair while the mirror faced towards them. They were given no instructions on where to look. Participants spent 15 seconds looking in the mirror then 15 seconds playing the distractor game until 1 minute of looking time had been completed.

2.3.3 Mirror turned away

Participants stood as in the 'neutral standing' condition while the mirror was turned away from them so they could not see their reflection. They were given no instructions on where to look. Participants spent 15 seconds looking in the mirror then 15 seconds playing the distractor game until 1 minute of looking time had been completed.

2.3.4 Positive standing

Participants stood as in the 'neutral standing' condition while the mirror was turned towards them. They were given instructions to "think about things that you like about yourself". Participants looked in the mirror continuously for 1 minute without playing the distractor game to allow them to focus on elements of themselves they liked.

2.4 Materials

2.4.1 Mirror and distracting task

We used a black framed, free-standing 37x153cm mirror which was placed approximately 1.5m from the participant (see Fig. 5-1, Panel A). In between 15 second trials, participants played a game where they had to pretend they possessed laser eyes and had to save the world from an alien invasion. Two cardboard characters were created for this task (see Fig. 5-1 Panel B) and appeared from behind a cardboard box (approx. 90x45cm) which sat upon a table. A research assistant hid behind the cardboard box and revealed the alien and/or child either above or to the sides of the box. The child was instructed to 'shoot' the alien with their laser eyes but make sure and not shoot the child. This game lasted 15 seconds.

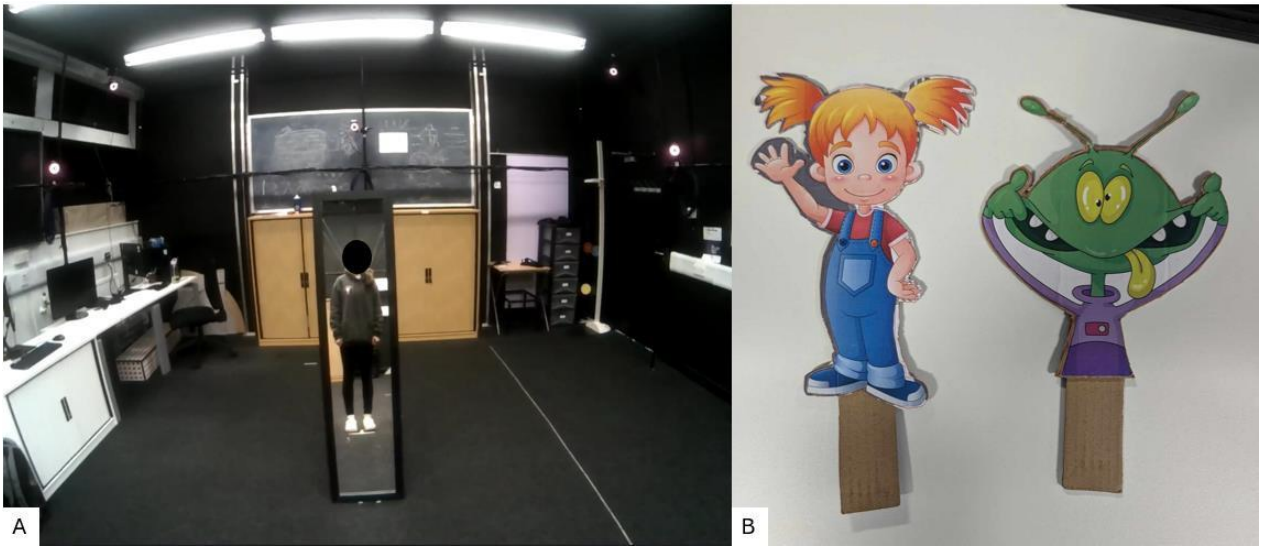


Figure 5-1. Panel A: experimental study set up for 'standing' conditions. Panel B: cartoon child (left) and cartoon alien (right) used during the distracting task.

2.4.2 Eye-tracking equipment

Eye movements were recorded using the 'all fun and games' child-sized frame for the Pupil Labs Neon eye-tracking glasses (Pupil Labs, Berlin, Germany) which includes two infra-red eye-cameras with 192x192 resolution, sampling at 200Hz and one world camera with 1600x1200 resolution, sampling at 30Hz. The eye-tracking glasses were connected but cable to a smartphone which could fit in children's pockets or held by their side if they did not have pockets. Recordings were uploaded to the Pupil Cloud where areas of interest (AOI) could be drawn and fixation durations by AOI could be extracted.

2.4.3 Body Satisfaction

Body satisfaction was measured using the Body Part Satisfaction Scale – Revised (BPSS-R; Petrie et al., 2002), a 14-item questionnaire which asks participants to rate their satisfaction with each

body part on a 6-point Likert scale from 1 (extremely dissatisfied) to 6 (extremely satisfied). For the current study, we simplified the wording of the Likert responses so that they were easy to understand for the youngest participants so the responses ranged from 1 (really hate it) to 6 (really love it). The BPSS-R had not been tested in children before but demonstrated good internal consistency in the current sample ($\alpha = 0.89$).

2.5 Procedure

The study aims, procedure, and data analysis plan were preregistered on the Open Science Framework (OSF) and can be found by following this link: https://osf.io/vc8b9.

On the day participants attended the lab, they completed the both current study and the virtual reality study presented in Chapter 6 of this thesis. The current study was always completed first. Parents of participants read an information sheet and privacy notice while the researcher verbally explained the study to the children/adolescents. Parents then signed a consent form and children/adolescents signed an assent to participate form. Participants then completed the BPSS-R before the eye-tracking task so that the 'positive standing' condition would not affect their body part satisfaction ratings. The researcher then measured the inter-pupillary distance of each participant. Once the participants had put on the eye-tracking glasses, the researcher asked them to look around the room at various objects in order to habituate the participants to wearing the glasses while the researcher could check the accuracy of the eye-trackers. The participant then completed each of the four conditions described above and played the distracting game. Once the participant completed the four conditions, they completed the virtual reality study then parents were given a debrief sheet and children/adolescents received a pen and a sticker for their participation.

2.6 Data analysis plan

Fixation proportions for each AOI were used as the outcome variable in each of the analyses run. Eight AOIs were developed for each condition (head; arms; chest; stomach; upper legs; lower legs; mirror; off mirror). The 'mirror' AOI consists of mirror space which was not taken up by the body; this was combined with the 'off mirror' AOI to calculate 'off body' fixation proportion.

As BPSS-R is used as both an indicator of how much a participant liked a given body part and overall body satisfaction, overall BPSS-R scores were z-scored. Individual body part satisfaction was calculated by using the mean of the BPSS-R items which corresponded to that body part: head = overall face; arms = shoulders and arms; chest = chest/breasts; stomach = stomach; upper legs = hips and upper thighs; lower legs = lower legs.

For the first two hypotheses, general linear mixed effect models were used to account for random effects of participant and individual body part size. Beta regressions were then used to determine fixations by body part, and for the last two hypotheses. Each analysis was then run again with age group and gender included in order to test for expected age and gender effects.

3. Results

All analyses were conducted using RStudio (RStudio Team, 2023), using Tidyverse (Wickham et al., 2019), ggplot2 (Wickham, 2016), betareg (Cribari-Neto & Zeileis, 2010), and glmmTMB (Brooks et al., 2017) packages. All analyses are based on the full sample of 40 participants.

Descriptive statistics for participants are shown in Table 5-1. Generally, participants focused on the head, chest, stomach, and off body. Adolescents focused more on the head, chest and off body while children focused on the chest, stomach, and off body.

Table 5-1. Mean and standard deviations for age, overall body satisfaction, and fixation proportion by body part for the whole sample and split by age group.

	All participants mean (sd)	**Adolescents mean (sd)**	**Children mean (sd)**
Age	9.93 (2.80)	14.00 (1.10)	8.38 (1.21)
BPSS-R	4.66 (0.77)	4.37 (0.67)	4.77 (0.78)
Fixation proportion (head)	0.11 (0.15)	0.21 (0.21)	0.07 (0.11)
Fixation proportion (arms)	0.07 (0.10)	0.11 (0.15)	0.06 (0.06)
Fixation proportion (chest)	0.17 (0.15)	0.18 (0.13)	0.17 (0.15)
Fixation proportion (stomach)	0.12 (0.14)	0.06 (0.05)	0.14 (0.16)
Fixation proportion (upper legs)	0.10 (0.10)	0.10 (0.10)	0.10 (0.10)
Fixation proportion (lower legs)	0.07 (0.07)	0.04 (0.04)	0.08 (0.08)
Fixation proportion (off body)	0.22 (0.17)	0.17 (0.15)	0.24 (0.17)

As an exploratory analysis to determine if there were any effects of age or gender on where children were looking, we entered all data into a GLMM with fixation proportion as the outcome variable, participant as a random effect, and body part, age group and gender as fixed effects. Full results of this analysis are presented in Appendix B. We found a significant interaction between fixation towards the head and age group (β=-1.27, SE=0.58, *p*=.028), and fixation towards the lower legs and age group (β=1.28, SE=0.59, *p*=.030), indicating that adolescents spent significantly more time looking towards the head, and less time looking at the lower legs. We furthermore found a significant interaction between fixation towards the head, age group, and gender (β=1.90, SE=0.94, *p*=.043)

indicating that adolescent girls looked significantly longer towards the head, followed by adolescent boys, then child boys and finally child girls spent very little time looking towards their head.

3.1 Participants who have higher overall body satisfaction will look more at body parts that they like

Data were entered into GLMM with fixation proportion as the outcome variable, participant and body part as random effects, and BPSS-R z-score and rating of body parts as favourite or not as fixed effects. The results are shown in Table 5-2. There were no significant main effects or interactions and adding age group and gender to the model did not change the results, suggesting that children and adolescents' gaze patterns are not influenced by body satisfaction or how positively a body part is rated.

Table 5-2. Linear model fixed effect results for fixation proportion, showing model estimates, SE, t-value, and p-value for each term. Participant and body part were entered as random factors.

	Model 1				**Model 2**			
	β	**SE**	***t***	***p***	**β**	**SE**	***t***	***p***
(intercept)	-2.01	0.10	-21.16	<.001	-2.23	0.22	-10.26	<.001
BPSS-R-z	-0.03	0.08	-0.37	.713	-0.25	0.20	-1.29	.198
Favourite or not	-0.17	0.14	-1.26	.208	0.34	0.31	1.09	.277
BPSS-R-z : Favourite or not	-0.11	0.14	-0.79	.433	0.18	0.33	0.56	.578
Age group (child)					0.32	0.28	1.09	.248
Gender (male)					1.09	0.65	1.16	.093
BPSS-R-z : Age group (child)					0.34	0.23	1.44	.149
BPSS-R-z : gender (male)					0.54	0.49	1.11	.267
Favourite or not : age group (child)					-0.66	0.41	-1.61	.107
Favourite or not : gender (male)					-1.02	0.77	-1.32	.186
Age group (child) : gender (male)					-1.28	0.69	-1.87	.062
BPSS-R-z : Favourite or not : age group (child)					-0.47	0.39	-1.21	.225
BPSS-R-z : Favourite or not : gender (male)					-0.31	0.76	-0.42	.678
BPSS-R-z : age group (child) : gender (male)					-0.56	0.54	-1.03	.303
Favourite or not : age group (child) : gender (male)					1.00	0.85	1.19	.235
BPSS-R-z : Favourite or not : age group (child) : gender (male)					0.55	0.84	0.66	.510

We then ran beta regressions for each body part to determine if participants' looking patterns were determined by how positively a body part is rated and their overall body satisfaction. Results are displayed in Appendix B. We found a main effect of age group (β=-1.44, SE=0.46, *p*=.002) on fixations towards the head (Fig 5-2 panel A), and age group (β=1.55, SE=0.50, *p*=.002) and gender (β=-1.16,

SE=0.34, *p*<.001) for fixations towards the lower legs (Fig 5-2 panel B). This suggests that adolescents look significantly more at the head; and female children and adolescent males look significantly more at the lower legs.

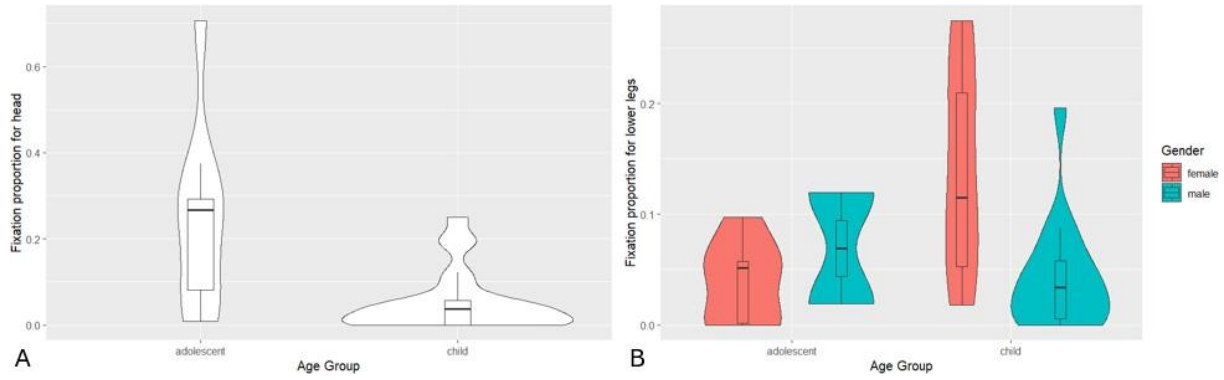


Figure 5-2. Violin plots showing the significant predictors of fixation proportions. Panel A shows the relationship between fixation proportions of the head and age. Panel B shows the relationships between fixation proportions for the lower legs, age group, and gender where females are represented in red and males are represented in blue.

3.2 Participants who have lower overall body satisfaction will look more at body parts that they do not like

The same models as in H1 were run but with children's rating of their least favourite body part, rather than their favourite. The results are shown in Table 5-3. There were no significant main effects or interactions and adding age group and gender to the model did not change the results (Appendix B), suggesting that children and adolescents' gaze patterns are not influenced by body satisfaction or how negatively a body part is rated.

Table 5-3. Linear model fixed effect results for fixation proportion, showing model estimates, SE, t-value, and p-value for each term. Participant and body part were entered as random factors.

	Model 1				**Model 2**			
	β	**SE**	***t***	***p***	**β**	**SE**	***t***	***p***
(intercept)	-2.13	0.14	-15.47	<.001	0.10	0.03	5.62	<.001
BPSS-R-z	-0.14	0.07	-1.96	.050	0.02	0.02	0.81	.416
Least favourite or not	0.03	0.15	0.21	.836	-0.10	0.05	-1.94	.052
BPSS-R-z : Least favourite or not	0.21	0.16	1.34	.181	-0.03	0.06	-0.50	.620
Age group (child)					-0.04	0.03	-1.27	.203
Gender (male)					-0.01	0.05	-0.19	.852
BPSS-R-z : Age group (child)					-0.04	0.03	-1.36	.175
BPSS-R-z : gender (male)					-0.03	0.04	-0.73	.468
Least favourite or not : age group (child)					0.11	0.06	1.70	.090
Least favourite or not : gender (male)					0.19	0.12	1.64	.101
Age group (child) : gender (male)					-0.01	0.05	-0.19	.853
BPSS-R-z : Least favourite or not : age group (child)					0.08	0.06	1.32	.187
BPSS-R-z : Least favourite or not : gender (male)					0.13	0.11	1.15	.250
BPSS-R-z : age group (child) : gender (male)					0.05	0.05	0.90	.369
Least favourite or not : age group (child) : gender (male)					-0.17	0.13	-1.34	.181
BPSS-R-z : Least favourite or not : age group (child) : gender (male)					-0.16	0.12	-1.36	.173

3.3 Participants will look more at body parts they like during the positive standing condition than in the neutral standing condition

We ran beta regressions for each body part AOI individually, with fixation proportion as the outcome variable and body part satisfaction, condition, and their interaction as predictors. The results are presented in Table 5-4. There were no significant main effects or interactions, suggesting that participants did not change their gaze patterns between the neutral and positive conditions.

Table 5-4. Beta regression results for fixation proportion by body part, showing model estimates, SE, t-value, and p-value for each term.

	Model 1			
	β	**SE**	***t***	***p***
Head				
(intercept)	-2.08	0.23	-9.10	<.001
Head satisfaction	-0.26	0.23	-1.11	.268
Condition (positive)	-0.32	0.29	-1.11	.266
Head satisfaction : Condition (positive)	0.01	0.35	-.03	.978
Arms				
(intercept)	-2.49	0.18	-13.92	<.001
Arm satisfaction	-0.16	0.22	-0.72	.470
Condition (positive)	0.06	0.22	0.27	.791
Arm satisfaction : Condition (positive)	-0.27	0.31	-0.88	.378
Chest				
(intercept)	-1.45	0.17	-8.63	<.001
Chest satisfaction	0.11	0.18	0.64	.524
Condition (positive)	-0.19	0.23	-0.85	.397
Chest satisfaction : Condition (positive)	0.17	0.26	0.66	.511
Stomach				
(intercept)	-1.96	0.19	-10.35	<.001
Stomach satisfaction	0.06	0.13	0.47	.634
Condition (positive)	-0.22	0.24	-0.90	.367
Stomach satisfaction : Condition (positive)	-0.08	0.19	-0.42	.675
Upper legs				
(intercept)	-2.10	0.15	-14.10	<.001
Upper leg satisfaction	0.22	0.21	1.05	.295
Condition (positive)	-0.25	0.21	-1.20	.229
Upper leg satisfaction : Condition (positive)	-0.12	0.29	-0.40	.687
Lower legs				
(intercept)	-2.67	0.23	-11.77	<.001
Lower leg satisfaction	0.22	0.24	0.91	.364
Condition (positive)	0.28	0.27	1.02	.306
Lower leg satisfaction : Condition (positive)	-0.09	0.33	-0.28	.781

When we added age group, gender, and their interactions to each model (Appendix B) we found a significant main effect of age group (β=-2.58, SE=0.65, *p*<.001) and a significant interaction between age group and gender (β=2.81, SE=1.11, *p*=.011) for fixations towards the head, suggesting that adolescents and boys look more at the head than children and girls do (Fig 5-3 Panel A). We also found a significant main effect of age group (β=1.71, SE=0.52, *p*<.001) and gender (β=1.62, SE=0.79, *p*=.042) and a significant interaction between age group and gender (β=-3.26, SE=0.96, *p*<.001) and between age group and condition (β=-1.70, SE=0.69, *p*=.014) for fixation towards the lower legs. From Fig 5-3 Panel B we can see that children's gaze towards the lower legs increases in the positive condition compared to the neutral condition, while adolescents' decreases. In Fig 5-3 Panel C we can see the interactions between age group and gender, although the three-way interaction between age, gender, and condition was not significant (β=-1.67, SE=1.23, *p*=.174) if we had more adolescent boys in the sample we may have seen an effect.

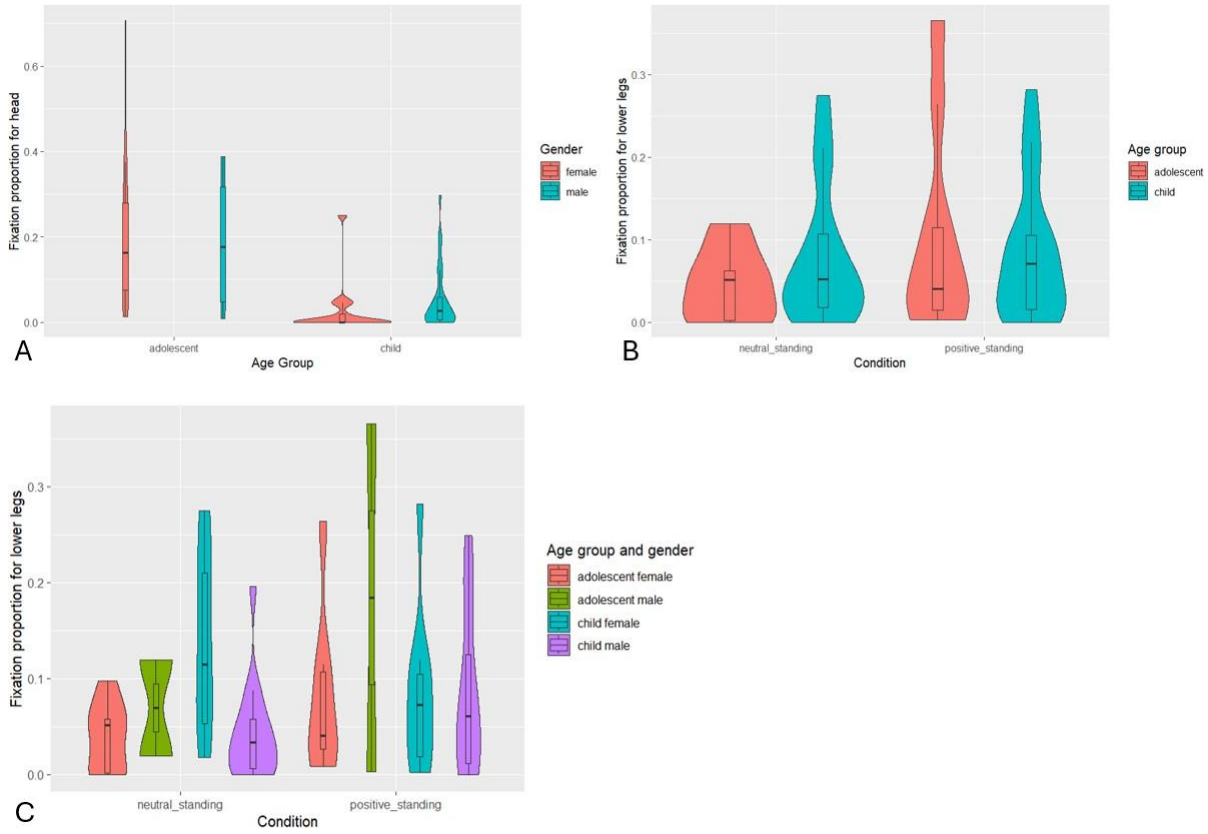


Figure 5-3. Violin plots showing fixation proportion towards the head (panel A) and the lower legs (panels B and C). Panel A shows the relationship between fixation proportion towards the head, age group and gender where females are in red and males are in blue. Panel B shows the relationship between fixation proportion towards the lower legs and condition by age group where adolescents are in red and children and in blue. Panel C shows the fixation proportion for the head and condition by age and gender where adolescent females are in red, adolescent males are in green, child females are in blue and child males are in purple.

3.4 Participants with lower body satisfaction will practise body avoidance more than participants with higher body satisfaction

For our final hypothesis, we ran beta regressions with fixation proportion off body as the outcome variable, and overall body satisfaction (z-scored), age group, gender, and their interactions as predictor variables. Results are presented in Table 5-5. In the first model there was no significant effect of overall body satisfaction. In the second model with age group and gender included, we found a significant main effect of overall body satisfaction and a significant interaction between overall body satisfaction and age group, suggesting that children who were more body dissatisfied practiced less body avoidance than children who were satisfied with their body, while adolescents showed the inverse relationship, with body satisfied adolescents spending more time looking at the body while body dissatisfied adolescents tended to avoid looking at the body (See Fig 5-4).

Table 5-5. Beta regression results for fixation proportion off body, showing model estimates, SE, t-value, and p-value for each term.

	Model 1				**Model 2**			
	β	**SE**	***t***	***p***	**β**	**SE**	***t***	***p***
(intercept)	-1.30	0.16	-8.24	<.001	-1.75	0.37	-4.74	<.001
BPSS-R-z	-0.05	0.14	-0.33	.740	-0.77	0.36	-2.14	**.032**
Age group (child)					0.73	0.44	1.68	.093
Gender (male)					0.01	0.63	0.01	.990
BPSS-R-z : Age group (child)					0.86	0.40	2.13	**.033**
BPSS-R-z : gender (male)					1.26	0.69	1.82	.069
Age group (child) : gender (male)					-0.36	0.71	-0.50	.616
BPSS-R-z : age group (child) : gender (male)					-1.43	0.78	-1.85	.065

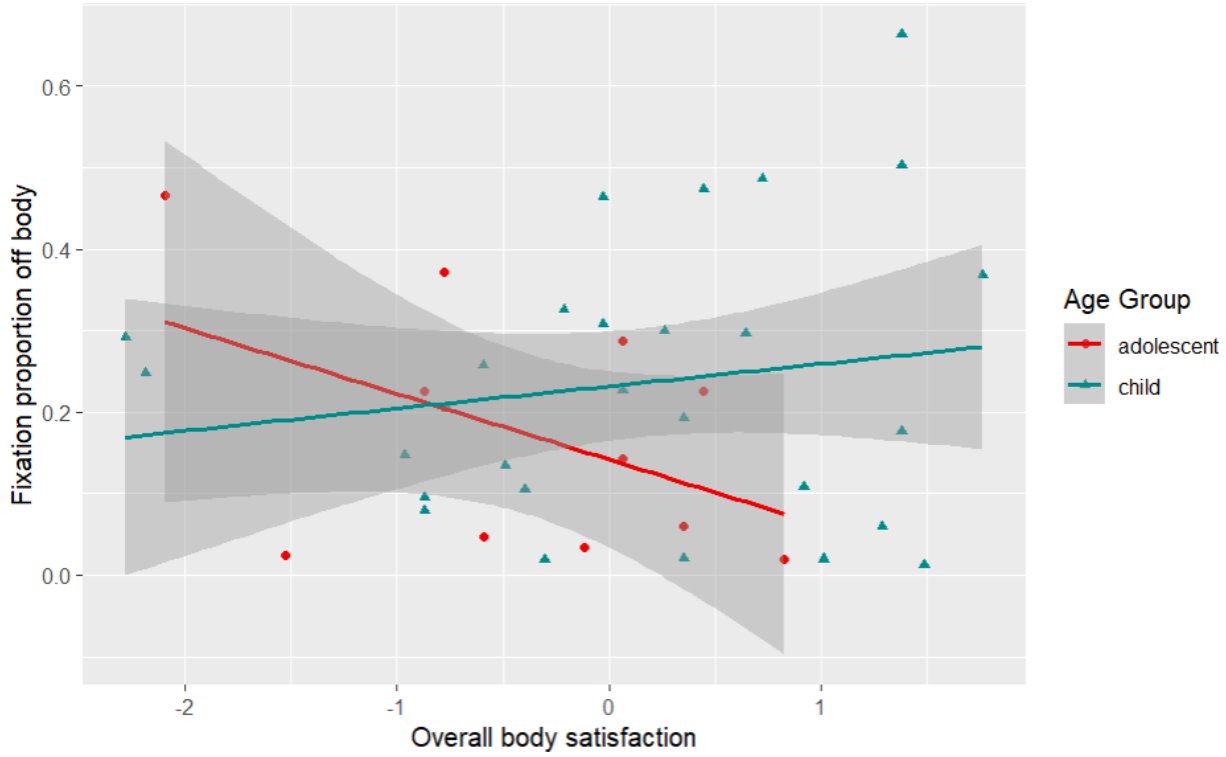


Figure 5-4. Scatterplot showing the relationship between fixation proportion off body and overall body satisfaction by age. Red circles represent the adolescent age group, and the blue triangles represent the child age group. The shaded area represents the 95% confidence intervals.

4. Discussion

The aim of the current study was to determine where children and adolescents look on their own body, and how this is influenced by overall body satisfaction, body part satisfaction, instructions, age, and gender. This was the first study to look at children and adolescents' gaze patterns and we found that children and adolescents show some key differences in gaze pattern from each other and from adults in previous research. Overall, children tend to look at the chest and stomach areas, while adolescents tend to look at the head and chest areas. Neither children nor adolescents preferentially look at or avoid body parts which they rate as their favourite or least favourite, and there are only small differences in gaze pattern between neutral mirror viewing and when prompted to think positively about oneself. Finally, body avoidance as a coping mechanism against body dissatisfaction appears to develop in early adolescence.

We first hypothesised that that participants who have higher body satisfaction would look more at body parts that they like than those they don't. This hypothesis was not supported by the results. We found that there was no effect of participants' reported favourite body part or overall body satisfaction in gaze patterns, suggesting that children and adolescents do not look preferentially at

liked body parts. We additionally found in relation to our second hypothesis that children and adolescents did not look more at body parts which they rated as their least favourite, suggesting that children and adolescents do not preferentially look at their least favourite body part. These are in contrast to the majority of literature in adults which has found that adults with higher body dissatisfaction look more at body parts they do not like, while adults who have lower body dissatisfaction look more at body parts they like (Greenberg et al., 2014; Jansen et al., 2016; Kerr-Gaffney et al., 2019; Tuschen-Caffier et al., 2015). Additionally, previous research on adolescents has found similar gaze patterns to adults (Bauer, Schneider, Waldorf, Braks, et al., 2017), although Bauer et al. (2017) conducted their study with adolescents with eating disorders while the current study recruited healthy adolescents. As such, these maladaptive gaze patterns may only develop in adolescents who are highly dissatisfied with their body or have eating disorder symptoms. Furthermore, as previous research has found that looking at negatively rated body parts increases body dissatisfaction (Smeets et al., 2011), there may be a bidirectional relationship between seeking out negatively rated body parts during times of low mood (Svaldi et al., 2016), and subsequent increased body dissatisfaction which adolescents who have lower depressive symptoms and body dissatisfaction do not participate in.

We additionally found that children and adolescents have different foci towards their own body which is distinct from (dis)satisfaction with that body part or overall body satisfaction. In the majority of adult studies, adults' gaze is drawn towards areas which are rated positively or negatively depending on their overall body (dis)satisfaction (Greenberg et al., 2014; Jansen et al., 2016; Kerr-Gaffney et al., 2019; Tuschen-Caffier et al., 2015). In the current study, we did not find that children or adolescents' gaze were directed in these ways, and instead found common gaze patterns towards body parts in each age group. However, the reason for this focus on body parts unrelated to perceived attractiveness or overall body image is unknown. Children had a general bias towards the chest and stomach, while adolescents focussed their gaze towards the chest and the head. For children, the chest and stomach may be salient due to the ease with which one can derive weight related information from the torso, in particular the stomach, and therefore may act as an early focal point for self-attractiveness judgements. Alternatively, it may simply be that the torso is a central focal point of the body and in an unusual situation they may have deliberately kept their gaze fixed upon the centre of their body, believing this to be the aim of the task.

Adolescents demonstrated a bias towards the chest and head. This could be due to the salience of the chest during puberty for breast growth in girls or muscularity in boys. One study has

found that advanced breast development at 13 years old was associated with increased depressive and eating disorder symptoms one year later (Lewis-Smith et al., 2020), suggesting that, in girls, breast development is a salient physical marker of pubertal development, but may also be associated with self-assessments of attractiveness which then influence body satisfaction. In boys, a similar relationship may exist, but with muscularity of the chest, rather than breast development. Adolescents' focus towards the face may be due to the salience of the face in one's image of oneself or sense of self, or may have been more interesting than the body for looking at. As this is the first study to consider where children and adolescents look on their own body, further research is required to determine what drives attention towards these areas.

Our third hypothesis that participants would look more at body parts they rated positively in the positive condition than in the neutral condition was not supported by the results. We did however find a significant interaction between condition and age group predicting fixation towards the lower legs, suggesting that children fixate more towards lower legs in the positive condition than in the neutral condition, while adolescents show the inverse effect. This could be related to functional salience of lower legs as pre-pubertal children have been suggested to value functionality over aesthetics (Riboli et al., 2022). Alternatively, as the lower legs are not a traditionally indicators of weight, or often cited as a negatively rated body part, children may practice a style of body avoidance while still maintaining focus on the body.

We did find a significant interaction between age group and gender, as well as age group and condition predicting gaze fixation towards the lower legs, although the three-way interaction was not significant. This could be due to the low number of adolescent boys included in the current study (n=3) as, when the results are split by age and gender, we can see a trend towards adolescent boys fixating a lot on their lower legs and this fixation increases during the positive condition while it decreases for adolescent girls. This could lend support to lower legs being associated with functionality as boys may value athletic ability and a muscular idea over a thin ideal (Tatangelo & Ricciardelli, 2013). Future research should therefore ensure recruitment of a sufficient number of adolescent boys and split analyses by boys and girls as well as age in order to explore this relationship further.

Finally, we hypothesised that participants with lower body satisfaction would practise body avoidance more than participants with higher body satisfaction. This hypothesis was somewhat supported by our results. We found that children who were more dissatisfied with their body fixated more on their body while those who reported more body satisfaction fixated less on their body.

Meanwhile, the inverse relationship existed for adolescents, indicating that adolescents who were less satisfied with their body spent more time fixating off body, while adolescents who were more satisfied spent more time fixating on their body. This is in line with literature which suggests that body avoidance may be a defence mechanism to protect against maladaptive thoughts about the body (Mendoza-Medialdea et al., 2023), so body dissatisfied individuals may practice more body avoidance than body satisfied individuals. As this is the first study to look at the development of gaze patterns and body dissatisfaction in pre-pubertal children and peri-pubertal adolescents further studies on this topic are required; however, the results of this study suggest that body avoidance may develop in early adolescence as the body aesthetics become more salient.

4.1 Limitations

A key limitation of this study is that the sample recruited was very small. Power analyses suggest we need approximately 55 participants to reach a power of 0.8 with a cautious effect size (0.2), so our sample of 40 was too few. This effect size was derived from previous studies which reported a medium effect size (Arkenau et al., 2022; Bauer, Schneider, Waldorf, Adolph, et al., 2017) and was reduced to be cautious due to the highly experimental and innovative nature of the current study. Additionally, we had very small numbers of participants in some groups (i.e. only 11 adolescents, only 3 adolescent males). Recruitment in Summer 2024 was constrained by the ending of my PhD funding. However, I will be working with MSc students in AY 2024- 25 in order to reach at least 60 participants, as per the study preregistration, before publication.

A second potential limitation is that we have no way with the current data to determine the style of visual processing being employed by children. Previous studies have shown that individuals with eating disorders have weak global processing (looking at the picture as a whole) and superior local processing (looking at the individual elements of a picture) (Lang et al., 2014). Given the nature of eye-trackers, it is impossible to determine if participants were focused on the individual area to which their gaze was concentrated, or if they were considering the body globally as one object in the environment. As such, in future studies, researchers should consider clarifying with participants as to what they felt they were looking at (i.e. their whole torso or specific body parts), or including a measure of processing style.

A further limitation was that the mirror that we used was fairly narrow as it had to be free standing, and as such it had to be placed far enough away from the child that they could see their whole body. This means the AOIs for the child's body parts were somewhat small and may not have

been as accurate as if the child was standing closer to the mirror. In future, research using mirrors may want to use a larger mirror, or a mirror wall to ensure the children can adequately see their whole body and this is fully recorded by the world camera on the eye trackers.

One potential limitation is the unusualness of the task presented. Children may have been confused about what to do or what was required of them, and adolescents may have found the task, particularly the distraction portion (shooting aliens with their laser eyes) odd or childish. However, although no qualitative data or feedback was collected about the task, the majority of participants did not comment that the task was particularly unusual or strange, and one young child later commented to their mother: "I don't understand how looking in the mirror charged the laser glasses" – suggesting that the distraction worked in the younger age group. Furthermore, although the adolescents sometimes found the distraction task cheesy, they accepted the explanation that it was a reaction test and were happy to 'play along'.

Finally, children's clothing was not standardised. This was in order to make children feel more comfortable in the lab environment and to encourage naturalistic gaze patterns. Furthermore, we wanted to make the study as accessible as possible for parents and therefore did not want to impose a clothing rule. One concern might be that participants' gaze patterns were focussed on colours, patterns, or pictures which are on their clothing, rather than their body shape or size. As these were the children's own clothes, however, children would be expected to be accustomed to the designs upon them, and so it is perhaps unlikely that children would focus on a stimulus which is not novel.

4.2 Future Directions for Research

Although we found an effect of positive condition for fixation towards lower legs, we did not find any other changes in fixations and found no effect of body part satisfaction. This could be due in part to the instructions which participants were given as they were not guided to think about positive aspects of their physical body or led through any full mirror exposure method. These instructions were chosen in order to be acceptable to parents (to overcome recruitment difficulties experienced in earlier chapters of this thesis), but future research should attempt to follow mirror exposure instructions to determine how this may influence gaze patterns.

It is currently unknown how conscious we are of our own-body gaze patterns as no research to date has asked participants where they thought they were looking. As such, future research on own body eye tracking should ask participants afterwards where they think they were looking, and how intentional their gaze was. This would allow us to determine how we decide what to look at on our

own body and how intentional gaze patterns may be related to body (dis)satisfaction, as those with high body satisfaction may plan or train themselves (consciously or unconsciously) to attend to positively rated body parts. Furthermore, answers to this question may help to understand the role of local and global processing in gaze patterns through childhood and adolescence.

Finally, the current sample were overall satisfied with their bodies and most had several 'favourite' or 'least favourite' body parts. As such, this may have influenced the results and indicated no changes in gaze patterns when there was not a sufficient sample of body dissatisfied individuals. Future research should endeavour to recruit a larger sample of both satisfied and dissatisfied participants so that proper comparisons can be made.

4.3 Conclusion

In conclusion, this is the first study to employ eye-tracking methods to determine where children and adolescents look on their body, and how this is influenced by overall body satisfaction, body part satisfaction, positive or neutral instructions, age, and gender. Our results indicate that gaze patterns in children and adolescents are drastically different from adults (as reported in previous research), that they are not yet influenced by overall body satisfaction, and that positive instruction adapts gaze patterns in the lower leg region only. We furthermore found that body avoidance as a coping mechanism for body dissatisfaction may develop in adolescence.

Chapter 6: Which body is fairest of them all? A mixed methods approach to how children think about different sized bodies in virtual reality

Abstract

Virtual reality is an excellent but underused tool for examining body image in young children, for whom other measures such as questionnaires may not be suitable. Research suggests that children may internalise the thin ideal from as young as 3-years old, but to what extent these ideals are internalised and what their developmental trajectory may be is relatively unknown. The current study aimed to assess children's thin ideal internalisation, through the presentation of different sized bodies in VR and a mixed methods approach. 42 children aged 7-16 were recruited and were presented with three different sized bodies across the adiposity spectrum. Our results indicate that children have a strong preference for thinner bodies but do not necessarily want that body to replace their own. Qualitative analyses indicated that children associated the low adiposity body with health and attractiveness, and that younger children thought of the avatar as a physical vessel while adolescents assessed its social status. Our study is the first to use VR to investigate body image and thin ideal internalisation in children. This study is associated with all three overarching aims of the thesis: it explores how internalised sociocultural ideals influence body size preferences and how we think about the body, it explores differences between pre-pubescent children (aged 7-16) and peri-/post-pubescent children (aged 13-16), and it assesses the acceptability of VR methods in body image research with young populations.

1. Introduction

Much of the literature which has investigated children's body ideals has used measurement tools like figure rating scales (FRS) in conjunction with 2D images on paper (e.g. Lombardo et al., 2014; Truby & Paxton, 2002), or on a screen (Nesbitt et al., 2019), or has used physical bodies such as dolls (e.g. Boothroyd et al., 2021; Dittmar et al., 2006). Chapter 2 of this thesis explored the issues with this approach, specifically that FRS may measure perceptual or cognitive body image, rather than the crucial dimension of evaluative body image which includes body dissatisfaction. As such, throughout this thesis we have explored different methods of measuring body image in children. No research to date has used Virtual Reality (VR) to give children a body which they see in first person or explored their thoughts around different sized bodies' capabilities and strengths. The present study therefore aimed to use VR as a tool to manipulate children's body size and explore their perceptions of body functionality and aesthetics in an embodied avatar whose physical dimensions were sometimes different to their own.

1.1 Children's perceptions of body size

Children as young as 3-years-old have been shown to have preferences for slim bodies (Harriger et al., 2019; Kościcka et al., 2016; Su & Aurelia, 2012) and even slim non-human figures (Harriger et al., 2010). Using semi-structured interviews, previous studies have shown that children as young as 5 years have a decent understanding of body size, how weight is gained and lost, and why you might want to gain or lose weight (Baxter et al., 2016; Rodgers et al., 2019). Furthermore, sociocultural ideals have been shown to predict body dissatisfaction in children as young as 7 (Clark & Tiggemann, 2006; Evans et al., 2013), so it is important that we understand children's thought processes when evaluating different body types in order to better understand this relationship.

Despite this early internalisation of sociocultural appearance ideals, pre-pubertal children have been suggested to think less about the aesthetics of their body than peri- or post-pubertal adolescents, and instead athletic ability is deemed important and is integral to a child's social standing (LaFontana & Cillessen, 2002; Lease et al., 2020; Rees et al., 2011). Previous literature has shown that children associate body size and shape with athletic ability (Dixey et al., 2001; León et al., 2021; Penny & Haddock, 2007), providing some evidence that children's internalised body ideals may be driven in part by perceived athletic ability; more than abstract sociocultural ideals. This is further demonstrated in doll studies where children assigned functional descriptors (good at sports, fit), socially desirable personality traits (kind, nice), and social status (has lots of friends) to slim-bodied dolls in particular

(see Chapter 4 of this thesis; (Harriger et al., 2010, 2019; Musher-Eizenman et al., 2004; Worobey & Worobey, 2014). However, a key issue with this research is that descriptors are often either positive feminine words (e.g. nice, quiet, has lots of friends), or negative feminine words (e.g. loud, mean, messy, has no friends), and few studies have included ability-related adjectives (e.g. sporty, strong). As such, while this shows that children are more likely to associate positive words with slim bodies and negative words with larger bodies in a forced choice task, it does not necessarily indicate that these are the words children would use naturally. In this study we allowed children to provide short answers about what the strengths of a particular body might be and explain their reasoning for wanting/not wanting a specific body size.

Research in adolescents suggests that teenagers, especially girls, think about the body more in terms of its aesthetic aspects over its function (Riboli et al., 2022). Adolescent girls felt that their pre-pubescent body was a physical vessel through which they experienced the world, and that around puberty their more mature body became something to be decorated and admired. Another study which conducted focus groups with both male and female adolescents found that boys also experienced a certain amount of pressure around their maturing body, but that role models were more likely to be sporting stars while girls tended to idolize singers and actresses (Tatangelo & Ricciardelli, 2013). Quantitative research has furthermore suggested that BMI is not an ideal predictor of body image in boys due to internalisation of the muscular ideal *and* anti-fat ideals (Grogan & Richards, 2002; D. C. Jones & Crawford, 2005; Prnjak et al., 2020).

1.2 VR as a tool for body image and eating disorder research

As discussed in Chapter 2 of this thesis, VR has been used extensively in body image and eating disorder research in adults (Clus et al., 2018; Ferrer-García & Gutiérrez-Maldonado, 2012; Turbyne et al., 2021), particularly in clinical samples (De Carvalho et al., 2017; Riva et al., 2021), but less work has been done in this area with children and adolescents. VR is an excellent tool for studying body image in children, particularly young children, for whom questionnaires and figure rating scales may not always be appropriately presented (Damiano et al., 2020). Furthermore, body evaluations in VR have been shown to be comparable to FRS in adolescents (Fisher et al., 2020), indicating it is a suitable tool for eliciting these evaluations in all age groups included in the current study. Previous studies using VR have found that children are able to experience a full body illusion (FBI) with a wide variety of avatars (Weijs et al., 2021) and are able to embody human avatars of different sizes (overall size of the avatar,

not body size) (Keenaghan et al., 2022). We should therefore expect that this method can be extended to embodiment over avatars with different body shapes.

Previous studies which have used VR with children and adolescents have used an egocentric (first-person) perspective, where the avatar shares a space with the child, and this is generally considered to promote embodiment of the VR avatar (Keenaghan et al., 2022; Weijs et al., 2021), however there is a significant lack of body image and eating disorder studies using VR with children and adolescents. Studies with adults have found that viewing avatars from an allocentric (third-person) perspective is effective in changing body size perceptions (Irvine et al., 2020), and reducing body dissatisfaction/increase body satisfaction (Irvine et al., 2020; Preston & Ehrsson, 2014). Furthermore, one study with adults found that participants rated their body as more attractive when it was seen from an allocentric rather than egocentric perspective (Neyret et al., 2020), indicating that an egocentric perspective results in higher embodiment and ownership of an avatar body. However, these studies aimed to change one's perception of one's body through visual diet and did not aim to explore participants' evaluations of different bodies to examine what children would think if they experienced embodiment of different sized bodies, an egocentric perspective was utilised.

Movement synchrony of the VR avatar to the participants' movements is a key factor in embodiment (Dewe et al., 2022, 2024), and studies have shown that from around 8-10 years old, bodies which move asynchronously break avatar embodiment (Weijs et al., 2021). However, one study has shown that very young children (aged 5 years) could also embody an avatar which moved asynchronously on their own (Keenaghan et al., 2022); further, the importance of multisensory cues for embodiment may grow with age (Cowie et al., 2018). Therefore, the current study employed both a synchronous and asynchronous condition. This allowed us to test the effect of synchrony on the embodiment of the avatar and to examine how embodiment affected satisfaction with the avatar's body size. These issues are both important for understanding how VR can be used as a method for exploring body image.

1.3 Current study

The aim of the current study was to discover how children think about different bodies using an FBI in VR. We recruited children aged 7-16 years to come into the lab and experience immersion in three different bodies across the BMI spectrum. We first hypothesised that participants would experience more agency and ownership over the synchronous rather than asynchronous bodies, and over the low adiposity body than the high adiposity body. Our second hypothesis was that preference

would be affected by body size, with participants preferring the low adiposity body. Finally, we hypothesised that this size preference would interact with embodiment, with participants preferring the low adiposity synchronous body. We also conducted a content analysis and a thematic analysis on the qualitative data which was collected in order to understand children's thoughts around different sized bodies which they experienced from an egocentric perspective.

2. Methods

2.1 Ethics

Ethical approval was gained from Durham University's Psychology Department Ethics Committee. Parents of an eligible child who had signed up to an online volunteer database were emailed with brief information about the study and a sign-up link. Volunteers then came into Durham University, read the full information sheet and could choose to give written consent to participate. The study was explained verbally to the child and they signed an assent to participate form to indicate they were happy to take part. Parents were given a debrief sheet once their child had completed the study; children were debriefed verbally and given a pen and a sticker for taking part.

2.2 Participants

We recruited 42 children (23 male, 19 female) aged 7-16 (*M* = 9.90, SD = 2.74) from the North East of England, United Kingdom. Exclusion criteria ensured that all participants had normal or corrected to normal vision and did not have any sensory processing difficulties or motor impairments which would affect their ability to take part in VR. Two participants reported they were autistic, and one reported having ADHD. All but one participant was of White ethnicity, and one was of Black ethnicity. Four children did not participate in some of the asynchronous conditions as they expressed distress during these conditions.

For some analyses, participants were split into two age groups. The child group (20 male, 11 female) were aged 7-10 (*M* = 8.45, SD = 1.26). The adolescent group (3 male, 8 female) were aged 13-16 (*M* = 14.00, SD = 1.10).

2.3 Materials

2.3.1 VR Equipment

This study was conducted in a VR lab. Participants wore 14 reflective clusters (Fig. 6-1), with four further markers attached to an Oculus Rift headset (Oculus Consumer Version; Menlo Park, CA, USA). These clusters were tracked by 16x Vicon Bonita infrared cameras (Vicon, Oxford UK) and Vicon

Tracker software (3.6.1). This 3D movement data was fed into Vicon Pegasus software (Pegasus 1.2.1) to map the participant's movements onto those of a corresponding virtual avatar.

Figure 6-1. Child wearing a morphsuit with all clusters and the VR headset.

2.3.2 Avatars

Virtual avatars were created using MakeHuman software (https://www.makehumancommunity.org/). A total of 26 avatars were created for this study, varying on sex (male/female), age (child/adolescent), and body size (low adiposity: 10th percentile BMI for that age group; average adiposity: 50th percentile BMI for that age group; high adiposity: 90th percentile BMI for that age group). Aside from different levels of adiposity, all avatars looked the same: fair skin, brown hair (short for boys, tied into a ponytail for girls), plain clothes, and of average height (see Fig 6-2 for examples).

Figure 6-2. Child age avatars created for each condition. The top row shows the girls' avatars, and the bottom row shows the boys' avatars. Top and bottom left-hand avatars are low adiposity; top and bottom middle avatars are average adiposity; top and bottom right-hand avatars are high adiposity. See Appendix C for adolescent avatars.

2.3.3 Measures

Children completed the following measures while in virtual reality. Body image and VR questions were asked in all five conditions, while the qualitative questions were only asked in synchronous low and high adiposity conditions.

2.3.4 Body Image

We adapted the Body Image States Scale (Cash et al., 2002) for this study (see Appendix C). To do this, we reduced the scale to five questions instead of six, as one item concerning weight was deemed unsuitable for the younger children for whom 'weight' may be too arbitrary a concept when

applied to avatar bodies. We additionally adapted and simplified the wording so that the questions were specifically regarding the child's feelings about the avatar body as opposed to their own body. We then split this scale into two new subscales: 3 questions on avatar likeability (how much they liked the avatar body, e.g. "How much do you like how you look with this avatar?") and 2 questions on comparative likability (how much they liked the avatar body compared to their real body, or the body of an average person, e.g. "How much do you like how you look with the avatar body compared to your normal body?"). Items were scored on a 5-point Likert-style scale, with high scores in the avatar likeability subscale indicating that the child liked the avatar. For the comparative subscale, a high score indicated the child preferred the avatar body, a low score indicated they preferred their own body or the body of an average person, and a score of 3 indicated they had no preference for either. A 5-point Likert-style scale was used rather than the 9-point scale presented in Cash et al. (2002)'s original scale as this was deemed more suitable for a young audience.

2.3.5 VR questions

Participants rated their level of embodiment for the avatar with a question on ownership ("Do you feel like the body you can see is your body or belongs to you?") and agency ("Do you feel like you're moving the body?"); they also rated a control statement ("Do you feel like the body is turning green?"). The items were rated on a 5-point Likert-style scale from 1 ("No, definitely not") to 5 ("Yes, lots and lots") as per previous studies on children's embodiment (e.g. Cowie et al., 2013, 2022).

2.3.6 Qualitative questions

Participants also answered qualitative questions regarding the low and high adiposity synchronous bodies. Two questions were asked regarding their perception of the function of the body ("What do you think you'd be good at if this was your body?") and whether they would like ownership over the body ("Would you like it if this was your body?"). Participants were asked to briefly expand on their answers after both questions.

2.4 Procedure

Participants visited the Psychology Department at Durham University for a VR study. They were told that they would see some different avatars in VR and that the aim of the study was to find out what they thought of each avatar. Parents were given time to read the information sheet and sign the consent form while the researcher explained the procedure of the study to the child. Once children had signed an assent to participate, they were dressed in a black morph suit to reduce reflectivity of clothing and the reflective clusters were attached to them using Velcro straps (See Fig 1). The VR

environment was created using Unity (Unity Technologies, San Francisco, CA, USA); participants saw a plain room with some furniture (a chair, a wardrobe, a tall plant) and a large mirror which calibrated to their shoulder height so they couldn't easily see the avatar's face to ensure participants were thinking about the avatar's body.

Participants experienced five conditions: they saw all three body sizes moving synchronously, and the low adiposity and high adiposity bodies moving asynchronously to test the effects of synchrony. The order of presentation was randomised, but participants always experienced the asynchronous condition directly after the synchronous condition of the same body size. At the start of each condition, participants ran through a series of movements to familiarize them with the avatar as detailed in Wolf et al., (2020). During asynchronous conditions, participants stood still while the avatar ran through the series of movements on a loop. After the movement phase, the researcher asked the questions verbally and read out the possible answers to which the participant responded verbally; their answers were recorded on a spreadsheet. Participants answered quantitative questions in each condition, and qualitative questions in the synchronous low adiposity and synchronous high adiposity conditions. Qualitative answers were recorded using a phone (Google Pixel 7). Answers were generally short, ranging between 45 seconds and 2 minutes 47 seconds (mean = 1 minute 33 seconds).

2.5 Data Analysis

Quantitative and qualitative analysis was conducted on the data. Repeated measures ANOVAs were used to test the differences between the three body sizes, and between synchronous and asynchronous conditions, and additionally to test the effects of the VR experience (ownership of the body, agency over the body, a control question). A content analysis was conducted on three of the qualitative questions where children gave short answers, and a reflexive thematic analysis (Braun & Clarke, 2012, 2020) was conducted on two questions where children were asked to expand their answers.

The lead researcher, a social and developmental psychologist conducted the interviews and created the codes and themes for the qualitative analysis. Interviews were transcribed by the lead researcher and a research assistant. The lead researcher re-familiarised herself with the data by reading over the transcripts while taking notes. Using an inductive approach, she then developed codes, drawing on her own perspective which was mainly informed by her knowledge and experience in sociocultural body image frameworks, functional body image literature, and child development. As discussed in Chapters 2 and 4 of this thesis, she used a critical realism approach, using children's

comments on different sized bodies to understand their thin ideal internalisation and weight stigma, and how these may be influenced by gender and age. The second author, a social and developmental psychologist who is a mother of four, and the last author, a social, developmental and evolutionary psychologist who is a mother of two, read over the themes and aided in their analysis and understanding.

3. Results

All quantitative data analyses were conducted using RStudio (RStudio Team, 2023), using Tidyverse (Wickham et al., 2019), rstatix (Kassambara, 2023) and ggplot2 (Wickham, 2016) packages. We first present the quantitative questionnaire data, then the qualitative data. Both analyses are based on the full sample of 42 children, while the synchronous/asynchronous comparisons are based on a sample of 38 children due to four children not liking the asynchronous conditions. As results do not meet assumptions for repeated measures ANOVAs, Friedman's Tests are presented and subsequent pairwise comparisons are completed using Bonferroni corrected Wilcoxon signed rank tests to control for multiple post-hoc comparisons. For interactions with gender, two-way mixed ANOVAs were performed with log transformations as there is no suitable non-parametric option.

3.1 Quantitative results

Zero-order non-parametric correlations (Spearman's Rho) are reported in table 6-1. For the low adiposity body, only agency was positively associated with ownership in the synchronous condition, while agency, avatar likeability and comparative likeability were positively related to ownership in the asynchronous condition. For the average adiposity body (which was only seen synchronously), avatar likability was positively correlated with agency and ownership, while comparative likeability was positively associated with ownership and avatar likeability. For the high adiposity body, ownership and comparative likability were positively related to avatar likeability in the synchronous condition, while ownership was positively correlated with agency and comparative likability, and comparative likeability was positively associated with avatar likeability in the asynchronous condition.

Table 6-1. Correlations among variables for each condition.

	Control	Agency	Ownership	Avatar likeability	Comparative likeability
Low adiposity					
Control	-	-.36	-.17	-.02	-.28
Agency	.26	-	**.49**	.32	.27
Ownership	.15	**.71**	-	.17	.16
Avatar likeability	-.01	.38	**.55**	-	.39
Comparative likeability	-.15	.37	**.45**	**.54**	-
Average adiposity					
Control	-	-.26	-.04	.11	.02
Agency		-	.25	**.43**	.29
Ownership			-	**.47**	**.46**
Avatar likeability				-	**.55**
Comparative likeability					-
High adiposity					
Control	-	-.16	.10	.27	.02
Agency	-.04	-	.22	.29	.21
Ownership	-.04	**.71**	-	**.48**	.23
Avatar likeability	-.04	.31	.36	-	**.45**
Comparative likeability	-.21	.42	**.49**	**.51**	-

Note: Correlations are Spearman's Rho. Coefficients for synchronous conditions are shown above the diagonal, and coefficients for asynchronous conditions are shown below the diagonal. Boldface signifies p<.005.

3.1.1 Control, agency, and ownership

Our first hypothesis was that participants would experience more agency and ownership over the synchronous rather than asynchronous bodies, and over the low adiposity body than the high adiposity body.

We first analysed responses to the control question to ensure that all subsequent responses were based on children's thoughts about the bodies, rather than any misperception of the VR environment, or response bias. The vast majority of children's responses were low (1 = body not turning green) in all five conditions. Friedman test indicated no significant differences between conditions ($X^2(4) = 4.42$, $p = .352$) and log transformed two-way mixed ANOVA showed no interaction with gender ($F(4, 144) = 0.36$, $p = .835$) or age ($F(4, 144) = 0.26$, $p = .904$). Therefore, given most children answered negatively (body not turning green) we are confident that any observable differences between groups are unlikely due to misunderstanding or response bias.

For agency ratings, Friedman's test revealed a significant difference between conditions ($X^2(4) = 91.81$, $p<.001$). Post-hoc pairwise comparisons revealed increased agency ratings for synchronous conditions compared to asynchronous conditions (see Fig 6-3 and Appendix C). Further analyses indicated no significant interaction with gender ($F(4, 144) = 0.30$, $p = .881$) or age ($F(4, 144) = 0.57$, $p = .686$).

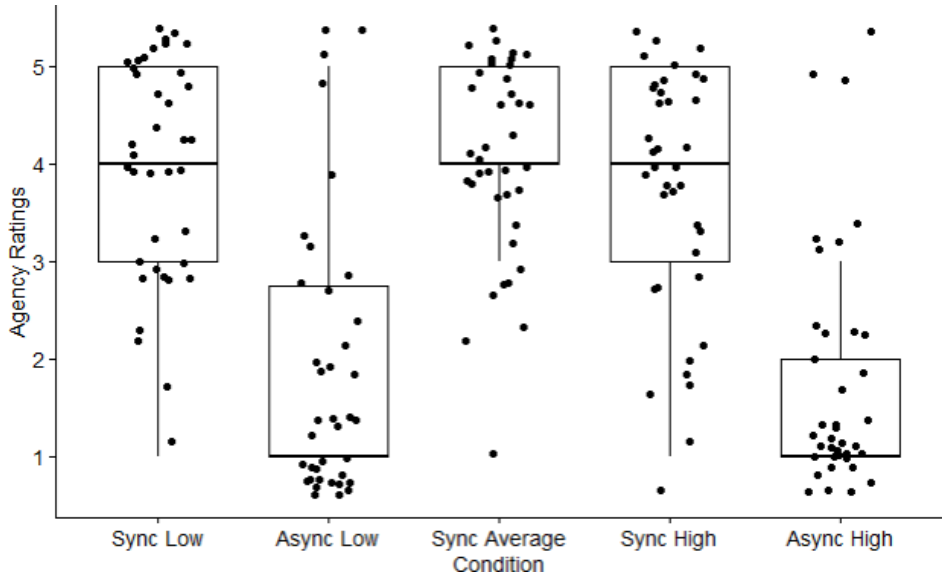


Figure 6-3. Box plot with jitter of agency ratings by condition. 'Low', 'Average', and 'High' refer to the adiposity of the body. 'sync' and 'async' refer to the synchronicity of the body.

Friedman's test revealed a significant difference between conditions regarding ownership ($X^2(4) = 22.01$, $p<.001$). Ownership was highest for the synchronous low adiposity condition ($Mdn=3$) and lowest for the asynchronous high adiposity condition (Mdn=1) (see Fig. 6-4). Post-hoc pairwise comparisons revealed significant differences between the synchronous low adiposity condition and the asynchronous high adiposity condition (V=259.5, $p_{bonf}=.002$), and the synchronous average adiposity ($Mdn=2$) and the asynchronous high adiposity (V=140.0, $p_{bonf}=.026$). Further analysis indicated no interaction with gender ($F(4, 144)=1.40$, $p=.238$) or age ($F(4, 144) = 2.35$, $p = .057$).

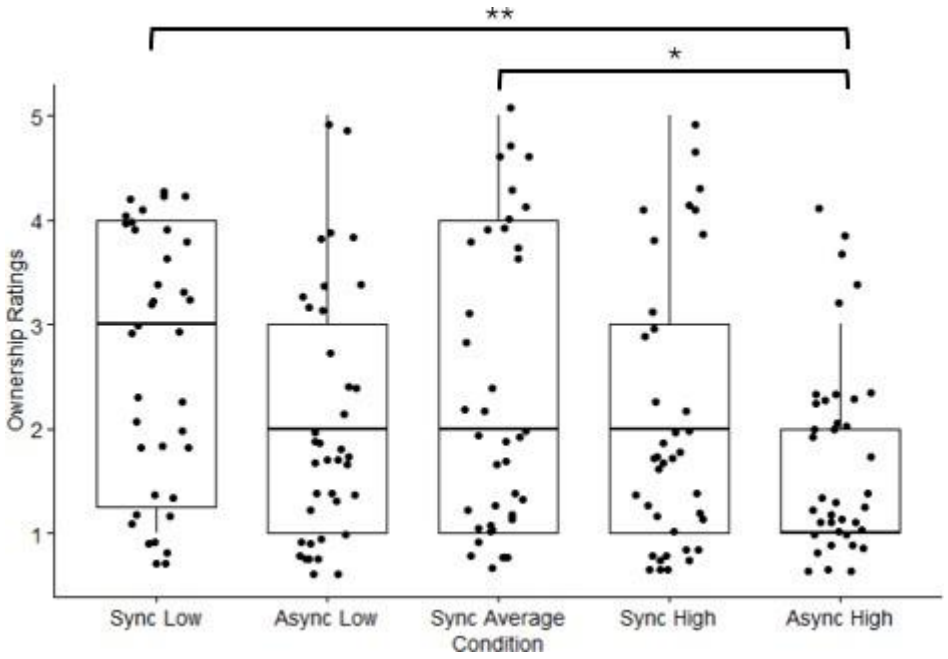


*Figure 6-4. Box plot with jitter showing mean ownership ratings by condition. 'Low', 'Average', and 'High' refer to the adiposity of the body. 'sync' and 'async' refer to the synchronicity of the body. *p<.05; **p<.01.*

3.1.2 Body image: effects of body size

Our second hypothesis was that avatar preference would be affected by body size, with participants indicating a strong preference for the low adiposity body. Friedman's tests were conducted to determine the effect of body size on the adapted Body Image State Scale subscales of avatar likeability and comparative likeability. This analysis focused on the effect of body size by examining the synchronous conditions only.

We found a significant difference between conditions for avatar likeability ($X^2(2) = 33.23$, $p<.001$) (See Fig. 6-5). Post-hoc pairwise comparisons indicated a significant difference between the low adiposity body (*M*dn=4) and the average body (*Mdn*=3.33) (V=462.0, $p_{bonf}=.049$), the low adiposity body and the high adiposity body (*Mdn*=2.33) (V=626.5, $p_{bonf}<.001$), and the average adiposity body and the high adiposity body (V=466.5, $p_{bonf}<.001$). Further analysis revealed no interaction between avatar size and child gender ($F(2, 78) = 0.58$, $p = .562$) or age ($F(2, 78) = 0.71$, $p = .495$).

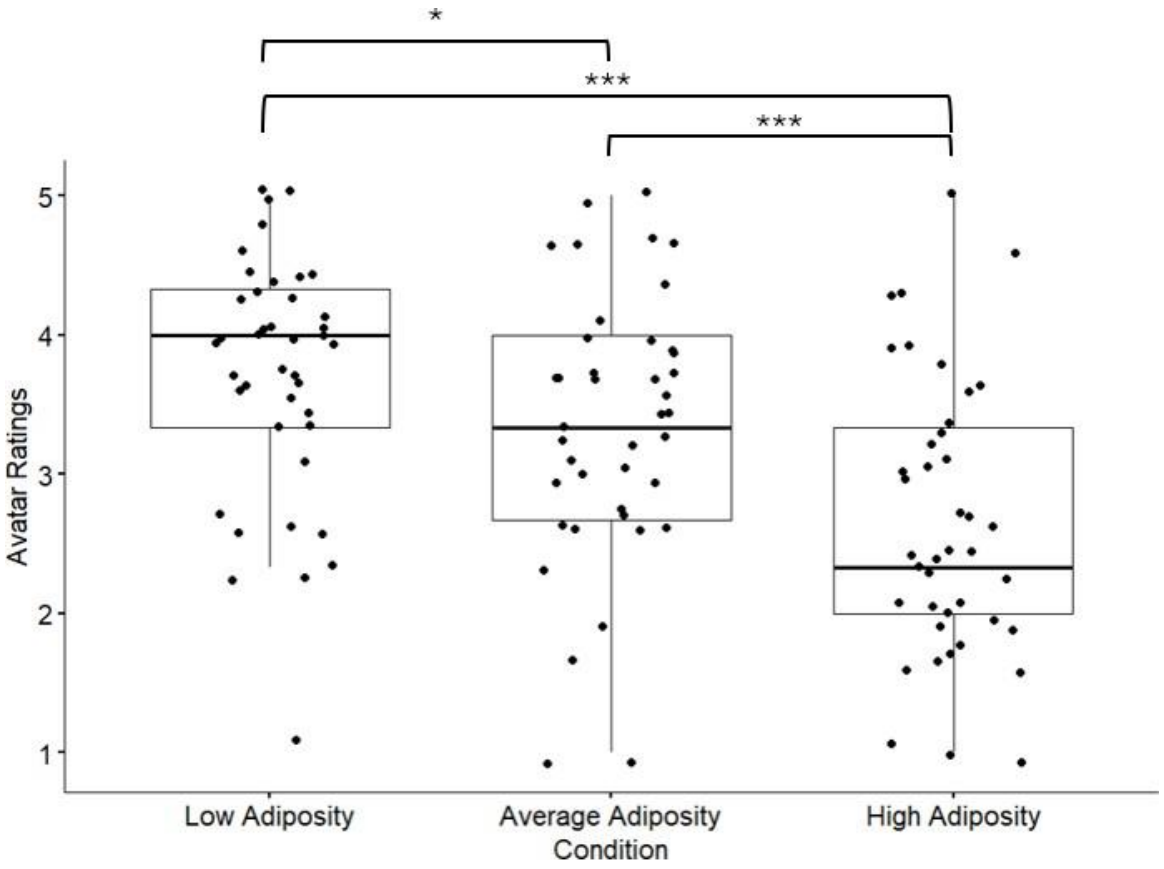


*Figure 6-5. Box plot with jitter showing the mean avatar likability ratings for each condition. *p<.05, ***p<.001*

There was no significant difference between conditions for comparative likeability ($X^2(2) = 2.94$, $p = .230$), and no interaction with gender ($F(2, 78) = 1.60$, $p = .208$) or age ($F(2, 78) = 2.43$, $p = .095$). One-sample Wilcoxon signed rank tests revealed that responses were significantly lower than ambivalent (a rating of 3) in all conditions, indicating that children significantly preferred their own body or the body of the 'average person' compared to the low ($V=81.5$, $p<.001$), average ($V=77$, $p<.001$), and high ($V=31$, $p<.001$) adiposity avatars (See Fig. 6-6).

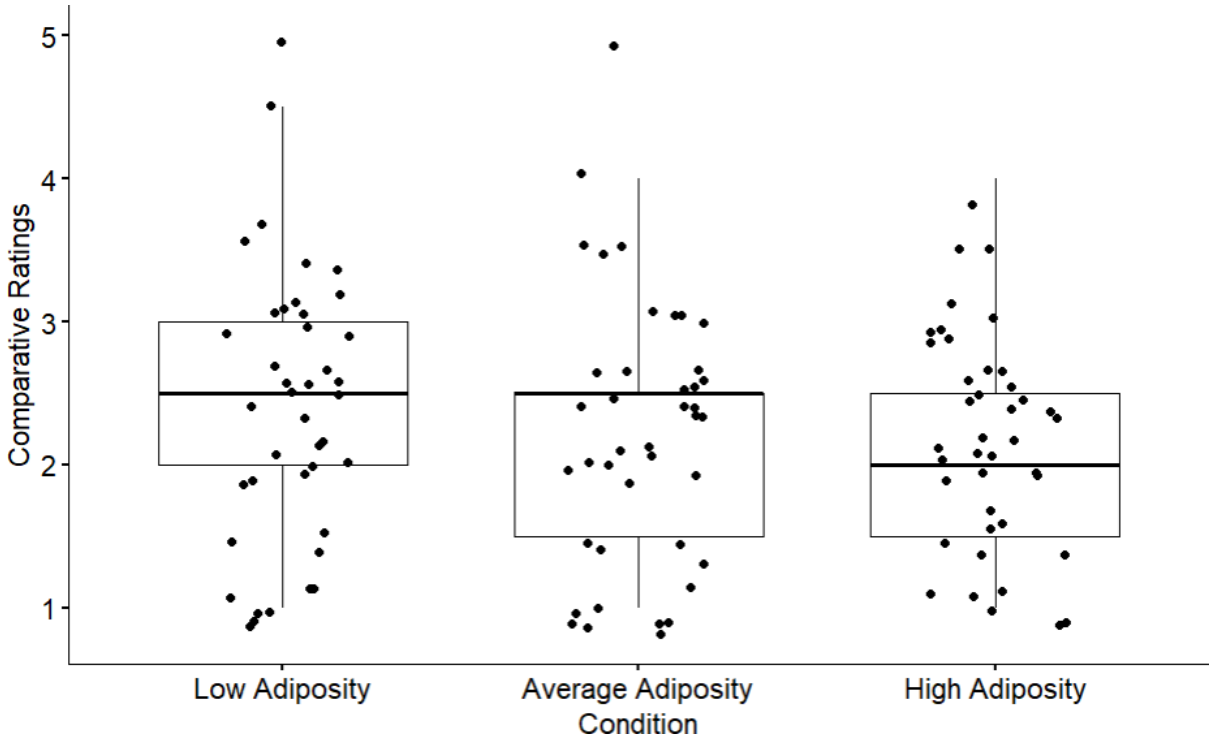


Figure 6-6. Box plot with jitter showing mean comparative likability of the avatar body by condition.

3.1.3 Body image: effects of synchrony and body size

Our final hypothesis was that size preference would interact with embodiment, with participants showing a strong preference for the low adiposity synchronous body. For the low and high adiposity bodies, Friedman's tests were used to determine the differences between synchronous and asynchronous conditions on avatar likeability and comparative likeability.

Analyses revealed a significant difference between conditions for avatar likeability ($X^2(3) = 41.01$, $p<.001$) (See Fig. 6-7). Post-hoc pairwise comparisons revealed a significant difference between synchronous/asynchronous conditions for the low adiposity body (V=329.0, $p_{bonf}=.025$) but not between synchronous/asynchronous conditions for the high adiposity body (V=203.0, $p=.745$). Interestingly, participants significantly preferred the low adiposity body over the high adiposity body, even when the low adiposity body was viewed asynchronously and the high adiposity body was viewed synchronously (V=431.0, $p_{bonf} = .002$). Further analysis revealed no significant interaction with gender ($F(3, 108) = 1.60$, $p = .177$) but a significant interaction with age ($F(3, 108) = 3.29$, $p = .023$), however, this effect did not hold up in Bonferroni corrected post-hoc pairwise comparisons.

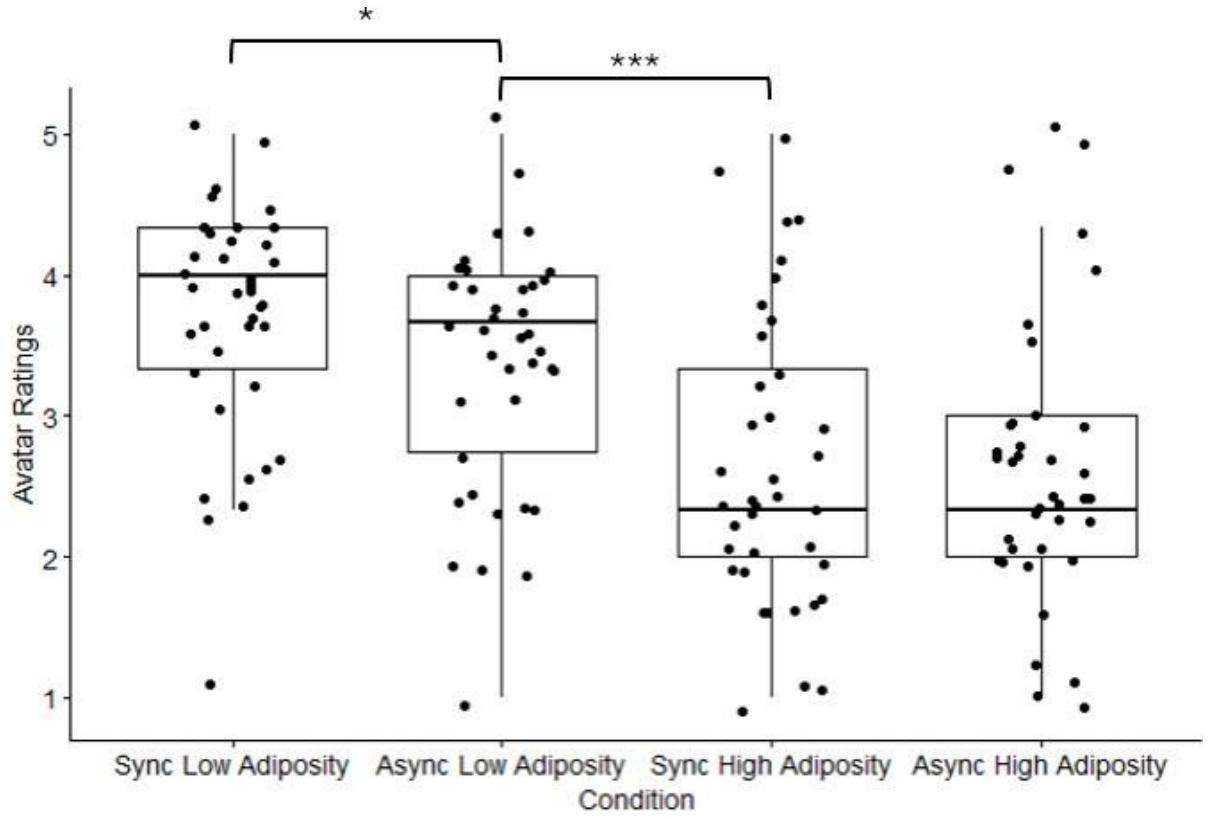


Figure 6-7. Box plot with jitter showing mean avatar rating by condition for the synchronous/asynchronous low and high adiposity conditions

Friedman's tests did not find any significant effect of synchrony on comparative likeability ($X^2(3) = 7.62$, $p=.055$). Post-hoc one-sample Wilcoxon signed rank tests were completed to determine if participants' responses were significantly different from ambivalent (3). We found for all four conditions; the synchronous low adiposity (V=81.5, p<.001), the asynchronous low adiposity (V=24, P<.001), the synchronous high adiposity (V=31, p<.001) and the asynchronous high adiposity (V=10, p<.001) avatars were significantly lower than ambivalent, indicating that in all conditions children reported strong preferences for their own body, or the body of the average person over the avatar body (see Fig. 6-8). Further analysis revealed there was no interaction with gender ($F(2, 78) = 1.78$, $p = .155$) or age ($F(3, 108) = 1.22$, $p = .307$).

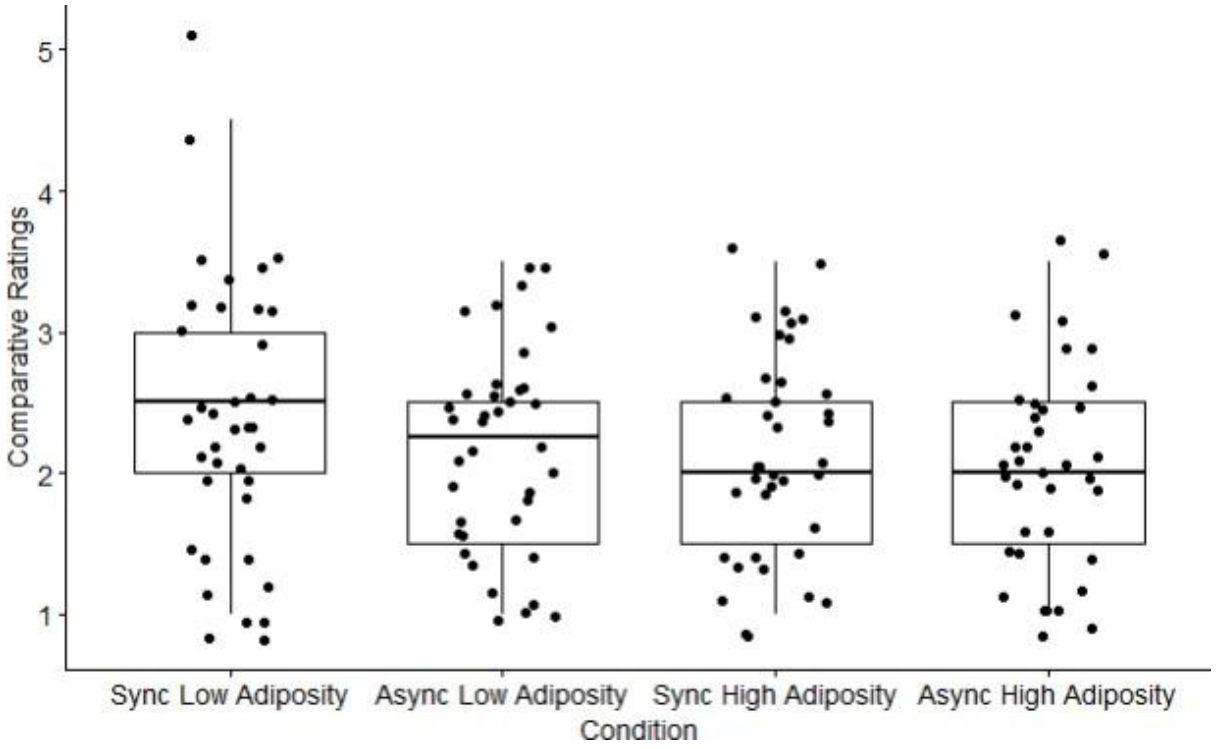


Figure 6-8. Box plot with jitter showing mean comparative likeability of the avatar body for synchronous/asynchronous low and high adiposity conditions

3.2 Qualitative results

3.2.1 Content Analysis

Results of the content analysis are presented in Tables 6-2 to 6-5. We conducted four main analyses: the use of ownership language, the choice of activity the avatar might do and whether that is similar or different to the child's abilities, and whether the child would like to have the avatar body as their own. We used Chi Square analyses to determine if there were statistically significant differences.

We analysed the language the participants used to determine how ownership was influenced by gender, age, or body size, and what language children were using when they described the bodies positively, neutrally, or negatively (see Table 6-2). Specifically, we coded each instance of first person and third person language in each interview. We found that boys and girls had equal distributions of using first person (male=29.03%; female=31.37%) and third person (male=70.97%; female=68.63%) language ($X^2(1, 113) = 0.004$, $p = .949$).

We had more children participating in the study than adolescents, but we found that children were more likely to use first person language (35.8%) than adolescents (15.63%) although this was not

statistically significant ($X^2(1, 113) = 3.53$, $p = .060$). However, both groups used significantly more third person (child=64.20%; adolescent=84.38%) than first person (child=35.8%; adolescent=15.63%) language.

Slightly more comments were made overall about the low adiposity body (55.65%) than the high adiposity body (44.35%) using this coding scheme, and we found that participants used more third person language overall (low adiposity=65.53%; high adiposity=76.47%) and were slightly more likely to use first person language for the low adiposity body (34.38%) than the high adiposity body (23.53%) although this was not statistically significant ($X^2(1, 115) = 1.38$, $p = .241$).

Finally, we coded the valence of the statement, whether they were saying something positive, neutral, or negative about the body. We found that participants made more positive comments (52.25%) than neutral (16.22%) or negative (31.53%) comments. For positive comments, participants were slightly more likely to use third person language (60.34%) than first person (39.66%), while the portion of language was more evenly split for neutral comments (first person=44.44%; third person=55.56%). For negative language, participants were much more like to use third person language (91.43%) while only a small number used first person language (8.57%) when making these comments ($X^2(1, 111) = 11.86$, $p = .003$).

Table 6-2. Instances of language used (first person/third person), disaggregated by gender, age, stimulus, and valence of the statement.

Language used	**Male (54.87%)**	**Female (45.13%)**	
First person (I/my)	18	16	
Third person (he/she/it/the body)	44	35	
	Child (71.68%)	**Adolescent (28.32%)**	
First person (I/my)	29	5	
Third person (he/she/it/the body)	52	27	
	Low adiposity (55.65%)	**High adiposity (44.35%)**	
First person (I/my)	22	12	
Third person (he/she/it/the body)	42	39	
	Positive (52.25%)	**Neutral (16.22%)**	**Negative (31.53%)**
First person (I/my)	23	8	3
Third person (he/she/it/the body)	35	10	32

We then analysed what kinds of activity children thought each body would be good at (see Table 6-3). Sedentary activity included anything would usually be done while sitting down, such as music, art, reading, and writing. Physical activity included anything which would involve moving around, usually in a capacity which would elevate one's heartrate, such as sports, running, boxing, and football. We found that almost three quarters of the responses for the low adiposity body involved physical activity (75.56%), while just over half of the responses for the high adiposity body were related to physical activity (52.27%). Participants were more likely to assign sedentary activities to the high adiposity body (27.27%) than the low adiposity body (15.56%) and were more likely to not answer the question for the high adiposity body (low = 8.89%; high = 20.45%) although these were not significantly different ($X^2(2, 89) = 5.35$, $p = .069$).

Table 6-3. Number of activity type chosen for each body size.

	Low adiposity (50.56%)	**High adiposity (49.44%)**
Sedentary activity	7	12
Physical activity	34	23
Don't know/no activity	4	9

We next assessed how often children's chosen activity was the same or different to what they were good at in 'real life' (see Table 6-4). We found that more participants chose an activity which matched their real-life skills for the low adiposity body (low = 58.97%; high = 46.67%), while comments for the high adiposity body were evenly split, with just over half of participants choosing an activity different to what they were good at for this body (low = 41.03; high = 53.33%); these differences were not statistically significant ($X^2(1, 69) = 0.60$, $p = .450$).

Table 6-4. Number of times participants chose an activity which was similar or different to their own capabilities.

	Low adiposity (56.52%)	**High adiposity (43.48%)**
Same as child	23	14
Different to child	16	16

Finally, we coded responses to the question "Would you like it if this was your real body?" using four codes (see Table 6-5), based on whether the answer was positive (they would like the body) or negative (they wouldn't like the body) and whether they used assertive language (e.g. absolutely, definitely, no, yes) or hesitant language (e.g. maybe, I wouldn't mind, not really, I guess). We found that responses for the low adiposity body were more spread across the four codes, with most participants either using assertive negative language (34.88%) or hesitant positive language (32.59%).

For the high adiposity body participants were significantly more likely to use certain negative language (59.52%), suggesting that they felt more averse to having a high adiposity body than a low adiposity body, although this was not statistically significant ($X^2(3, 85) = 6.19$, $p = .103$).

Table 6-5. Instances of assertive or hesitant language relating to if the participant would want the avatar body in real life.

	Low adiposity (50.59%)	**High adiposity (49.41%)**
Definitely not	15	25
Maybe not	8	7
Maybe would	14	8
Definitely would	6	2

3.2.2 Thematic Analysis

We then conducted a thematic analysis (Braun & Clarke, 2012, 2020) using expansions on answers to the two main qualitative questions: what do you think you'd be good at if this was your body; would you like it if this was your real body? Using inductive thematic analysis we created four main themes. Children are referred to by a pseudonym (generated by using the top 50 boy and girl names of 2023) to preserve their anonymity and so they cannot be associated with their quantitative answers. Gender and age of the participant are noted after the pseudonym to provide context. Finally, the body the child is referring to is denoted using a letter, L = low adiposity body, H = high adiposity body.

3.2.2.1 Theme 1: Size matters

The first key theme was centred around the body size of the avatar and is split into two subthemes. This first theme was evidenced throughout both questions as participants explained their reasoning behind their answers to the initial questions. Generally, participants thought the low adiposity body was healthier, fitter, and better looking than the high adiposity body. They furthermore assigned different skills to the bodies, with the low adiposity body generally being deemed fit and athletic and good for sports where this is important such as running or gymnastics, while the high adiposity body was assessed as more sedentary or muscular.

Subtheme 1a: Body size = health = attractiveness

Many participants associated the low adiposity body with being healthier ("It just looks healthy" – Daniel, 16, L) and more attractive ("I feel it's, like, a lot slimmer than I am. And looks better" – Evelyn, 15, L; "it looks quite strong and like, kind of good looking I guess" – Owen, 14, L). One

participant compared it to the other bodies they had seen ("I just feel like it's better than the other ones [bodies]" – Charlotte, 8, L) saying it was overall a better body.

When thinking about the high adiposity body, participants often commented on size, especially when explaining why they wouldn't want that body in real life ("Because it's larger than I'd like it to be" – Evelyn, 15, H) and the younger participants tended to be the most direct ("it's too chubby" – Ava, 9, H; "Because, too, fat" – James, 7, H; "Because it's a bit like, overweight" – Henry, 10, H; "Cause I don't like the shape" – Mia, 7, H; "I just like I look kind of fat…I like my slim body" – Kai, 8, H). A smaller number of participants felt the high adiposity body was desirable as it seemed like it was well proportioned:

> Because it just kind of seems like a well-rounded body. Not too fat, not too thin not too muscly, not too, not too not muscly – Asher, 10, H

Importantly, none of the participants mentioned the low adiposity body's weight, size or shape as a negative, indicating that from a young age individuals internalise high adiposity bodies as unhealthy and unattractive but the same is not seen for low adiposity bodies.

Subtheme 1b: The body as an indicator of personality and skills

As well as associating body size with health and attractiveness, participants tended to indicate that the body's physical capabilities and aspects of one's personality were linked to body size. For the low adiposity body, many participants highlighted its slenderness as an asset for sporting excellence, in particular its legs ("with quite long legs, so I can run easily" – Asher, 10, L; "He looks, he's got long legs. He's a bit slim so like he'd be quite quick" – Henry, 10, L; "it looks quite strong. And, um, it just generally looks like quite a fast pair of legs" – Daniel, 14, L; "I can't tell if they have longer legs…it kind of looks like it" – Mila, 13, L), its height ("Um, because I'm really tall and thin" – Amelia, 10, L; "Like I've got, like, a tall body and, because I've got a tall body" – James, 7, L) and its general slenderness ("That the body seems quite, like, slender." – Evelyn, 15, L; "because it's slimmer so the muscle will be more toned than like, there's lots of it" – Aria, 14, L, "now that I don't feel fat, I think now like running, maybe throwing" – Kai, 8, L).

Comparatively, participants often chose either sedentary activities such as reading, writing, or painting, or high muscle sports such as weightlifting, swimming or wrestling as activities that the high adiposity body would be good at. Some participants felt that the high adiposity body was ill suited to sports ("Because it's calm and not really sporty, I feel that with this body it would tire me out very

quick" – Ava, 9, H; "Because reading doesn't really need you to move around a lot" – Evelyn, 15, H; "because I feel like it would be a lot harder to do like sports and things" – Violet, 13, H) while others thought it would be good at certain aspects of sports ("wrestling it matters less what your body's like, if you're slender or not" – Evelyn, 15, H; "Because he's quite tall…he will be a good striker" – Henry, 10, H). One participant discussed muscle distribution of the body and its consequences:

> Because this body looks like it probably has a lot more muscle than, something like sprinting which requires a smaller figure, um, so you'd have good stamina with this – Aria, 14, H

Aside from physical attributes, many participants associated the body with social roles and drew conclusions about the avatar's personality based on its size. This was particularly evidenced by adolescents who seemed to focus less on the avatar as a shell and thought more about what the avatar would be like, or what they would be like if they were the avatar:

> I look like someone who's in like, a netball team, or plays tennis actually, I look like I play tennis. And I look like a really girly girl, like I'd do art or listen to music – Chloe, 13, L

One participant felt that the low adiposity avatar would be good at football due to his physique ("He just looks fit" - Ethan, 13, L), and the high adiposity avatar would be good at football and maths because "he looks like he would enjoy football. And he looks smart" (Ethan, 13, H), indicating that while participants may assign the same activities that the avatar is good at, they use different reasoning behind their answer which is based on the size of the avatar's body. Two participants described the high adiposity avatar as tough/strong ("Because it looks quite, like, tough and like, can probably hold the most hits" - Owen, 14, H; "he's a bit strong so he can throw himself about and score some good goals" - Henry**,** 10, H), suggesting that in men, bigger size is strongly associated with toughness from adolescence, and that those with bigger bodies are expected to act more aggressively. One participant indicated that the high adiposity body would have high social status ("I look cool" - James, 7, H), suggesting that while high adiposity bodies are associated with more aggressive personality, they are also socially desirable in boys. This was not evidenced by the girls, who felt that the high adiposity body was plain ("it's pretty basic so no one would judge us I guess" - Chloe, 13, H), and would have a more a maternal social role ("Umm, I feel like I'd be a mum" - Chloe, 13, H).

3.2.2.2 Theme 2: The Ship of Theseus: When is my body not my body anymore?

This theme concerned how participants felt about the avatar, particularly in relation to their own body. Participants embodied the avatar and used their own experiences to inform their answers

regarding the body's capabilities while simultaneously maintaining a strong sense of their own body as separate from the avatar body and articulated that their own body was integral to their sense of self. Many participants seemed to think of the avatar as a shell and the younger children in particular were more concerned with the outside appearance and function of the avatar. This theme is split into two subthemes which cover the avatar body as a vessel effects and the body's importance to the self.

Subtheme 2a: The avatar body as a vessel

The first subtheme covers how some participants expressed their thoughts around the avatar's capabilities by using their own body as a reference. This theme was particularly evident when the participant felt the avatar body matched their own body ("Cause I just feel it's quite similar to mine" – Violet, 13, L; "Just, it looks a bit like me, so, again, I'd get it" – Jack, 10, L; "Eh, it looks similar to what I look like" – Leo, 10, H). One participant clearly expressed his comparison to his own body:

> I honestly don't know why I'd be good at swimming, but it's just, I'm good at swimming in real life, so, and it feels like my own body, so it feels like this avatar would be good at swimming – Jack, 10, L

Some participants however seemed to indicate that their current abilities transcended their physical body, and that they would be good at an activity regardless ("Just because, like, it's still my body" – Isabella, 8, L) or that they would feel the same about their body regardless of its look ("Because it would be my body" – Mason, 10, L).

Subtheme 2b: Own body over avatar body

Comparatively, as discussed in this second subtheme, many of the participants preferred their own body to both the low and high adiposity avatar bodies but struggled to express their reasoning ("I don't know, it just doesn't look like me" - Aurora, 15, L; "it just doesn't seem, feel right to me" - Asher, 10, L; "Because of like, I dunno how to explain it but it feels sort of weird for me" - Ezra, 8, L). Some participants, mainly adolescents, expressed that they were comfortable in their own body, or that they were more 'used' to their own body ("Not 100% sure. Don't know. I don't know whether I've just gotten used to mine" - Daniel, 14, H; "Probably because I'm used to it" - Ethan, 13, L; "It's not that I don't like it, just that I'm more comfortable in my body" - Mila, 13, L). In the younger age group, children were more likely to not give a reason for preferring their own body ("I just like my own body better" - Isabella, 8, L; "Because I just like, my, my own body" - Henry, 10, L; "I just like my own body" - Charlotte, 8, H; "Because I prefer my own body" - Luca, 8, H), however some participants did focus

on looks, both in preference of their own body ("Because I prefer how my real body looks" - Lily, 13, H; "I just think [my body's] got better features than this one" - Kai, 8, L), and of the avatar body ("It just sort of looks kind of, better than my body that I have right now" - Owen, 14, H). One participant directly compared the avatar body to her own body:

> Cause it doesn't look how I actually look and I like the way I look and I don't want to change that – Olivia, 10, H

Subtheme 2c: Existing in the VR world

VR is an excellent tool for manipulating children's bodies, however it is not perfect and, due to the integrated camera system, there were ways in which the participants could cause glitching of the avatar body, such as by hiding or covering the reflective clusters. As such, the first subtheme is concerned with participants who commented on aspects of the VR, both positive and negative. Some participants thought of the VR as a game device and based the avatar's capabilities upon how they could move the body ("Because my body moves how it actually moves in real life" - Olivia, 10, L; "Kind of because, like, you can kind, like, control it a bit" - Ellie, 7, H; "I can move my body in that way" - Scarlett, 10, H), particularly the legs on the low adiposity body ("Just the leg movement is quite good" - Layla, 10, L; "Because the legs are quite swingy" - Mason, 10, L; "it's like, really easy to like, move your legs" - Hazel, 7, L; "Because the movement actually matches with my, eh, like, feet and stuff" - Sebastian, 9, L). One participant used the body movement and the VR environment to inform his thoughts about what the VR body would be good at:

> Because I can look at myself in the mirror and I can do a superhero or something like that pose – Alexander, 7, H

Some participants, however, focused on the glitches in VR, especially when considering if they would want the avatar body as their own ("It's glitchy" - Levi, 8, L; "My arm is a little twisty. Literally took my arm all the way round. It goes inside of it" - John, 9, H; "It just feels so weird, also, um, my hands can go inside my hands" - Asher, 10, H). One participant felt that if his real body were glitching in that way it would impede his ability to move:

> Because I don't, I don't wanna, I don't want my legs to be glitching like this...I don't want to be glitching and I don't wanna, I don't want to sit on the ground – Liam, 7, H

Finally, one participant used the glitching of the avatar to dictate what the avatar would be good at:

Because my legs are not glitching that much as my arms...and you can't use your arms in football – Liam, 7, H

A further feature of the VR which influenced participants decision on what the avatar's capabilities would be and if they would like the avatar body as their own was the superficial features of the avatar. This was mainly evidenced in the younger participants, but some adolescents did also use superficial features as a factor in their decision making. Many of the participants commented positively on the clothes the avatar was wearing ("Yeah, cause I'm wearing black and white" - Emma, 7, H; "Because it's, like, kind of, like, my style" - Ellie, 7, L); one participant used the avatar's clothes as an example of why he might like the avatar body:

> I mean, it looks quite realistic to what I'm doing. Mainly the surprise of black trousers. And I also sometimes wear a white top. - Leo, 10, L

While another participant felt that the clothes would be a reason to not want the avatar body as his own:

> It's just because, it's really basic clothes, and I don't really like white and black clothing. I'd really prefer, t-shirt like, a different colour, like blue – Sebastian, 9, H

Other participants focused on elements of the avatar such as its face, hair, and hands. Participants expressed that they would like the avatar body due to its hair ("I just quite like the hair" - Hazel, 7, H) or that the avatar would be good at football "because she's got a ponytail" (Aurora, 15, L) while another suggested the avatar would be good at English and maths due to her face ("I don't know, the face" - Camila, 15, L). Finally, three participants commented on the hands, positing that the avatar would be good at art ("Cause it's got big hands to draw" - John, 9, H), and music ("Just the hands...just the appearance of them" – Camila, 15, H; "Because you know, like, the hands can play a guitar like that" - Samuel, 7, L).

Subtheme 2d: What goes unsaid: unwillingness to comment on 'fat' bodies

This final subtheme demonstrates some participants' unwillingness to speak negatively about the high adiposity body while still demonstrating an implicit bias against it. Specifically, quotes made by participants for both the low and high adiposity bodies indicate that participants often felt it was acceptable to comment negatively on the low adiposity body, but were more ambiguous or vague with their reasoning for the high adiposity body. For one participant this was evidenced through commenting positively on the low adiposity bodied avatar's clothes ("because it's, like, kind of, like,

my style" - Ellie, 7, L) but being unwilling to say why they wouldn't want the high adiposity body and struggling to think of what to say:

> Because, mm, it's just, umm, like a little bit, kind of like, um weird, and a bit like, just, I don't know – Ellie, 7, H

Two more participants evidenced similar difference between answers for both avatars, with one liking the low adiposity avatar because it looked like them ("Just, it looks a bit like me, so, again, I'd get it" - Jack, 10, L) while they didn't want to say why they wouldn't want the high adiposity body ("Uh, I really don't know, yeah I just, don't know" - Jack, 10, H), and the second saying they would like the low adiposity body as it would be their body ("Because it would be my body" - Mason, 10, L) but did not feel they would like the high adiposity body if it were their body ("Uh, I just don't like the look of it" - Mason, 10, H).

Finally, two participants were clear about their reasons for not wanting the low adiposity body ("It's not that I don't like it, just that I'm more comfortable in my own body" - Mila, 13, L; "I, I just don't like it that much" - Layla, 10, L), but commented positively on the high adiposity body ("Um, not sure...I think it's nice" - Mila, 13, H) or specifically commented on body size ("Well, um, it doesn't really matter about body size" - Layla, 10, H).

4. Discussion

The aim of the current study was to examine how children and young people think about different bodies using virtual reality in which they look in a mirror at a virtual body which may differ from their own in size. We found that participants exhibited a strong preference for the low adiposity body over the average or high adiposity body in terms of what was deemed attractive. However, this bias did not carry over to wanting the body for themselves. As expected, we found that children experienced agency for the synchronous but not asynchronous bodies, but only experienced mild ownership over the synchronous low adiposity body. Surprisingly, participants experienced similar levels of ownership for the asynchronous low adiposity body and the synchronous high adiposity body, suggesting that children may embody an idealised avatar which does not match their movements more readily than a non-idealised avatar which does. Furthermore, children had significant *preferences* for the asynchronous low adiposity body over the synchronous high adiposity body. These findings suggests that while synchrony is important for children's embodiment (Dewe et al., 2024), it may be overridden by avatar desirability or similarity to the individual's own body.

In the content analysis we found that younger children were slightly more likely to use embodied language than adolescents; and that all participants were more likely to use embodied language when talking about the avatars positively, and for the low adiposity body. Additionally, participants were more likely to report that the high adiposity body would be best at sedentary activities or high weight/muscle sports while the low adiposity body would be best at all sport but especially sports where leanness is desirable (e.g. gymnastics, running). Finally, we found two overarching themes in the participants' answers. Participants reported that the low adiposity body was healthier, fitter, and more attractive than the high adiposity body, with the high adiposity body being associated with being bad at/unable to do sport, aggressive, calm, and smart. Only some of the boys reported the high adiposity body as being attractive, which may stem from larger bodies in boys being associated with more muscle (Edwards et al., 2014), social dominance (Swami et al., 2013), and other stereotypically masculine traits (Lennon & Johnson, 2021).

While participants did report liking the low adiposity avatar more, they also felt that their own body was better. Regardless of age, participants reported being more comfortable in their own body, thinking their own body was more attractive, and generally preferring their own body. This is not in keeping with the literature which shows that many children and adolescents are unhappy with the way they look (M. C. S. Martini et al., 2022; Tatangelo et al., 2016) and report wanting a thinner body (León et al., 2021; Navarro-Patón et al., 2021). This may however be due in part to the overall embodiment of the avatars in the current study. Ownership ratings for the synchronous low adiposity body were generally ambivalent, and ownership was correlated with comparative likeability in both asynchronous conditions and the synchronous average adiposity condition, indicating that as embodiment increased, so did participants' desire for that body. As such, higher embodiment of avatars as measured by ownership may influence comparative likability of the avatar, especially for avatars which participants do not have strong feelings over, such as those whose movements do not match the participants', or an average avatar. In support of this, our thematic analysis did indicate that some children did not want the avatar body due to reasons associated with the virtual reality itself, rather than the avatar's body size or shape.

Our first hypothesis was that participants would experience more agency and ownership of the synchronous bodies, and that this would interact with body size. This hypothesis was partially supported by our data, indicating that children experienced higher agency for synchronous over asynchronous bodies. Additionally, this interacted with body size: they only experienced mild ownership for the synchronous low adiposity body, and did not experience ownership over average or

high adiposity avatars. While existing literature suggests that synchrony is an important factor in the ownership and embodiment of virtual bodies (Dewe et al., 2024), most studies have used bodies which are identical in all ways except for synchronicity (Dewe et al., 2024; Keenaghan et al., 2022). We have shown that children experience stronger embodiment for low adiposity bodies – likely because these are deemed attractive, and/or because they closely resemble their own real body (while children's BMI was not directly measured in the current study, we observed that participants were on average closer to the low or average adiposity bodies than the high). This effect is not seen in adults who are able to embody avatars which differ in race (Banakou et al., 2016; Groom et al., 2009), body size (T. Liu et al., 2022; Serino et al., 2020), and gender (Lopez et al., 2019; Schulze et al., 2019), and research with children has shown that they are able to embody unrealistic features such as a giant or tiny body (Keenaghan et al., 2022), animal hands (Preston & Kirk, 2022), or extremely small and large hands (Cowie et al., 2022) to a greater extent than adults (Cowie et al., 2022; Keenaghan et al., 2022). It may be that children are more sensitive to avatars in the 'uncanny valley' of being very similar to them (e.g. an avatar with different skin tone, age, or gender) than adults, but are able to suspend disbelief when the avatar is very different (e.g. an animal). Alternatively, as participants reported thinking the high adiposity avatar was undesirable, it may be that children's embodiment is somewhat controlled by their desire to embody a given avatar and the cognitive dissonance in what they want their body to look like compared to how the high adiposity avatar looked prevented embodiment of an 'undesirable' body.

Our second hypothesis was that participants would have a strong preference for the low adiposity body, feel ambivalent about the average adiposity body, and have a strong dislike for the high adiposity body. This hypothesis was again partially supported by the results. We found that participants thought the low adiposity avatar was the most attractive, that the average adiposity avatar was of average attractiveness, and that the high adiposity avatar was the least attractive, but these perceptions of attractiveness did not influence participants' desire to have that body in real life. Indeed, participants in all conditions showed a strong preference for their own body, or the body of an 'average' person over the avatar body. This finding is interesting as it contradicts much of the literature which has found that even children as young as 5-years-old have a strong desire to have a thinner body (Hayes & Tantleff-Dunn, 2010; Pallan et al., 2011; Perez et al., 2018), and that between 20-70% of children and adolescents are dissatisfied with their current body (Tatangelo et al., 2016). However, these studies primarily use FRS or questionnaires, and as such the reality of owning a different body to their own may be easier to consider vaguely or imaginatively, compared to when they are placed

into a full-size 3D body. Alternatively, there may be conceptual differences between stating a desire for a slimmer body which participants picture as their own body, and being offered ownership of a different body which is slimmer than your own. In the qualitative results, one participant expressed that if she wanted her body to look slimmer, she would change her own body rather than swapping it for a different body, suggesting that the avatar body was not seen as the self. Furthermore, we found that many participants expressed satisfaction with their current body and reported that they had 'gotten used' to their own body so having another body would feel strange. This shows a strong sense of self and embodiment in one's own body. Previous research in adolescents has found that feeling secure in your identity is a protective factor against body dissatisfaction and internalisation of sociocultural appearance ideals (Palmeroni et al., 2021; Vankerckhoven, Claes, et al., 2023; Vankerckhoven, Raemen, et al., 2023), suggesting that while individuals are able to temporarily experience embodiment outwith their own body, they do not experience a transference of self to the new host.

Our third hypothesis was that participants would prefer the synchronous body to the asynchronous body, and that there would be an interaction with body size, whereby they would rate the synchronous low adiposity body the highest, and the asynchronous high adiposity body the lowest. This hypothesis was partially supported by our data. We found that for the low adiposity avatar, participants preferred it when it was viewed synchronously rather than asynchronously, as would be expected based on previous literature. However, we found no significant difference between avatar ratings for the high adiposity body in relation to synchrony, indicating that participants disliked the high adiposity avatar regardless of synchrony. Furthermore, participants significantly preferred the asynchronous low adiposity body over the synchronous high adiposity body, indicating that their preference for thin bodies may have been stronger than the effect of synchrony. This could suggest that avatar similarity or desirability is a strong influence in embodiment, in line with the free-energy self-recognition theory by Apps and Tsakiris (2014) whereby self-recognition is learned through multisensory cues and top-down processes which reduce 'surprise' and allow integration of the body into the sense of self. As such, while children may be able to embody highly unrealistic avatars (Keenaghan et al., 2022; Preston & Kirk, 2022), the surprise of a dissimilar *and* undesirable avatar may act as a more heavily weighted cue than multisensory cues for embodiment.

Together with the results of our second hypothesis, this shows a strong internalisation of the thin ideal in children and adolescents. The qualitative analysis furthermore indicated that the low adiposity body is perceived as healthier and better at sport than the high adiposity body, suggesting

that children and adolescents who have fairly positive body image themselves (indicated by a strong preference for their own body over the avatar body), possibly have high functional body image, and that functionality plays a strong role in their developing body image. Functional body image has been shown to be a protective factor against body dissatisfaction (Alleva & Tylka, 2021; Guest et al., 2022) but no research to date has investigated the relationship between functional body image and thin ideal internalisation. As such, it may be that functional body image acts as a mediator in the relationship between thin ideal internalisation and body dissatisfaction.

Of the qualitative analysis, we were able to add explanation and depth to the quantitative findings, allowing us to understand children's reasoning behind which body they consider better than others. Furthermore, we found that children and adolescents have a conceptual difference in the way in which the body is thought of. The younger children in the sample tended to think of the body as a vessel in which they existed, and used the body's external features (weight, clothing, movement) as validation for physical abilities, such as long legs are good for running, clothes indicate this avatar is good at physical education class, etc. Meanwhile, adolescents were able to draw conclusions about the avatar's personality and social standing from its external appearance, such as being a 'girly girl'. This is in keeping with current literature which suggests that children experience the body more as a vessel in which they exist which allows them to interact with the world (i.e. high functional body image), while a change occurs around adolescence during which there are large upheavals in social hierarchies and personal aesthetics become more important (Riboli et al., 2022).

4.1 Limitations

Although there are many strengths to the current study, there are some limitations which need to be acknowledged. It is possible that we experienced some selection bias in our sample, as parents of children with known body dissatisfaction or body self-consciousness may not have signed up for the study, while parents of children who felt neutral or happy with their body were more likely to be happy for their child to complete a body image study. Our participants were recruited from around the North East of England and many were from County Durham which has an average number of 'healthy' weight children comparatively to the rest of the UK (Office for National Statistics, 2023).

A second limitation of the study was the VR software, specifically its integration with the motion capture. Although it is an excellent tool for manipulating one's body size, there are some simple ways to cause the system to glitch, and many children found ways to cause glitches, although they were given directions which should have avoided them. As such, embodiment or likeability of the

avatar may in some instances have been influenced by VR glitches, as is shown in our thematic analysis. Therefore, as VR technology improves, avatar embodiment may increase.

A further limitation was that the VR environment was not particularly engaging once the novelty of VR with motion capture had worn off, and by the last condition many participants were becoming increasingly bored. The order of conditions were randomized so as to avoid any effects of boredom, but simple gamification (even as little as adding bubbles to pop to indicate their answer) may have avoided any attentional attrition which occurred.

A final limitation was that we collected no data on participants' personal body image, thin ideal internalisation, or perceived sociocultural pressures, nor did we collect any information on height, weight, or body composition. These measures were not collected due to potential issues parents may have with the content of such questionnaires (as in Appendix A) and the decision was taken in the design stage to exclude these measures from the current study. As such, we cannot be certain that preferences or biases that we found are related to, or interact with, any of those factors. Had we been able to collect this data, we may have found associations between high internalised sociocultural body ideals, higher perceived sociocultural appearance pressures, higher body dissatisfaction, and higher BMI with a preference for the low adiposity body and a desire to have that body as their own. As such, future research using a similar design should seek to incorporate these measures in a way that is approved of by parents. Despite this, we did find patterns in children's answers which suggest strong thin ideal internalisation from 7-years old, but a possible protective effect of own body satisfaction. This possible relationship requires further exploration using validated measures.

4.2 Future directions

There are some clear future directions for research which have been highlighted by our results. First, gamification of the VR experience, especially when running it with young children may have helped with attention and embodiment. From a young age children are used to gaming and may have experienced higher embodiment of the VR avatar if there were a gaming element to the study. Furthermore, having different activities available in the VR (e.g. football, climbing, archery, shooting) may have strengthened our finding that children think low adiposity bodies are better at sports (e.g. football, climbing) while high adiposity bodies are better at sedentary activities (e.g. archery, shooting).

The study could be further strengthened by including quantitative measures of body (dis)satisfaction, thin ideal internalisation, functional body image and perceived sociocultural

pressures as this would allow us to further understand children's perceptions of their own and other bodies and, combined with qualitative enquiry, delve deeper into children and adolescents' thoughts and behaviours around the body.

Finally, future research may benefit from more examination of functional body image as a protective factor against body dissatisfaction. Previous research has shown that it is a predictor of body appreciation in adults and has qualitatively found that adolescent girls think back on their childhood bodies as functional vessels, rather than something to be decorated and looked at (Riboli et al., 2022). This is somewhat seen in the current study, where younger children were more likely to think of the avatar body as a vessel through which they could interact with the world, while adolescents were more likely to comment on the social connotations of the body.

4.3 Conclusion

The current study has shown that VR is an effective tool for manipulating one's body and measuring body ideals. We found that children strongly preferred a low adiposity body over a high adiposity body, but did not necessarily want that body instead of their own. Participants' preference for a low adiposity body was stronger than their preference for synchronous movement of the avatar, suggesting that children and adolescents' VR embodiment is somewhat influenced by avatar similarity to themselves. Finally, we found that children and adolescents qualitatively reported strong thin- and athletic- ideal internalisation, but that their own functional view of their body may have acted as a protective factor against them wanting a body different to their own.

Chapter 7: Examining body appreciation in six countries: The impact of age and sociocultural pressure

Abstract

Previous research on body appreciation across the lifespan has produced conflicting results that it increases with age, decreases with age, or is generally stable with an increase in women over 50-years-old. Furthermore, most of the research has been conducted in White, Western populations. Cross-cultural research suggests that both Chinese and African women experience similar sociocultural pressures as White Western women, and that appearance ideals are shifting to resemble a more Western ideal. We cross-sectionally and cross-culturally examined body appreciation across the lifespan, recruiting White Western women (UK, USA, Canada, and Australia), Black Nigerian women, and Chinese women. 1186 women aged 18–80 completed measures of body appreciation, internalisation of thin and athletic ideals, and perceived sociocultural pressure. Body appreciation did not vary with age in women from any country. Nigerian women reported the highest body appreciation, and Western women the lowest. Higher thin/athletic ideal internalisation, and higher perceived sociocultural pressure were significantly associated with lower body appreciation in all countries and age-groups. Overall, our findings indicate that although levels of body appreciation differ drastically between ethnicities and cultures, it is generally stable across age, and shows cross-culturally robust relationships between sociocultural internalisation and pressure. This chapter provides insight into how sociocultural appearance pressures continue to influence body image through the lifespan, highlighting the persistence of these past adolescence. Furthermore, it demonstrates the differences between recruitment for questionnaire-based body image studies in adults compared to children and adolescents, highlighting the recruitment crisis in younger age groups.

1. Introduction

Body image is a multifaceted and complex phenomenon encapsulating how we think, behave, and feel about our body (Bailey et al., 2017; J. K. Thompson et al., 1999), including how it is influenced by gender, culture, and sociocultural influences. To date, most body image research has focused on young, White, Western women. A much smaller volume of research has investigated body image in a cross- cultural context, and in women of a wider age range. Further, most work has focussed on negative, rather than positive body image. Positive body image is argued to be more than the absence of body dissatisfaction – it is a broader concept which includes body appreciation, high body esteem, functional body image, and body satisfaction (Avalos et al., 2005; More et al., 2022; Tiggemann & McCourt, 2013). Higher levels of positive body image are associated with improved quality of life (Baceviciene et al., 2020; Becker et al., 2019), and decreased internalisation of appearance ideals (Alleva et al., 2022). The current study focuses on body appreciation, a concept defined by Tylka and Wood-Barcalow which encapsulates positive thoughts and feelings regarding one's own body and promotes healthy body- related behaviours (Tylka & Wood-Barcalow, 2015).

In a sociocultural context, the Tripartite Influence Model (TIM) (J. K. Thompson et al., 1999) posits that body image is influenced by three main sources: family, peers, and the media. However, the original model is intended to account for body dissatisfaction, and does not feature body appreciation (J. S. Mills et al., 2022; J. K. Thompson et al., 1999). Recently, some studies have investigated body appreciation as a moderator between sociocultural pressures and body dissatisfaction and have found that it moderates this relationship (Jankauskiene & Baceviciene, 2022). It furthermore acts as a protective factor against body dissatisfaction (J. S. Mills et al., 2022) and reduces likelihood of future risky health behaviours (Andrew et al., 2016a; Iannantuono & Tylka, 2012; J. S. Mills et al., 2022; Tylka & Wood-Barcalow, 2015). Additionally, body appreciation is argued to be distinct from body dissatisfaction and thus may function differently in the context of sociocultural variables (Tylka & Wood-Barcalow, 2015). Furthermore, in their review of body appreciation literature, Linardon et al., (2022) recommended that future research focus on body appreciation and the factors underpinning it in non-Western populations, and across the lifespan. The current study therefore intends to explore this relationship by determining how body appreciation is predicted by the facets of the TIM across women of different cultures and ages.

In a review of global body image literature, Rodgers et al. (2023) highlight the disparity of literature in non-Western populations compared to English-speaking Western populations,

especially in the positive body image field. Research in Africa is the least populous, while research in English-speaking Western countries makes up the majority (Holmqvist & Frisén, 2010; Landor et al., 2024). They recommend including more diverse groups, especially in Africa and the Middle East, and increasing the range of ages included in body image research. Therefore, in this study, we consider how adult women's body appreciation is related to sociocultural pressures and internalisation of physical ideals across age in three different cultural contexts: White Anglophone countries, China, and Nigeria.

1.1 Sociocultural influences on body image

There is strong evidence for the impact of sociocultural pressure on body image across the lifespan and across cultures, although most research in this area has been conducted on young, White, Western samples. These studies have improved our understanding of how perceived pressure from family, peers, and the media influence our body ideals, and subsequently our body dissatisfaction, but less is known about how the TIM relates to body appreciation. In an ethnically diverse sample, Burke et al., (2021) found that while mean levels of perceived pressure differed based on ethnicity, the strength of the TIM's pathways were the same, indicating that culturally diverse women in the USA experienced similar sociocultural pressures, and that this reliably predicted body dissatisfaction levels.

The relationship between sociocultural pressure and body dissatisfaction is often mediated by thin-ideal internalisation, which has been reported across the lifespan (Ahern et al., 2011; Bissell & Rask, 2010; Carrard et al., 2020; Vartanian et al., 2023) and is a main predictor of body dissatisfaction (Paterna et al., 2021; Vuong et al., 2021) and disordered eating (Aparicio-Martinez et al., 2019; Morton et al., 2020). Conversely, body appreciation has been shown to act as a protective factor against thin-ideal internalisation and disordered eating in adolescent girls, and against media pressures and disordered eating in adolescent boys (Jankauskiene & Baceviciene, 2022), but in adults this relationship may be flipped as increased perceived media pressure has been suggested to reduce body appreciation (Sonmez & Esiyok, 2023). Furthermore, with increasing globalisation of Western media which has been suggested to be a main factor in the increase in preference for thinner bodies in non-western populations (Boothroyd et al., 2020), it is important that we consider how sociocultural factors are related to body appreciation across cultures.

1.2 Body image and age

Research conducted with older participants has, thus far, found conflicting evidence for how women's body image develops through the lifespan. Tiggemann and McCourt (2013) recruited women

aged 18 to 75, and found that, while body satisfaction/dissatisfaction were generally stable across age, women over the age of 50 had significantly higher body appreciation. The authors define this difference as body shape and weight (dis)satisfaction being stable across the lifespan, while appreciation of body functionality and health increases. As such, women who were older appreciated their bodies significantly more than younger women but remained as satisfied/dissatisfied. The authors theorise that this is due to older women's bodies increasingly diverging from the societal ideal and therefore being 'forced' to accept and appreciate their bodies for their functionality and health over their physical appearance. Gagne et al. (2012) found that over 70% of women over 50 reported being more dissatisfied with their current body compared to when they were younger, and 79% felt that their body shape played an important role in their self-perception. However, the women in this study were asked to think retrospectively about their younger bodies, while Tylka and McCourt compared women across the lifespan on how they felt in the present. As such, it may be the case that women think more fondly about their more youthful bodies than they did when they were inhabiting them. Additionally, previous research has suggested that body (dis)satisfaction remains stable across all ages while body appreciation increases (Tiggemann & McCourt, 2013). As such, while a majority of their sample expressed high body dissatisfaction, they may have also expressed high body appreciation if it had been measured. This seems unlikely as 62% felt that their body shape or weight negatively affected their lives, which is not in keeping with high body appreciation. This finding is in line with More et al., (2022) who suggest that body dissatisfaction and body appreciation represent a body image continuum, as opposed to separate constructs. However, More and colleagues only measured young participants (18-30) and so this may suggest that body appreciation and body dissatisfaction are a continuum in early life but diverge as separate constructs in later life. Two further studies have found that older women were significantly more satisfied with their body size and shape than younger women (Biolcati et al., 2020; Borland & Akram, 2007), highlighting that body image in older women is not well understood.

Frederick and colleagues (2022) propose that because older individuals are further from the youthful body ideal, due to different social roles (parenthood, employment) and higher likelihood of being in a long-term committed relationship, older individuals experience less sociocultural pressure. Other findings by Tiggemann and Lynch (2001) support this theory, reporting that while body dissatisfaction remains stable, self-objectification, body monitoring, appearance anxiety and disordered eating symptomology were all significantly higher in women aged 20-29 than women aged 30-69, and lowest in women over 70 (Tiggemann & Lynch, 2001). McKinley (2006) found in a 10-year

longitudinal study that body esteem increased across time, while body surveillance and body shame decreased. They further suggest that changes in body image are more likely to occur at times of important life transitions (e.g., leaving University for employment, onset of menopause) rather than a gradual change over time. Their results provide some support for this hypothesis as the younger women (18-20 years old at time 1 and 27-30 at time 2) reported larger changes in body esteem than the older women (40-58 at time 1 and 50-68 at time 2), and indeed the older women showed no change in body surveillance or shame while the younger women reported significant reductions. These findings suggest that body image across the lifespan in adult women may not be a linear relationship, but that it may change quickly at times of important life changes and remain more stable at times of relative calm.

1.3 Body image cross-culturally

Most body image research has been conducted on individuals in culturally western countries such as the United States of America (USA), the United Kingdom (UK), Australia, and Canada. Recently, some research has been conducted in countries which have markedly different appearance cultures, such as China (where thin ideals may be stronger than in the West) and West Africa (where thin ideals may be weaker than in the West) (Yepes et al., 2016). Although there are fewer studies in these countries than in Western samples, and the sample size is often smaller, existing research points to the global diversity of appearance pressures experienced by women.

Studies in China have indicated that Chinese women report strong internalisation of the thin ideal (Barnhart et al., 2022; Jackson et al., 2020, 2021; Jung, 2018; Luo et al., 2005; Stojcic et al., 2020; L. Zhang et al., 2018) and cross-cultural comparisons suggest that Chinese women are more dissatisfied with their bodies than women from Croatia (Stojcic et al., 2020), but more satisfied than women from Japan and the USA (Madanat et al., 2011). Other research has shown that Chinese women believe being closer to the (Chinese) cultural ideal of beauty has socioeconomic benefits such as higher likelihood of employment, being able to use appearance to gain material benefits, and attracting male romantic partners (Wu et al., 2022). Despite a growing literature investigating body image within China, few studies to date have directly compared Chinese women to western women, and to our knowledge none have compared Chinese and African women. Some studies have considered Eastern Asian women living in western countries, and have found for instance that Asian American women report less body dissatisfaction than White American women (Burke et al., 2021; Cachelin et al., 2002; Rakhkovskaya & Warren, 2016), but may be more focussed on physical features unrelated to body

shape or size (Burke et al., 2021; Frederick, Kelly, et al., 2016). While most research on Chinese women has focussed on body dissatisfaction, some recent studies have examined the validity of the Body Appreciation Scale – 2 (Tylka & Wood-Barcalow, 2015) in this population, and have found comparable levels of body appreciation to women from other countries when comparing between studies (Aimé et al., 2020; Swami et al., 2016). Finally, no studies have compared Chinese women's body image across the lifespan, and the few studies which have looked at older Chinese adults report that they experience body dissatisfaction through similar pathways as younger Chinese adults (Barnhart et al., 2023; H. Zhang et al., 2022), highlighting the need for more research on body appreciation across the lifespan in Chinese adults.

Research in several African countries suggests that body ideals in Africa are significantly different than those in Europe and Asia, with the ideal body size being larger (Duda et al., 2007; Yepes et al., 2016). However, research in African countries (and specifically in Nigeria for our purposes) is sparse compared to that focusing on western and Eastern Asian populations (Maruf et al., 2014). Macia et al., (2019) completed a study in Senegal which considered individual's body image across the lifespan and reported that older Senegalese adults were less satisfied with their body than young adults. However, this study used only four questions adapted from a different study on Swedish adults (Öberg & Tornstam, 1999), and reported a high degree of appearance satisfaction, even among the 'less satisfied' older age groups. Another West African study from Ghana found that higher belief in Afrocentric values mediated the relationship between body image satisfaction and psychological wellbeing (Dotse & Asumeng, 2014). The authors suggest that internalisation of African values and culture acts as a protective factor against body dissatisfaction as these promote a larger, healthier body. However, studies which have looked at urban Nigerian youth have found that between 36.7% and 55% of young Nigerians report body dissatisfaction (Amazue, 2014; Otakpor & Ehimigbai, 2016), and that rural Nigerian adolescents have a significantly better body image (Amazue, 2014). The author suggests that this is due to higher internalisation of traditional Afrocentric values in rural populations, and more exposure to Western media in urban populations. Further research has suggested that urban Nigerian women's body ideal is shifting to resemble a more Western ideal (thin body, light skin, long and straight hair) (Abimbola, 2017; Offiah & Ogbu, 2017), compared to women from other African nations such as Kenya (Balogun-Mwangi et al., 2023). Additionally, all studies which have considered body image in Nigerian women have used measures of negative body image and body dissatisfaction. It should be noted that strong identification with Black African culture has been shown to reduce body dissatisfaction and promote body appreciation among African American women (Watson et al., 2019).

Despite this, only one study has looked into women across the lifespan in Western African countries. Given these factors, it is important to further our knowledge of body appreciation in African women of all ages living in Africa, comparatively to women of other ethnic and cultural groups, and how this is influenced by sociocultural factors.

1.4 Current Study

The current study aimed to understand how body appreciation differs across age in three different cultures, and how sociocultural pressure influences body appreciation across these populations. We therefore recruited participants from Western countries (Australia, Canada, United Kingdom, United States of America), China, and Nigeria to fill in a series of questionnaires on body appreciation and sociocultural pressure. We first hypothesised that older participants would report greater body appreciation across all groups. Drawing on previous research, we further expected that Black Nigerian women would report the highest levels of body appreciation, and White Western women would report the lowest levels. Second, we expected that older participants would report lower thin/athletic ideal internalisation and perceived sociocultural pressure, and that this would be the same across ethnicities. Our final hypothesis was that high thin ideal internalisation and perceived sociocultural pressure would be associated with lower body appreciation in all cultures.

2. Methods

2.1 Ethics

Ethical approval was gained from Durham University's Psychology Department Ethics Committee. After reading an online information sheet explaining the study's methods and purpose, participants completed an online consent form in which they confirmed they had read and understood the information sheet and privacy notice and agreed to participate. If participants indicated that they did not consent they did not proceed further. Participants also viewed a debrief statement once they had completed all questions, in which the study's purpose was reiterated and a link provided to a body image support website.

2.2 Participants

Data was collected in two waves. Wave 1 took place from 20th October 2021 to 1st March 2022 and included Black Nigerian women and some of the White Western women. Wave 2 took place from 10th October 2022 to 1st March 2023 and included the Eastern Asian Chinese women and some of the White Western women.

Participants were recruited to this fully online study via: Durham University's departmental participant pool (Durham university students); word of mouth within the UK, China and Nigeria; posters which were posted around Durham (England) and Glasgow (Scotland); and online promotion on popular social media platforms (Facebook, Twitter, Weibo) for all countries. The study was mainly advertised in urban areas, with focus points of Durham, Glasgow, and Washington DC for the Western population, Lagos for the Nigerian population, and Hohhot and Shanghai for the Chinese population. A total of 1393 women were recruited with an age range of 18-80 and a mean age of 34.89 (SD 14.77).

Participants completed the questionnaires as part of a larger cross-sectional study exploring body appreciation, relationship status and satisfaction, and pregnancy. The current study reports relationships amongst body appreciation, sociocultural factors, age, and cross-cultural variables. All participants were recruited using similar methods (social media, word of mouth through an author), with the exception of posters in the UK (these accounted for a small number of the older UK sample) which were not distributed in other countries.

Participants were included in the current analyses if they reported their current country of residence as Australia, Canada, United Kingdom, United States of America, China, or Nigeria. We then split participants into three groups based on country of residence and ethnicity. The White Western group consisted of women reporting White ethnicity and currently living in Australia, Canada, the UK or the US. The Nigerian group was based on women reporting Black/African ethnicity and currently living in Nigeria. The Chinese group was women currently living in China reporting Eastern Asian ethnicity. All other combinations were removed. This left a final sample of 1186 women; 811 White Western participants aged 18-76, mean 36.04 (SD 15.96), 246 Black Nigerian participants aged 18-57, mean 32.17 (SD 10.85), and 129 Eastern Asian Chinese participants aged 18-80, mean 37.36 (SD 11.52).

2.3 Measures

Participants completed the following questionnaires in order unless specified:

2.3.1 Demographic questions

Participants were asked to indicate their age in years, gender, sexual orientation, ethnicity, country of residence, and relationship status, at the start of the study.

2.3.2 Body Appreciation

Participants completed the Body Appreciation Scale – 2 (BAS-2; Swami et al., 2016; Tylka & Wood-Barcalow, 2015) as a measure of positive body image. The BAS-2 contains 10 items concerning acceptance of (e.g., "I appreciate the different and unique characteristics of my body"),

positive thoughts about (e.g., “I feel good about my body”), and respect for (e.g., “I respect my body”) one’s body. All items are forward scored on a 5-point Likert-style scale from ‘Never’ to ‘Always’ where a high average score indicated higher body appreciation. The questionnaire has been shown to have good reliability and validity (Tylka & Wood-Barcalow, 2015). It has also been validated in China (Aimé et al., 2020; Swami et al., 2016), in other non-western countries such as Japan, Poland, Serbia, and Iran (Razmus et al., 2020) and in Zimbabwe (Swami et al., 2012) indicating that it is suitable for use in this study. In the current study, the internal consistency values (Cronbach’s Alpha) were .94 for White Western participants, .94 for Black Nigerian participants, and .92 for Chinese participants.

2.3.3 Sociocultural pressures and thin-ideal internalisation

Participants completed the Sociocultural Attitudes Towards Appearance Questionnaire – 4 (SATAQ-4; Schaefer et al., 2015; Stojcic et al., 2020), a 22 item scale split into five subscales concerning: internalisation of thin ideals (e.g., “I want my body to look very thin”), internalisation of the athletic/muscular ideal (e.g., “I think a lot about looking muscular”), pressure from family (e.g., “Family members encourage me to get in better shape”), pressure from peers (e.g., “My peers encourage me to get thinner”), and pressure from the media (e.g., “I feel pressure from the media to improve my appearance”) to obtain and maintain an idealised body. Items are forward scored on a 5-point Likert-style scale from ‘definitely disagree’ to ‘definitely agree’ where a high average score indicates higher internalisation of the thin/muscular ideal, and higher perceived pressure from family, peers, and the media. This questionnaire has been shown to have good reliability and validity in the UK (Schaefer et al., 2015), Brazil (Barra et al., 2019), and China (Ma et al., 2023), indicating that it has good cross-cultural validity. Previous versions of the SATAQ have been shown to have good reliability in Ghana (Michels & Amenyah, 2017) and in women of African origin (Warren et al., 2013). Internal consistency values for each subscale by country are listed in Table 7-1.

Table 7-1. *Internal consistency (Cronbach's Alpha) for each subscale of the SATAQ-4 by study group.*

	Thin ideal internalisation	Athletic ideal internalisation	Pressure from family	Pressure from peers	Pressure from media
Black Nigerian	.67	.85	.85	.88	.90
Eastern Asian Chinese	.80	.79	.86	.90	.96
White Western	.81	.90	.90	.91	.95

2.4 Procedure

Participants were directed to follow a link or scan a QR code which took them directly to the study hosted by Qualtrics™, an online research platform. Separate links were provided for English vs Mandarin Chinese versions of the questionnaire; Black Nigerian and White Western women completed the English version, and Eastern Asian/Chinese women, the Chinese version.

After reading the information sheet and privacy notice and clicking a button to 'sign' the consent form, participants provided demographic information and completed the questionnaires described under Measures.

2.5 Statistical analysis

In advance of the main analyses, we conducted tests of missingness to determine the potential influence of missing data. We found that Black Nigerian women were more likely to have missing data on the BAS-2, but otherwise the data was missing at random. As such, we used mean imputation for missing items where participants had completed over half of the questions in a given scale. We then use pairwise deletion for analyses where participants have missed an entire scale.

To answer our main research questions, we conducted a series of multiple linear regressions. To test our first hypothesis that with increased participant age there would be a significant increase in body appreciation for all women, and that this would be strongest for Black Nigerian woman, and weakest for White Western women, we conducted two linear regressions, using age, ethnicity, and their interaction as predictor variables. For our second hypothesis, that with increased participant age there would be a significant decrease in thin/athletic ideal internalisation and perceived sociocultural pressure, and this would be the same across ethnicities, we conducted five linear regressions (for each subscale of the SATAQ-4) using age, ethnicity, and their interaction as predictor variables. Finally, for our third hypothesis that high thin ideal internalisation and perceived sociocultural pressure would be

associated with lower body appreciation, we ran five correlations (one for each subscale of the SATAQ-4).

Summary statistics and zero-order correlations for all variables with the full sample are shown in Table 7-2. Other than age and body appreciation, all variables were significantly correlated with each other.

3. Results

Linear Regression models were used to test for possible effects of age, ethnicity, sociocultural attitudes and thin/athletic internalisation on body appreciation. Analyses were conducted using R version 4.3.0 (RStudio Team, 2023) and data and code can be found in the supplementary materials.

Table 7-2. *Tabulated correlations (Pearson's r) for all variables in the full sample (N= 966)*

	Mean	Standard Deviation	1	2	3	4	5	6
1. Age (years)	35.38	14.68						
2. BAS-2	3.50	0.93	.03					
3. SATAQ-4 (athletic)	2.64	0.90	-.28**	-.15**				
4. SATAQ-4 (thin)	2.45	1.02	-.28**	-.22**	.83**			
5. SATAQ-4 (family)	2.30	1.16	-.20**	-.24**	.23**	.26**		
6. SATAQ-4 (peers)	2.02	1.06	-.11**	-.12**	.30**	.30**	.50**	
7. SATAQ-4 (media)	3.28	1.37	-.17**	-.49**	.31**	.33**	.36**	.30**

*BMI = Body Mass Index; BAS-2 = Body Appreciation Scale 2; SATAQ-4 = Sociocultural Attitudes Towards Appearance Questionnaire 4. *p<.05, **p<.01*

Descriptive statistics broken down by study group are shown in Table 7-3.

Table 7-3. *Descriptive Statistics including mean age, BAS-2, and SATAQ-4 for each study group.*

	Number of ppts	Mean Age (years)	BAS-2	SATAQ-4 (athletic)	SATAQ-4 (thin)	SATAQ-4 (family)	SATAQ-4 (peers)	SATAQ-4 (media)
Black Nigerian	246	32.17	4.35	2.21	2.04	2.19	2.11	2.41
Eastern Asian Chinese	129	37.36	3.90	3.49	2.90	2.46	2.76	2.66
White Western	811	36.04	3.18	2.63	2.50	2.30	1.88	3.64

3.1 Body appreciation would be higher in older women, with Black Nigerian women reporting the highest body appreciation, and White Western women reporting the lowest.

Data were entered into linear regression models with BAS-2 as the outcome variable, and age (Table 7-4, Model 1), and ethnicity and the age x ethnicity interaction (Model 2) as predictors. In model 1 we found no significant effect of age on BAS-2 score (p=.342). In Model 2, we conducted a linear regression with Black Nigerian women as the reference category and found that there was no significant effect of age, but both Chinese and White Western women had lower body appreciation than Black Nigerian women, with White Western women scoring the lowest (Model 2: $F(5, 1173) = 90.66$, $p<.001$, $R^2_{Adjusted} = .28$; see Table 7-4). There were no significant interaction effects, although Figure 7-1 suggests that Chinese women may show a more positive trend between age and body appreciation than other groups in a larger sample (note the width of the CI shading in the upper age range.)

Table 7-4. *Linear regression models for effects of Age, ethnicity, and their interaction on BAS-2. Ethnicity entered as a categorical predictor with Black as reference category.*

	Model 1				**Model 2**			
	β	**SE**	***t***	***p***	**β**	**SE**	***t***	***p***
(Intercept)	3.44	0.07	48.64	<.001	4.20	0.16	26.37	<.001
Age	0.03	0.002	0.95	.342	0.07	0.005	1.01	.315
Ethnicity (Chinese)					**-0.30**	**0.29**	**-3.16**	**.002**
Ethnicity (White)					**-0.57**	**0.17**	**-6.63**	**<.001**
Age : Ethnicity (Chinese)					0.15	0.01	1.51	.132
Age : Ethnicity (White)					-0.02	0.005	-0.20	.841

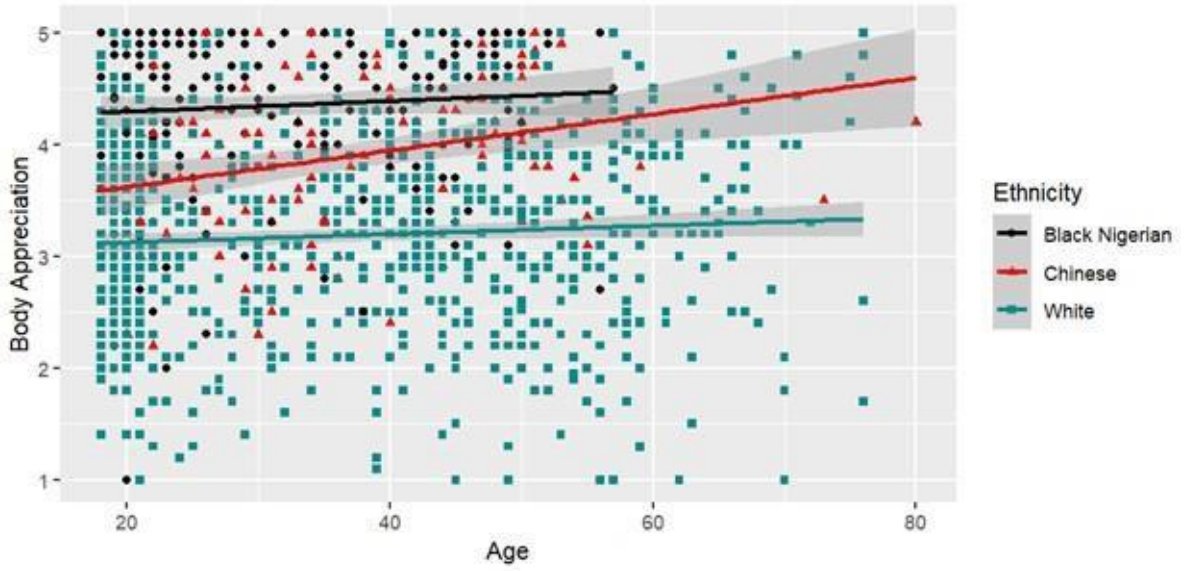


Figure 7-1 Scatterplot showing the relationships of age and ethnicity with body appreciation. Black circles represent Black Nigerian women; Red triangles represent Eastern Asian Chinese women; and cyan squares represent White Western women. Lines indicate linear model.

3.2 Thin ideal internalisation and perceived sociocultural pressure would be lower in older women, with no effect of ethnicity.

Data were entered into linear regression models with SATAQ-4 subscales (internalisation of the thin ideal, internalisation of the athletic ideal, perceived pressure from family, perceived pressure from peers, perceived pressure from the media) as the outcome variables, and age, and ethnicity as predictors. We found that perceived sociocultural pressure from family, peers, and the media decreased significantly as age increased (see Fig. 7-2), but there was no significant effect of age on thin-ideal or athletic-ideal internalisation (See Table 7-5). With Black Nigerian women as the reference category, we found that there was no significant main effect of ethnicity on perceived pressure from family, but that it remained stable across age for Chinese women while it decreased with age for White Western and Black Nigerian women ($F(5, 1101) = 11.56$, $p<.001$, $R^2_{Adjusted} = .05$). White Western women experienced significantly higher pressure from the media ($F(5, 1095) = 131.5$, $p<.001$, $R^2_{Adjusted} = .37$) and significantly lower pressure from peers ($F(5, 1097) = 107.9$, $p<.001$, $R^2_{Adjusted} = .33$), and this interacted with age – Black Nigerian women reported less perceived pressure from peers as age increased, while this remained generally stable for White Western and Chinese women. Finally, we found that Chinese women reported the highest thin and athletic ideal internalisation followed by western women, both of which were significantly higher than Nigerian women, and that there was a significant interaction between age and White ethnicity. As shown in Figure 7-2, White Western women's thin ($F(5, 1101) = 43.82$, $p<.001$, $R^2_{Adjusted} = .16$) and athletic ($F(5, 1103) = 76.94$, $p<.001$, $R^2_{Adjusted} = .26$) ideal internalisation was lower with higher age, while no such relationship was observed for the other groups (see Fig. 7-2).

Table 7-5. *Linear regression models for effects of Age, ethnicity, and their interaction on SATAQ-4 subscales.*

	β	**SE**	***t***	***p***
SATAQ-4 Thin Ideal Internalisation				
(Intercept)	2.20	0.19	11.30	<.001
Age	-0.07	0.006	-0.87	.383
Ethnicity (Chinese)	0.18	0.35	1.71	.087
Ethnicity (White)	**0.55**	**0.21**	**5.73**	**<.001**
Age : Ethnicity (Chinese)	0.09	0.01	0.85	.396
Age : Ethnicity (White)	**-0.43**	**0.01**	**-3.39**	**<.001**
SATAQ-4 Athletic Ideal Internalisation				
(Intercept)	2.44	0.16	15.08	<.001
Age	-0.12	0.005	-1.51	.132
Ethnicity (Chinese)	**0.33**	**0.29**	**3.32**	**<.001**
Ethnicity (White)	**0.52**	**0.18**	**5.73**	**<.001**
Age : Ethnicity (Chinese)	0.13	0.008	1.25	.213
Age : Ethnicity (White)	**-0.37**	**0.005**	**-3.10**	**.002**
SATAQ-4 Family				
(Intercept)	2.99	0.24	12.58	<.001
Age	**-0.31**	**0.01**	**-3.54**	**<.001**
Ethnicity (Chinese)	-0.16	0.42	-1.44	.150
Ethnicity (White)	-0.04	0.26	-0.36	.716
Age : Ethnicity (Chinese)	**0.28**	**0.01**	**2.36**	**.018**
Age : Ethnicity (White)	0.15	0.01	1.10	.273
SATAQ-4 Peers				
(Intercept)	2.77	0.21	13.04	<.001
Age	**-0.28**	**0.01**	**-3.29**	**.001**
Ethnicity (Chinese)	-0.05	0.38	-0.47	.636
Ethnicity (White)	**-0.27**	**0.23**	**-2.72**	**.007**
Age : Ethnicity (Chinese)	**0.29**	**0.01**	**2.49**	**.013**
Age : Ethnicity (White)	**0.26**	**0.01**	**1.98**	**.048**
SATAQ-4 Media				
(Intercept)	3.00	0.26	11.72	<.001
Age	**-0.20**	**0.01**	**-2.46**	**.014**
Ethnicity (Chinese)	0.09	0.46	0.83	.406
Ethnicity (White)	**0.45**	**0.28**	**4.74**	**<.001**
Age : Ethnicity (Chinese)	-0.01	0.01	-0.08	.937
Age : Ethnicity (White)	-0.01	0.01	-0.08	.939

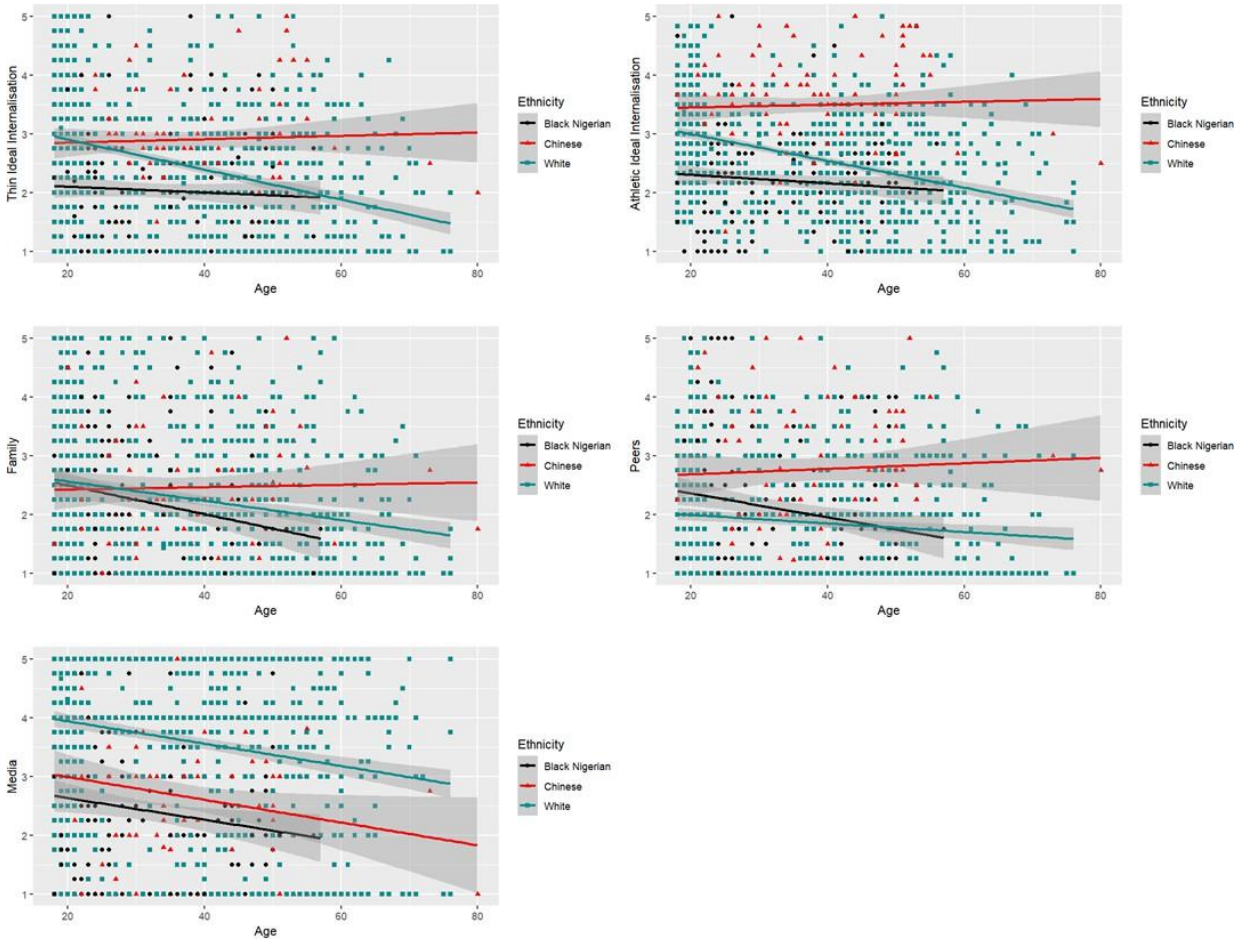


Figure 7-2. Scatterplots indicating the effect of age and ethnicity on SATAQ-4 subscales. Top left: Thin ideal internalisation; Top right: Athletic ideal internalisation; Middle left: Pressure from family; Middle right: Pressure from peers; Bottom left: Pressure from the Media. Black circles represent Black Nigerian women; Red triangles represent Eastern Asian Chinese women; and cyan squares represent White Western women. Lines indicate linear model.

3.3 High thin ideal internalisation and perceived sociocultural pressure would be associated with lower body appreciation.

We used Pearson's correlations to test our third hypothesis, looking at the relationship between BAS-2 and each SATAQ-4 subscales (internalisation of the thin ideal, internalisation of the athletic ideal, perceived pressure from family, perceived pressure from peers, perceived pressure from the media). For all subscales there was a negative relationship between ideal body internalisation/sociocultural pressure and body appreciation, indicating that higher internalisation of thin ideal ($r(1098) = -0.22$, $p<.001$), higher internalisation of the athletic ideal ($r(1100) = -0.15$, $p=.001$) and higher perceived sociocultural pressure from family ($r(1098) = -0.24$, $p<.001$), peers ($r(1101) = -0.12$, $p<.001$), and the media ($r(1099) = -0.49$, $p<.001$) were associated with lower body appreciation (see Table 7-2). There were no interactions with ethnicity.

4. Discussion

The aim of the present study was to determine how body appreciation was associated with age in women from three different cultures, and how body appreciation is associated with internalisation of thin and athletic ideals and perceived sociocultural pressure.

Our first hypothesis was that body appreciation would be higher in older women, that Black Nigerian women would report the highest body appreciation, and White Western women would report the lowest was partially supported. We found no significant difference in body satisfaction between women of different ages. These results are in contrast with previous research which found that women's body appreciation increased across the lifespan (Biolcati et al., 2020; Borland & Akram, 2007; McKinley, 2006; Tiggemann & McCourt, 2013). We found that Black Nigerian women had the highest body appreciation, followed by Eastern Asian Chinese women, and White Western women had the lowest body appreciation. This is in keeping with previous research which has found that Chinese women are more satisfied with their bodies than western populations (Madanat et al., 2011). In additional analyses, we found that ethnicity remained the strongest predictor of body appreciation even when considering its interaction with perceived sociocultural pressure and age, and when controlling for BMI. This suggests that ethnicity and culture are important influences for body appreciation and can act as protective factors which promote positive body image.

Our second hypothesis that older women would report significantly lower thin ideal internalisation and perceived sociocultural pressure than younger women, and that this would be the same across study groups, was partially supported. We found that older White Western and Black Nigerian women reported significantly lower thin-ideal internalisation than younger women, while there was no relationship between thin-ideal internalisation and age-group in Chinese women. For women from all cultures, older women reported lower perceived sociocultural pressure from all sources, although White Western women experienced less perceived pressure from peers than Chinese women and more from media than Black Nigerian and Chinese women. Our results also showed an association between perceived sociocultural pressure and ethnicity, suggesting that Black Nigerian women experienced the lowest sociocultural pressure, and that Chinese women reported the most pressure. This finding is in keeping with studies from China which have found that Chinese women have strong internalisation of the thin ideal (Barnhart et al., 2022; Jackson et al., 2021; Luo et al., 2005; Stojcic et al., 2020; L. Zhang et al., 2018).

Our third hypothesis that high thin ideal internalisation and perceived sociocultural pressure would predict with lower body appreciation was supported by our results. We found that high internalisation of the thin ideal, and high perceived pressure from family, peers, and the media, all were associated with significantly lower body appreciation. This provides evidence for the TIM (J. K. Thompson et al., 1999) using body appreciation instead of body dissatisfaction. Given that body appreciation may be a separate concept from body dissatisfaction (Avalos et al., 2005; More et al., 2022; Tiggemann & McCourt, 2013) and previous research has mainly considered how sociocultural pressures and thin ideal internalisation influence body dissatisfaction (J. S. Mills et al., 2022), our study has shown the inverse relationship exists with body appreciation, expanding our understanding of how body appreciation interacts with the TIM to predict the way we feel about our body. We found that across age and culture, perceived sociocultural pressure to obtain a culturally ideal body was a strong predictor of body appreciation, specifically that those who reported higher perceived sociocultural pressure had significantly lower body appreciation than those who reported low sociocultural pressure.

4.1 Limitations and future research

It is important to note that while we had a large population of women from across the lifespan, our age range remained skewed at the bottom end, with a large proportion of our sample aged between 18-30 years, and smaller numbers of older participants. In a fully representative sample we would predict a drop in participation after 50 years as the majority of the UK and Chinese populations are aged 20-50 years (Office for National Statistics, 2022; Statista, 2023), but our sample declines prior to that, at around 30 years. Therefore, further research should seek to recruit more women in the older age groups to get a fully representative picture of women's body appreciation across the lifespan. This could be achieved through use of recruitment tactics which may be more accessible to individuals over 30, with word-of-mouth (Munoz et al., 2019), mass mailing and email (Tate et al., 2014), and recruitment through community settings (Godbole et al., 2023) suggested as the most acceptable tactics for recruitment of an older population.

Furthermore, we recruited a larger sample of White Western women than we did of Black Nigerian and Chinese women, and used measurement tools developed in predominantly White Western populations. Post-hoc assessment of our effect sizes suggested we had sufficient power even if all group sizes were constrained to the smallest sample (see Supplementary materials 'Power analysis'). However, the current study may not have fully captured the extent of body appreciation or

sociocultural preferences in the Nigerian and Chinese populations due to cultural differences in body ideals or how they are expressed. Development of measurement tools which are suitable for these populations is therefore a necessity for future research in cross-cultural contexts.

Additionally, the questionnaires that we used have been mainly tested and validated with younger populations. As such, older generations may not experience the same *kinds* of body concerns as younger women, especially given that older women are further removed from the thin ideal which can cause feelings of shame and depression (Hofmeier et al., 2017), are more likely to participate in 'old talk' over 'fat talk' (Becker et al., 2013), can experience discrepancy between how they feel and how they look (Hofmeier et al., 2017; Liechty, 2012), have changing social roles which can lead to feeling forgotten and invisible (Hofmeier et al., 2017), and are more likely to be in a long term relationship (Frederick et al., 2022). This may mean that older women experience other kinds of concerns which are not sufficiently captured by our measures. Future research should consider the validity of using these measures with an older population and consider developing measures of body image to be used in this population.

Finally, although we advertised mainly in cities, we did not ask participants whether they were from a rural or urban area. Research has shown that body appreciation is higher and body dissatisfaction is lower in individuals living in rural areas compared to those living in urban areas (Pradeilles et al., 2022; Senekal et al., 2001) and this effect is seen cross-culturally in Malaysia (Swami & Todd, 2022), South Africa (Prioreschi et al., 2017), and Brazil (Petroski et al., 2012), as such future research should consider participants' locality (urban/rural) when measuring body appreciation.

4.2 Practical implications

The results of the current study can be used when developing positive body image interventions, especially when considering a cross-cultural and lifespan perspective. For instance, body appreciation did not noticeably increase with age and as such older women may also benefit from the body image interventions which are largely targeted at younger populations. However, some aspects of sociocultural pressure and internalisation did alleviate with age; as such body image interventions aimed at older women might need to employ different foci than e.g. dissonance techniques aimed at reducing thin-ideal internalisation. However, these must be further adapted given the age by ethnicity interactions observed in some aspects of sociocultural pressures/internalisation. As such culturally specific further research is likely to be required when developing interventions for a given group.

4.3 Conclusion

Our study examined body appreciation and some of its predictors across the lifespan in three different cultures, finding evidence that the Tripartite Influence Model can be applied to body appreciation as well as body dissatisfaction, and in age-diverse samples. We also find that there are both similarities and differences between cultures in how body appreciation, sociocultural pressure, and thin ideal internalisation, vary across age in different cultures.

Chapter 8: General Discussion

The overarching aim of this thesis was to explore the risk factors for body image and eating disorder development through childhood, adolescence, and beyond. Risk factors have been identified in adolescence and particularly in young adulthood but less is known about their development in pre-pubertal childhood and past middle-age. This thesis summarised the literature surrounding this development and explored what methods are fun, engaging, and acceptable to both participants and parents. I furthermore present five new studies exploring the development of known risk factors for body dissatisfaction and eating disorder symptoms, such as puberty, internalisation of appearance ideals, and perceived sociocultural pressure in populations aged 4-80 years old. I have shown that risk factors are present from an early age, but do not become risk factors for eating disorder symptoms until peri-pubertal adolescence, and that these risk factors are maintained until around mid-life, after which they decline (although this may be due to changing internalised ideals, rather than decreasing internalisation). Overall, this thesis highlights when risk factors develop, and how they are maintained throughout the lifespan and provides valuable insights for body dissatisfaction and eating disorder prevention.

1. Summary of findings

This thesis had three overarching aims: to investigate the influence of sociocultural appearance pressure and ideal body internalisation on body image and eating disorder symptom development, to understand the role of pubertal development, and to assess the effectiveness of various methodologies for use in sensitive research in youth populations. The first aim was addressed in chapters 4, 6, and 7, where I found that sociocultural appearance related pressures are internalised from an early age, that they influence how we think of the body and what biases we have towards different sized bodies, and how these pressures evolve and change across the lifespan. The second aim of this thesis was addressed in chapters 3, 5, and 6, where I found that puberty was a significant correlate of BMI and eating disorder symptoms in girls only, but that there may be some differences in the ways in which the body is experienced and thought of before and after puberty, such as children possibly having a very literal understanding of the body while adolescents may possess a more nuanced and abstract concept of the body. The final aim is addressed in all chapters. In chapters 3 and 7 and Appendix A we demonstrate the differences in recruitment ease and success between adolescents and adults to sensitive research. While the data presented in Appendix A took over two

years to collect, the data presented in chapter 7 was collected in two waves across a combined period of 10 months. Furthermore, there were no complaints about the data collection in chapter 7, while some parents did contact me in regards to concerns with the contents of the research for chapters 5, 6, and Appendix A. I found that the most widely accepted method of data collection was using dolls where children mostly reported enjoying the study and parents commented that they felt the topic was approached in an age-appropriate manner. Parents were generally very accepting of the eye-tracking and VR approaches, with only some parents concerned that their children might feel upset about the research topic, particularly the contents of the questionnaire used in chapter 5 (the BPSS-R), further suggesting that parents are particularly averse to the use of questionnaires in this field.

Chapter 3 presented a longitudinal population-based cohort study which examined potential predictors of eating disorder at 15 from age 7 years. BMI, body dissatisfaction/esteem, dietary restraint, puberty, depression and eating disorder symptoms were measured at 4 time points; I found that most variables were self-maintaining, especially from ages 12-15, but that there were significant differences between the pathways for girls and boys. For girls, depression mediated the relationship between body esteem and future eating disorder symptoms, as proposed in key models of eating disorders such as the sociocultural model (Evans et al., 2013; Stice et al., 1996; Stice & Agras, 1998). However, this relationship was not found in boys, for whom eating disorder symptoms at 15 were predicted only by previous eating disorder symptoms and depression, although the latter failed to reach statistical significance in the final model. As such, I concluded that boys' eating disorder symptoms were self-maintaining, and somewhat influenced by body dissatisfaction at 9 years and depression at 12 years, but there may be other factors which are more important which were not measured in this study. Finally, I found that puberty was a significant correlate of BMI and eating disorder symptoms at 12 for girls only, suggesting that pubertal development is an important variable at 12 years for girls, both as a direct correlate of eating disorder symptoms, and as a predictor of BMI which (in girls) predicts future body esteem which then may predict future depression and eating disorder symptoms. This study highlights the different pathways to eating disorder symptoms in boys and girls, including known risk factors such as body dissatisfaction, BMI, and depression.

Chapter 4 employed observational behavioural methods to investigate children's attitudes and beliefs towards different sized bodies. To do this, I used dolls which varied in body size, age, and gender as well as doll props which varied in activity level and gender stereotypes. The results of this study indicate that both boys and girls demonstrated strong internalised gender stereotypes, and this was

often correlated with choosing the adult female low weight doll and engaging in stereotypically feminine non-active play (e.g., cooking, childcare). I furthermore found that children who chose to play with the child dolls often engaged in more active play (e.g., horse riding, gymnastics), suggesting that gender stereotypes and thin ideal internalisation develop concurrently and become synonymous at an early age, but this may relate more to adult figures than child figures.

The aim of Chapter 5 was to determine how children and adolescents look at their own body in a mirror, and how this is related to their body satisfaction. Participants wore eye tracking glasses while they looked in a mirror, both without instruction then after they were told to think about aspects of themselves that they liked. I found that children and adolescents did not preferentially look at liked or disliked areas of the body, even when accounting for overall body satisfaction. When comparing between neutral and positive conditions, I found that adolescent boys increased their attention towards the lower leg region, while child girls decreased their attention in this area, in the positive condition. Finally, results suggest that body avoidance as a coping mechanism for body dissatisfaction may develop during puberty, as adolescents who were more body dissatisfied spent more time looking off body than those who were satisfied, while the children showed the inverse effect.

Chapter 6 used virtual reality to measure children's thin ideal internalisation and desire for an ideal (thin) body while they embodied different sized bodies. Children experienced three body sizes and demonstrated a strong preference for the low adiposity body over the average or high adiposity bodies. However, despite this preference, participants reported that they would not want any of the avatar bodies over their own. Qualitative results indicated a strong sense of self with participants reporting that they were 'used to' or 'more comfortable in' their own body and having another body would feel weird. I furthermore found that subjective embodiment was correlated with ratings of the avatar bodies except for the most and least desirable bodies (synchronous low adiposity and asynchronous high adiposity), with participants who felt more embodied in the avatar rating the avatar as more attractive and having a higher desire to have the avatar body as their own. This suggests that for bodies which are perceived as average, embodiment within that body predicts perceptions of attractiveness and desirability and a strong sense of self may be a protective factor against body dissatisfaction.

The final empirical chapter (Chapter 7) looked beyond childhood and adolescence to determine how body appreciation, appearance ideal internalisation and perceived sociocultural pressure developed across the lifespan and across cultures. There were significant effects of culture,

with Black Nigerian women reporting the highest body appreciation and White Western women reporting the lowest. Furthermore, body appreciation was not significantly higher in older women of any culture, suggesting that once body appreciation (or lack thereof) has developed, it may remain consistent. Furthermore, internalisation of thin and athletic ideals was high in young women and decreased with age for Black Nigerian and White Western women, suggesting that as women age, the thin and athletic ideals become less salient. This study highlights the ongoing effects of body image through adulthood, and the significant influence of culture on body image and sociocultural ideals and pressures.

2. Overarching themes

From the research included here, three key themes have emerged. First, risk factors for body image and eating disorder symptoms and the pathways which lead to the development of eating disorder symptoms across development. Second, the validity of the methods which I use to measure body image, especially in children and adolescents where it is difficult to determine the validity of certain methods such as FRS and parents are averse to the use of questionnaires. Finally, this thesis provides key insights into the future of body image and eating disorder research across the lifespan, both in terms of methodology and of new and evolving knowledge on this subject.

2.1 Early emergence and long-term trajectories of body image

Throughout this thesis I have shown that risk factors for body dissatisfaction develop early in childhood, although present somewhat differently in children than in adolescents and adults. In Chapter 4 I found that children as young as 4-years demonstrated strong internalisation of thin ideals, as well as stigmas about the capabilities and, to a lesser extent, the stereotypically gendered social roles that each body size might entail. Specifically, I found that the adult female low adiposity doll was usually given the role of caregiver, teacher, cook, or cleaner, while the adult female high adiposity doll was not so often constrained to these patriarchal conventions. This early internalisation of these ideals has been documented in previous research, with children as young as 3-years old (Harriger et al., 2010) found to implicitly endorse the thin ideal. Internalisation of the thin and athletic ideals is then evidenced throughout this thesis in increasing ages. From the data collected in schools (Appendix A) we can see that thin ideal internalisation (measured by the SATAQ-4) is high across ages, with children (M=2.76) and adolescents (M=2.87) reporting higher thin ideal internalisation than adults (as reported in Chapter 7; M=2.45). This is furthermore supported by the results obtained in the virtual reality study (Chapter 6) where children and adolescents both showed a strong preference for the low adiposity

body over both the average and high adiposity bodies. Furthermore, in the qualitative exploration, I found that both children and adolescents associated the low adiposity body with health, fitness and attractiveness, while the high adiposity body was associated with sedentary activities and strength/aggression related sports. As such, similarly to the doll play study, children appear to associate low adiposity female bodies with stereotypical femininity while the high adiposity body is perceived in more traditionally masculine terms. Finally, thin ideal internalisation is high throughout adulthood, especially in White Western and Chinese women. For Chinese women, I found that thin ideal internalisation did not decrease with age, while for White Western women, thin ideal internalisation was relatively low by age 50-60. Together, the results of this thesis suggest that in Western culture, internalisation of thin ideals appears early in childhood, and is then stable until around age 60, whereafter I theorise that the thin ideal is replaced by the more age-relevant 'youthful ideal'. Given that internalisation of appearance ideals features in both the sociocultural model (Evans et al., 2013; Stice et al., 1996; Stice & Agras, 1998) and the Tripartite Influence Model (J. K. Thompson et al., 1999), prevention strategies should potentially include parental education so as to reduce internalisation from early childhood.

In addition to the thin ideal, the current thesis has highlighted further risk factors for the development of eating disorders in childhood and adolescence. The first empirical chapter (Chapter 3) identified longitudinal predictors of eating disorders at age 15 and these were different for boys and girls. Depression and previous eating disorder symptoms were the two strongest predictors of eating disorder symptoms at 15 for girls, while previous eating disorder symptoms alone was the strongest predictor for boys. Additionally, body dissatisfaction at 9 correlated with eating disorder symptoms at 9 years for both boys and girls, indicating that while it may not be longitudinally salient, it is somewhat involved in the initial development of eating disorder symptoms (although the direction of this effect is unknown), after which eating disorder symptoms are self-maintaining at least into mid-adolescence. In support of this, in the data presented in Appendix A I found that low body esteem predicted higher eating disorder symptoms three months later in adolescents (aged 12-16) but not children (aged 7-10), and that this was not influenced by gender. This link between body esteem, depression, and eating disorder symptoms has been well explored in the literature concerning mid-adolescents (Cruz-Sáez et al., 2020; Stice et al., 1996; Stice & Agras, 1998) and adults (Brechan & Kvalem, 2015; Ergüney Okumuş et al., 2019; Sander et al., 2021) and is somewhat documented in longitudinal studies of the same age range (Lewis-Smith et al., 2020), suggesting that this relationship is robust and that early development of depression and low body esteem are key risk factors for the development of eating disorder

symptoms in mid-adolescence.

2.2 The role of puberty

Finally, one of the main aims of this thesis was to investigate the role of puberty in the development of body dissatisfaction and eating disorder symptoms. As puberty is not commonly directly measured in previous studies, I aimed to determine the role of physical markers of pubertal development (e.g., growth spurt, lowering of voice for boys, menstruation for girls) on the development of these key variables. In Chapter 3, I found that puberty at 12 years was predicted by BMI at 9 (as expected) and correlated with BMI at 12 (as expected) but did not predict future BMI or correlate with body esteem at 12 years. In girls, I found that puberty significantly correlated with eating disorder symptoms at age 12, indicating that girls who were more pubertally advanced also reported higher eating disorder symptoms. This is somewhat in line with our hypothesis that individuals who were more pubertally advanced would develop eating disorder symptoms in order to combat the effects of their maturing body which differentiated them from their peers (Le Grange et al., 2014; Vo et al., 2021). This effect was not found in boys, for whom puberty at 12 years was only predicted by previous BMI, and did not correlate with any other measured variables at 12 years old. These results are not replicated in the data presented in Appendix A, where previous and concurrent puberty were not associated with eating disorder symptoms, even when controlling for age and gender. As such, the role of puberty as measured by physical markers remains relatively unknown. Previous research has suggested that there is a significant effect of puberty on body dissatisfaction, eating disorder symptoms, and depression (Dantas et al., 2017; Le Grange et al., 2014; Thériault et al., 2019; van Rijn et al., 2023; Vo et al., 2021), and that girls report a change in the role their body plays in their social environment (Riboli et al., 2022), but the findings of the current thesis suggest that physical puberty alone may not be the driving force behind these changes.

In the eye-tracking (Chapter 5) and VR (Chapter 6) studies, participants were recruited on either side of the average age of onset for puberty. Participants in the 'child' group were aged 7-10 and participants in the 'adolescent' group were aged 13-16. This decision to recruit around the onset of pubertal development, rather than measure it using a scale was taken mainly due to parental aversion to the questions regarding puberty, especially for participants in the late-childhood and early-adolescent age groups. In Chapter 5, I highlight important differences and similarities between the two age groups in their gaze patterns towards their own body. Interestingly, and in contrast to adult and clinical adolescent populations, both children and adolescents did not preferentially look at body parts which they reported liking or disliking, no matter their reported overall body satisfaction. However, as

our sample were generally satisfied with their body, the results may have been different if more body dissatisfied participants had been included, especially in the adolescent age group. I did find that adolescents who were less satisfied with their body practiced more body avoidance than those who were satisfied, similarly to body dissatisfied adults (Mendoza-Medialdea et al., 2023), while the inverse relationship was found in children (those who reported low body satisfaction spent less time looking off mirror than those who reported high body satisfaction). As such, this may indicate that body avoidance as a coping mechanism for dissatisfaction with one's body may develop around puberty as the body matures and physical appearance becomes more salient.

In the virtual reality study (Chapter 6), age differences were not found in the quantitative analysis (although some of the graphs indicate that a larger sample may have identified age related differences), indicating that children and adolescents both had strong internalisation of thin ideals as measured by body size preferences. However, this did not translate to a desire to have that body as both children and adolescents reported a strong preference for their own body over all avatars. In the qualitative analysis, both age groups reported a strong sense of self which was tied to their physical body, and this is somewhat supported by correlations which indicated that higher embodiment was related to higher avatar ratings, suggesting that high embodiment in one's own or another body is related to higher ratings of perceived attractiveness of that body. As such, future research should potentially consider the role of developing sense of self, embodiment in one's own body, and body image across childhood and adolescence. Furthermore, in the qualitative data, I found that children and adolescents both thought of the low adiposity body as more attractive, fitter, and healthier but there were some differences in the inferences participants made concerning the bodies. Children were more likely to talk about the avatar body as a vessel through which they could interact with the world, and used physical cues to determine the body's skills and abilities which were often physical activities (e.g., sport, singing, reading) while adolescents drew more abstract conclusions about the avatars based on body size (e.g. smart, girly girl). This suggests that around puberty there is a maturation in the way that bodies are perceived, where the body becomes more than an indicator of physical abilities, and begins to represent aspects of one's personality and sociocultural roles.

In conclusion, in relation to this aim of the thesis I did not conclusively find evidence of the role of puberty in body image and eating disorder symptom development. I did, however, find evidence of significant changes which take place simultaneously to the onset of puberty, such as the development of body avoidance coping mechanisms, the predictive importance of body dissatisfaction/esteem in later eating disorder symptoms, and the way in which the body is a

representation of the self. As such, the general lack of direct relationship between pubertal development and body image or eating disorder symptoms may indicate that physical pubertal development is not the sole cause of changes in these factors, and there may be broader changes in the sociocultural environment which drive these changes. This is somewhat supported in the final empirical chapter (Chapter 7) where cultural factors were the strongest predictor of body appreciation in adults, and sociocultural pressures predicted body appreciation across age and culture, indicating the importance of these variables in the maintenance of body image across the lifespan.

2.3 Methods in body image and eating disorder research

A secondary aim of the thesis was to investigate the effectiveness, validity, and acceptability of different methods of measuring child and adolescent body image and eating disorder symptoms. In the first and last empirical chapters, as well as the data collected in schools (Appendix A), I employed questionnaires to measure each variable. Potential issues with using questionnaires in children were discussed in depth in Chapter 2, however, questionnaires do appear to be a valid and reliable measure of body image and eating disorder symptoms by adolescence, as indicated by good internal consistencies reported in Chapter 3 and Appendix A. In particular, internal consistencies for the SATAQ-4 in adolescents (Appendix A) were similar to internal consistencies for the SATAQ-4 in adults (Chapter 7). In children, internal consistencies for questionnaires were generally lower, but still largely within acceptable ranges. As such, while questionnaires may not be the ideal method of measuring these variables in pre-pubertal children, they do provide an acceptable and easily analysed quantitative measure of body image and eating disorder symptoms.

The main issue with using questionnaires in this age group lies not in the validity or reliability of the answers provided, although these should be kept in mind when analysing child questionnaire responses, but rather in parents' concerns regarding questionnaires which collect information relating to sensitive topics. In three of the five studies on children's body image in the current thesis (Chapters 5, 6 and Appendix A) where data was collected by the lead author, parents raised concerns over the nature of the research topic, frequently citing that the questions were not appropriate for their child, that they did not want the concept of body dissatisfaction or eating disorders to be introduced to their child, and that they did not want their child to develop body-related concerns or eating disorder symptoms as a result of learning about them after completing the aforementioned studies. While these concerns and a deep protective nature is understandable in parents, many did not want their child participating even after discussing these concerns with me and being given evidence which

debunks the myths around the harmful impact of completing body image questionnaires (Damiano et al., 2020; Jarman, Slater, et al., 2021). However, no such issues were raised either by the ethics committee or by concerned potential participants regarding these perceived harmful effects when conducting the research for Chapter 7, which included adults aged 18-80 years, and was highly successful in its recruitment (although recruitment difficulties did still exist and are discussed in Chapter 7 and below in section 3). It is clearly understood that by 18, individuals have a thorough understanding of body image and some knowledge of what an eating disorder is. However, many parents seemed concerned that their 16-year-old would be introduced to and influenced by questions relating to eating disorders and body image. Future research may want to consider including parents both in the study design stage of research, as well as creating parent materials for education on how to talk to their child about their body and their eating attitudes and behaviours so that this topic is not perceived as taboo until early adulthood. This may have the dual beneficial effect of providing parents with the materials and confidence to talk to their child without causing potential harm, as well as increasing the number of parents who are willing for their child to participate in body image and eating disorder studies, especially if they are involved in the design process.

One study design which proved popular with parents and children was the use of dolls (Chapter 4). Children, especially girls, enjoyed the study, felt comfortable and confident during the study, and did not seem to guess at the purpose or nature of the study. Furthermore, many parents who were present during data collection commented afterwards that they appreciated the subtle nature of the study design and felt it was an age-appropriate method for measuring body-related attitudes. This is in keeping with literature which suggests that parents perceive dolls, in particular the Disney brand, as 'safe' for their child (Orenstein, 2012). This suggests that research into body image and eating disorders for young children could employ dolls, toys, or clips from animated children's movies as a condition or as a distraction technique while a verbal interview is conducted, and these techniques may be more acceptable to parents. One caveat to this method is the known increase in thin ideal internalisation and body dissatisfaction experienced by young girls after 10 minutes of play with an ultra-thin doll (Boothroyd et al., 2021; Dittmar et al., 2006) which is not reversed after subsequent play with 'healthy' sized dolls (Boothroyd et al., 2021). However, given that doll ownership is high, with around 59-88% of children owning at least one doll (Anschutz & Engels, 2010; Sherman & Zurbriggen, 2014; Worobey & Worobey, 2014), and owning an average of 5 dolls each in one study (Worobey & Worobey, 2014), it is likely that children will be exposed to ultra-thin dolls outside of research situations, and therefore research should employ dolls with caution, but should not rule out

their use completely.

The final two methods employed in this study (eye tracking and VR) sit somewhere between questionnaires and doll play in terms of parent acceptability. Parents who attended sessions with their children noted that the sessions were engaging and asked about children's body image and attitudes towards bodies in a novel and sensitive way. Furthermore, many were especially excited about the VR portion of the study and reported signing up specifically for that reason. However, there were some parents who were concerned that the topic of body image would not be as well camouflaged as in the doll study, and that asking children to discuss their body and the avatar bodies may act as a catalyst for, or aggravate existing, body image concerns and maladaptive eating behaviours. Involving parents in the research design as suggested above may help to alleviate some of these concerns in future research.

2.3.1 Epistemology

This thesis is mainly guided by the epistemological concept of critical realism. This approach assumes both the existence of an external shared reality, and that experiences, causes, and events are related in a generally linear fashion (Öğütle, 2023). This epistemological framework influenced the methods and analysis of the data collected in some important ways. First, the assumption of an external shared reality posits that the participants in these studies shared somewhat similar experiences and opinions, such as the internalisation of a shared sociocultural ideal body which is internalised at a young age and persists through childhood, adolescence, and adulthood. As such, when children and adolescents discussed the body and its connotations, I interpret their discussion in a manner which relies upon them having internalised a similar ideal to their peers and to others in the literature. Furthermore, when children describe their experiences, thoughts and opinions, I interpret these within the context of existing literature, frameworks, and sociocultural norms despite my best effort to distance myself from these and interpret purely the words in the transcripts/what the data says. This approach to analysis, particularly for qualitative analysis, is inevitable as the researcher does not exist outwith these cultures and social environments, and therefore must acknowledge their experience of the shared reality to highlight where the interpretation of children's thoughts and experiences may be biased by the researcher's own experiences and knowledge of the shared reality.

A second challenge that this epistemology may present is the interpretation of language itself, particularly evidenced in qualitative studies. In Chapters 4 and 6 of this thesis, I rely on children and adolescents' ability to adequately and eloquently convey their subjective interpretation of our shared reality, and the researcher's ability to correctly interpret their meaning. However, with the researcher

and participants existing within a shared reality and therefore having some shared experiences of that reality, the deeper interpretation – that is the meaning and deep thoughts behind the words used to covey this – may be reached through qualitative analysis, such as reflexive thematic analysis. Furthermore, reflexive thematic analysis using a critical realism approach allows the researcher to acknowledge and utilise their own experience and understanding of the shared reality to interpret the meaning behind the participants subjective descriptions of their experiences, meaning the researcher can interpret the participants' words to somewhat represent their inner experiences and subjective experience of a shared reality. These internal experiences can be associated with causes (i.e. the shared reality, shared understanding of sociocultural ideals) and manifest as physical events (i.e. eating disorder symptoms).

This guiding epistemology can additionally be seen to guide the quantitative methods in this thesis through the selection of measures and methods used. The questionnaires selected to be used in the data collected in schools were chosen specifically based on existing models and untested theorised links between functional body image, puberty, and eating disorder symptoms. In sum, my understanding of the shared reality, combined with previously proposed models of body image and eating disorders (others' understanding of the shared reality), shaped the questionnaires and topics covered in these questionnaires. In Chapters 5 and 6, the questionnaires and methods used were based both on the desired factors of interest for myself, as well as what methods were acceptable to parents, and Chapter 7 utilised measures which were based on examining how similar or different the shared reality may be cross-culturally.

2.3.2 Ethical considerations

A further constraint on the research included in this thesis was the stringent ethical standards held by the Durham University ethics committee. Ethical approval was obtained for all studies included in the current thesis, however in some cases, to obtain ethical approval, certain elements of the original research plan had to be reworked or removed entirely, such as in the doll play study presented in chapter 4 where, due to the event in which participants were recruited, no questions directly about the body, eating attitudes and behaviours, or sociocultural pressures could be asked. Another example is in the research presented in chapters 5 and 6 where I did not include any direct measures of sociocultural pressures, puberty, or eating disorder symptoms in order to facilitate recruitment, and still some parents did not approve of the inclusion of the BPSS-R. Finally, research in schools was strictly opt-in, where parents had to return a consent form to the school or fill out online consent for their child to participate which may have resulted in lower participation rates due to some parents not receiving or reading the

information sheets or children forgetting to hand them into the teacher.

2.4 Implications of this thesis for body image and eating disorder research

The research presented in this thesis may have far reaching implications for body image and eating disorder research in children and adolescents. Existing research on pre-pubertal children is relatively sparse in comparison to late-adolescent and early adults, and this is likely due to methodological and recruitment difficulties. In this thesis I have presented four different methods for use in children, and their effectiveness for recruitment and their validity and reliability have been discussed extensively in Chapter 2 and above in section 2.2. However, it must be noted that three of the four methods did not include any measure or mention of children's eating attitudes and behaviours or puberty, as these were the topics with which parents expressed the most concerns. In future, methods which explore these without the use of questionnaires (e.g., picture books, short, animated clips, or dolls) may be a more accepted measure of these variables.

The populations included in this thesis were varied in age and gender, and this allowed us to obtain a bigger picture view of body image and eating disorder risk in males and females aged 4-80. I have shown that internalisation of appearance ideals and gender stereotypes occurs early in boys and girls, as has been found in previous research (Harriger et al., 2010; Kanka et al., 2019), and that they are present throughout the lifespan. Furthermore, body dissatisfaction becomes a risk factor for future eating disorder symptoms around 12-15-years old, especially in girls. Importantly, internalisation of appearance ideals and perceived sociocultural pressure are often the first variables presented in models of eating disorder symptoms (Stice et al., 1996; Stice & Agras, 1998; J. K. Thompson et al., 1999). As such, the development of these occurring first, followed by body dissatisfaction, then depression, and finally eating disorder symptoms follows the expected patterns of influential models of eating disorders. This thesis proposes that these function not only as accurate models of eating disorder symptoms from adolescence onwards, but also predict the order in which these variables emerge through childhood. Furthermore, I show that both boys and girls experience internalisation of appearance ideals, body avoidance as a coping mechanism, body dissatisfaction, and eating disorder symptoms, justifying boys' inclusion in this field of research from early childhood and through the lifespan.

3. Key contributions, limitations, and future research

Initially, this thesis aimed to answer one big question: at what point do factors influencing eating disorder development become salient predictors and when do they initially emerge. The aims

of this thesis have evolved to include an exploration of methodologies for sensitive research in vulnerable populations, and to understand how children and adolescents think conceptually about their body. I have identified key ages at which various factors are present (e.g. thin ideal internalisation and gender stereotypes present at 4-years-old; body dissatisfaction evident and possibly self-maintaining from around 9-years-old) and at what stage these factors begin to predict future eating disorder symptoms (e.g., body esteem predicts future eating disorder symptoms through the mediation of depression from around 12-years). Furthermore, I have identified pathways for boys and girls to understand the development of eating disorders from age 7-15. The findings of this thesis suggest there is a significant change which occurs around the onset of puberty regarding how the body is thought of and experienced which may in part explain why body dissatisfaction becomes longitudinally salient around this time.

I do, however, also highlight some similarities between children and adolescents which mark them as distinct from adults, such as gaze patterns. This suggests that while a change does occur around puberty, adolescent body image is still developing throughout adolescence and does not immediately match the way in which adults think and behave regarding their bodies. Finally, I note some large differences between the way which body image and eating disorders are measured in adults (where questionnaires are valid and do not raise ethical concerns) and the way in which it must be measured in children and adolescents. Aside from the ethical concerns raised by parents which hamper recruitment efforts, questionnaires may not be suitable for pre-pubertal children, so methods should attempt to elicit behaviours and verbal responses from which I may ascribe meaning and promote understanding of the differences between body image across the lifespan.

3.1 Theoretical contributions

This thesis adds much to theories in body image and eating disorder literature. Mainly, it demonstrates how aspects of these theories such as thin ideal internalisation or internalised sociocultural pressures are present in a much younger age group than these theories are normally tested on. I furthermore test an adapted Dual Pathway Model (Stice et al., 1996; Stice & Agras, 1998) in Chapter 3 which highlighted the differing pathways to eating disorder symptoms at 15-years-old for girls and boys.

In Chapter 1 I discuss three important theories in body image and eating disorder literature: The sociocultural model (Evans et al., 2013; Stice et al., 1996; Stice & Agras, 1998), the tripartite influence model (J. K. Thompson et al., 1999), and objectification theory (e.g. Calogero, 2012). This thesis provides new knowledge on how these theories may manifest in early childhood and through

adolescence. For the sociocultural model, I posit that from age 7, BMI is self-maintaining, and from age 9 eating disorder symptoms are self-maintaining. I further highlight the role of body dissatisfaction/esteem in the development and maintenance of depression, which influenced eating disorder symptoms directly in girls, and to a lesser extent in boys. This study therefore provides some longitudinal evidence for how an adapted sociocultural model applies to the development of eating disorder symptoms across childhood and adolescence.

In Chapters 4, 6, and 7 I explore elements of the TIM in populations aged 4- to 80-years-old. I highlight how appearance ideals are internalised early in childhood (Chapter 4), how social cues and status may be derived from the body and how this develops around puberty, which may be related to the development of sociocultural appearance ideals and social comparison, and how sociocultural appearance pressures are experienced across the lifespan and their relation to body appreciation. As such, this thesis adds evidence to the factors included in this model and demonstrates the range of ages which experience these pressures and ideal internalisation.

Finally, while objectification theory is not explicitly explored in this thesis, there are some clear links, particularly in Chapters 4 and 6, where children and adolescents are encouraged to vocalise in their own words their experience and interpretation of the body. In Chapter 4, I find that young children, particularly girls due to the sample, may associate body type and age with gender stereotypes. This may indicate early internalisation of objectifying principles. In other words, children aged 4-10 may objectify the body of others, which is the first step in objectification theory and may lead to the development of self-objectification in future years. Indeed, in Chapter 6 we found that adolescents were more likely to draw social conclusions regarding the body than children who were more likely to think about the body in a more literal sense (i.e. being good at sport because they 'seem' sporty rather than because they have long legs). As such, self-objectification may begin around or in the latter stages of puberty, resulting from internalisation of objectification of others in childhood years. However, since we did not directly test objectification in any manner, further research is required to further understand this possible link.

3.2 Limitations

While limitations specific to each study are discussed in each chapter, there are some limitations which were common across all chapters which warrant consideration. First and foremost, as has been discussed extensively throughout this thesis, I experienced significant recruitment difficulties and as such, Chapters 5, 6 and Appendix A are statistically underpowered for the analyses conducted. Although this lack of data was unavoidable, it does mean that results from those analyses

should be interpreted with caution as a larger sample may have revealed significant effects of age or gender which were perhaps not sufficiently powered to reach significance in this instance.

A second limitation is the nature of the investigation itself. With very young children, it is difficult to absolutely, incontrovertibly assess the extent to which the meaning drawn from their responses to questionnaires or to verbal interviews represents their everyday thoughts and feelings on a matter. In particular, measuring body dissatisfaction on a more conceptual level than simply liking or disliking body parts may be beyond the scope of some children's cognitions or awareness of their own body. For example, although I measured body part satisfaction and some children reported dissatisfaction with some parts of their body, this does not tell us how often this dissatisfaction manifests in their everyday life, and it is possible that children's body part satisfaction is only salient when they are actively guided towards thinking about it. In support of this theory, a number of the younger children expressed that they had never thought about how satisfied they were with their individual body parts such as their arms, shoulders, or legs, and a significant number required help identifying where certain body parts were, and often looked to their parents for an indication of satisfaction. Although this limitation is unlikely to complicate results of the qualitative studies, or of the eye tracking study, it does raise the question of when these factors, such as thin ideal internalisation, become known to the child at a conscious level, and whether they can be safely and effectively targeted by prevention efforts before this point.

3.3 Future directions for research

The overall results of the thesis pave the road for future research to continue investigating body image and eating disorder symptoms from childhood through to adolescence. Some key themes for future research which can be drawn from this thesis include prevention efforts in pre-adolescent children, the exploration and encouragement of protective factors in childhood, and the continued study of body image cross culturally and in older age groups.

First, I have shown the way that the body changes conceptually between late-childhood and early adolescence, and some key information for use in prevention efforts is presented. One example is the finding that body avoidance techniques as a coping mechanism for body dissatisfaction seem to develop in early adolescence. As such, prevention strategies which use mirror exposure techniques may be beneficially targeted towards young children, or parents of young children so that they are taught to how to look at the body in a way which prevents body avoidance *and* attention bias towards negatively rated body parts. Alternative methods may wish to target early internalisation of thin ideals

and gender stereotypes, with dual aims of separating thinness from culturally traditional femininity, as well as reducing overall thin or athletic ideal internalisation. Finally, assessing the timing of these interventions may be key, as one's conceptual representation of one's body may be a key component of intervention success. As such, the sociocultural and developmental changes which occur around the onset of puberty should be further explored to understand at what stage of development preventions and interventions may be best administered.

As part of the above preventative efforts and as a distinct research topic, future researchers may want to consider some of the potential protective factors which have been highlighted in this thesis and how these can be encouraged in early adolescence. A main finding of Chapter 6 was the protective effect of a strong sense of self, and the influence of embodiment on body satisfaction ratings. Specifically, future research should consider embodiment in one's own body alongside the strength of one's sense of self through adolescence and the potentially protective effect this may have against body dissatisfaction and eating disorder symptoms. Some research has already considered this in adolescents (Palmeroni et al., 2021; Vankerckhoven, Claes, et al., 2023; Vankerckhoven, Raemen, et al., 2023) and have found that adolescents who felt secure in their identity reported lower body dissatisfaction and internalisation of sociocultural appearance ideals. Future research should investigate this relationship in pre-adolescents to determine at what age a secure sense of self can develop and when this becomes a protective factor.

The final theme for future research which is drawn from this thesis lies in the continued study of body image and eating disorders across cultures and age. This theme can be split into two subthemes – how to adequately research this in hard-to-reach populations, and how body image and associated factors change through the course of one's life from infancy to old age. The first stage of this research must be assessing barriers to participation in these groups. As discussed in Chapter 7, recruitment was highly successful for young adults in all three cultures (although recruitment overall was less successful outside of Western countries, probably due to the location of the researchers) but participant numbers declined at around 30-years, indicating some difficulty with recruitment of adults over 30 for body image research. Future research should therefore consider qualitative methods with schools, parents, and adults over 30 to determine barriers and facilitators for participation in this research topic which could lead to the creation of guidelines for recruitment of (potentially vulnerable) participants to sensitive research topics. Furthermore, as with children, currently existing measures of body image, eating disorder symptoms, and sociocultural pressures may not be salient to older populations who may feel more removed from a youthful ideal, rather than a thin ideal, and whose

body image concerns and maladaptive body-changing behaviours may be different from those of a young adult. As such, future research should work with adults over 30 to plan and execute research which explores these topics sensitively and with tangible outcomes which will help to improve the wellbeing of all.

4. Conclusions

In conclusion, this thesis summarises and contributes to the literature surrounding the development of body image and eating disorder risk across the lifespan. I explored how different risk factors develop and interact with one another and tested a variety of methods to determine which methods might be more suitable for use in a young population. Generally, key models of eating disorders were found to apply to eating disorder development longitudinally (notably, in girls) and I added to the overall understanding of what factors develop at what ages, and how these self-maintain and become salient to eating disorder development. I furthermore highlighted the continuity and maintenance of key variables such as sociocultural pressures and internalisation of sociocultural appearance ideals across the lifespan and across cultures. This thesis lays much of the necessary groundwork for future research into eating disorder development and maintenance across the lifespan and contributes to a greater understanding of body image and eating disorder risk across development.

Appendix A: Results of Schools Research

Below are the results of short-term longitudinal data collected in schools including a brief outline of the methods.

Participants

Participants were 64 children (37 female, 27 male) aged 7-16-years (M=12.34, sd=2.96) from the North East of England and central Scotland. Exclusion criteria ensured that all participants did not have any current eating or growth condition which might affect their responses or cause distress. The majority of the participants were white (n=55), one was East Asian, one was South Asian, 1 was of mixed ethnic groups, and five preferred not to say.

For analyses involving body esteem, participants were split into two age groups as different questionnaires were used. The child group (9 female, 13 male) were aged 7-10 (M=8.82, sd=1.30) and the adolescent group (28 female, 14 male) were aged 9-16 (M=14.19, sd=1.55). Baseline correlations for the two age groups are presented in Table A1.

Table A1. Baseline correlations for Appendix A by age group.

	Age	BMI	EIS	BES	SATAQ athletic	SATAQ thin	SATAQ family	SATAQ peers	SATAQ media	ChEAT	PDS
Age	-	.21	-.29	.41	.08	.11	-.27	-.38	-.15	-.68**	.62**
BMI	.20	-	-.23	-.07	.18	-.02	.33	.44	.35	.26	.26
EIS	-.27	-.20	-	-.05	.13	.17	.05	.18	.33	.08	-.66**
BES	-.40**	-.29	.43**	-	-.22	-.39	-.27	-.55**	-.15	-.41	.26
SATAQ athletic	.19	-.25	.42**	-.27	-	.59**	.59**	.47*	.59**	.30	-.28
SATAQ thin	.16	-.06	.40**	-.30	.84**	-	.18	.19	.13	.09	.08
SATAQ family	-.02	.44**	.15	-.35*	.37*	.43**	-	.80--	.78**	.47*	-.38
SATAQ peers	.32*	.11	.10	-.52**	.56**	.59**	.44**	-	.73**	.61**	-.36
SATAQ media	.16	.16	-.06	-.54**	.51**	.43**	.44**	.46**	-	.56**	-.45
ChEAT	.23	.07	-.04	-.41**	.43**	.32*	.43**	.50**	.61**	-	-.34
PDS	.65**	.15	-.32**	-.30	.10	.12	-.03	.12	.23	.25	-

*Note. Correlations are Pearson's r. Children's data are presented above the diagonal and adolescent data are presented below. BMI = Body Mass Index; EIS = Embodied Image Scale; BES = Body Esteem Scale; SATAQ = Sociocultural Attitudes Towards Appearance Questionnaire; ChEAT = Children's Eating Attitudes Test; PDS = Pubertal Development Scale. *p<.05; **p<.01.*

Materials

Body Esteem

Body esteem was measured using the Body Esteem Scale for Children (Mendelson & White, 1982) for the 'child' group, and the Body Esteem Scale for Adults and Adolescents (Mendelson et al., 2001) for the 'adolescent' group. The Body Esteem Scale for Children (BESC) is a 15-item scale which asks participants to choose 'yes' or 'no' for a series of questions regarding their satisfaction with their body and appearance such as "I'm happy with the way I look". Answers are then summed, and a higher score indicates higher body esteem. This scale demonstrated adequate internal consistency in the current sample (α=.80). The Body Esteem Scale for Adults and Adolescents Appearance subscale (BESAA) is a 13-item scale which asks questions regarding participants' attitudes towards their appearance with questions such as "I'm pretty happy about the way I look". It is rated on a 5-point Likert-scale from 1 (Never) to 5 (Always) and higher scores indicate higher body esteem. This scale showed excellent internal consistency in the current sample (α=.94).

Functional Body Image

The Embodied Image Scale Functionality Subscale (EIS; Abbott & Barber, 2010) was used to measure functional body image. It asks questions regarding the importance of fitness to the participants' body image, such as "I feel really good about what I can do physically". The 9-item subscale is scored on a 5-point Likert-style scale from 1 (not at all true for me) and 5 (very true for me), with higher scores indicating higher functional body image. In the current sample, the scale showed adequate internal consistency in children (α=.69) and excellent internal consistency in adolescents (α=.90).

Sociocultural Pressure

To measure internalisation of sociocultural appearance ideals and perceived sociocultural pressure, participants completed the 22-item sociocultural attitudes towards appearance questionnaire – 4 (SATAQ-4; Schaefer et al., 2015). The SATAQ-4 is split into five subscales concerning internalisation of the thin ideal (e.g. "I think a lot about looking thin"), internalisation of the athletic ideal (e.g. "It is important for me to look athletic"), pressure from family (e.g. "I feel pressure from my family members to look thinner"), pressure from peers (e.g. "I feel pressure from my peers to look in better shape"), and the media (e.g. "I feel pressure from the media to improve my appearance). Item wording was simplified for the younger age group. Items are scores on a 5-point Likert-style scale from

1 (definitely disagree) to 5 (definitely agree) and higher scores indicate higher internalisation of thin/athletic ideal or perceived pressure from family, peers or the media. Internal consistencies for each subscale by age group are shown in Table A2.

Table A2. Internal consistency (Cronbach's Alpha) for each subscale of the SATAQ-4 by age group.

	Thin Ideal Internalisation	**Athletic Ideal Internalisation**	**Pressure from Family**	**Pressure from peers**	**Pressure from media**
Child	.56	.79	.77	.83	.79
Adolescent	.76	.79	.84	.87	.95

Eating Disorder Symptoms

To measure eating disorder symptoms, participants completed the 23-item Children's Eating Attitude Test (ChEAT; Maloney et al., 1988). The ChEAT asks questions on children's eating behaviours and beliefs (e.g. "I think about food a lot of the time") and is scored on a 6-point scale from 1 (Never) to 6 (Always). Responses are coded 1, 2, or 3 for the most symptomatic answers, or 0 for the three least symptomatic responses. Scores are summed and a higher score indicated more eating disorder symptoms. In the current sample, the ChEAT showed good internal consistency in children (α=.80) and adolescents (α=.90).

Puberty

Pubertal development was measured using the 5-item pubertal development scale (PDS; Petersen et al., 1988). This scale was filled out by participants, or by parents of participants under 12-years-old. Questions ask about physical signs of pubertal maturation such as breast development or voice deepening. The PDS is scored on a 5-point scale from 1 (has not started) to 4 (seems complete) and higher scores indicate the individual is further through puberty. In the current sample, the PDS demonstrated adequate internal consistency in children (α=.73) and adolescents (α=.71).

Procedure

The lead researcher recruited schools across the North East of England and central Scotland to a two-session longitudinal study of body image and eating disorder development in children. Two separate sessions were conducted three months apart to determine the role of puberty and age on the development of these variables. Parents of eligible children received a consent form electronically or in paper form (at the schools' discretion) to sign their child up. In each session, children were given a verbal summary of the information sheet and completed an assent to participate before filling in the

questionnaires. Children were also weighed and measured (if their parents consented) at the end of each session using the same methods outlined in Chapter 3 section 2.2.5 and their BMI was calculated. At the end of each session, children were verbally debriefed and had the opportunity to ask any questions. They were given a debrief sheet to take home and a pen and a sticker for participating. Schools received a £25 book voucher for each wave of data collection, totalling £50 if both sessions were completed.

Results

Multiple linear regression was used to assess the changes in variables across time. Each regression was run with the variables of interest first, and then with age and gender included in the model. Results for sociocultural pressure predicting future functional body image are presented in Table A3. For all models, the EIS at time 2 was entered as the outcome variable and the SATAQ-4 subscales at time 1 were entered as the predictor variables. For Model 2 age at time 2, gender, and their interactions were entered as predictor variables.

Table A3. Linear regression models for effects of SATAQ-4 subscales at time 1, age at time 2, gender, and their interaction on EIS at time 2.

	Model 1				**Model 2**			
	β	**SE**	***t***	***p***	**β**	**SE**	***t***	***p***
Thin ideal internalisation								
(intercept)	2.12	0.40	5.31	<.001	2.87	3.83	0.75	.458
SATAQ-4 thin	0.38	0.13	2.84	**.007**	0.31	1.12	0.28	.781
Age					-0.15	0.26	-0.57	.572
Gender (male)					0.68	4.36	0.16	.877
SATAQ-4 thin : age					0.03	0.07	0.40	.692
SATAQ-4 thin : gender (male)					-0.21	1.39	-0.15	.880
Age : gender (male)					0.12	0.30	0.40	.961
SATAQ-4 thin : age : gender (male)					-0.03	0.10	-0.32	.751
Athletic ideal internalisation								
(intercept)	2.28	0.46	4.94	<.001	9.08	3.23	2.81	.008
SATAQ-4 athletic	0.32	0.16	2.08	**.044**	-1.66	1.08	-1.53	.134
Age					-0.60	0.23	-2.59	**.013**
Gender (male)					-3.78	3.85	-0.98	.331
SATAQ-4 athletic : age					0.17	0.08	2.24	**.031**
SATAQ-4 athletic : gender (male)					1.02	1.37	0.75	.459
Age : gender (male)					0.45	0.28	1.59	.121
SATAQ-4 athletic : age : gender (male)					-0.12	0.10	-1.23	.225
Pressure from family								

(intercept)	3.01	0.45	8.63	<.001	2.70	3.46	0.78	.440
SATAQ-4 family	0.10	0.15	0.68	.503	0.66	1.57	0.42	.679
Age					0.01	0.23	0.04	.965
Gender (male)					4.81	4.27	1.13	.267
SATAQ-4 family : age					-0.04	0.11	-0.40	.688
SATAQ-4 family : gender (male)					-1.83	1.80	-1.01	.317
Age : gender (male)					-0.31	0.30	-1.03	.309
SATAQ-4 family : age : gender (male)					0.13	0.13	1.05	.300
Pressure from peers								
(intercept)	2.82	0.32	8.80	<.001	3.38	2.86	1.18	.244
SATAQ-4 peers	0.18	0.13	1.40	.169	0.34	1.27	0.27	.789
Age					-0.11	0.20	-0.56	.579
Gender (male)					1.79	3.31	0.54	.591
SATAQ-4 peers : age					0.01	0.09	0.16	.873
SATAQ-4 peers : gender (male)					-0.71	1.42	-0.50	.618
Age : gender (male)					0.02	0.24	0.08	.934
SATAQ-4 peers : age : gender (male)					0.00	0.10	0.00	.997
Pressure from media								
(intercept)	3.53	0.33	10.71	<.001	5.69	3.26	1.75	.088
SATAQ-4 media	-0.12	0.10	-1.12	.269	-0.72	1.34	-0.53	.597
Age					-0.18	0.22	-0.81	.424
Gender (male)					-3.33	3.94	-0.85	.403
SATAQ-4 media : age					0.05	0.09	0.51	.616
SATAQ-4 media : gender (male)					1.31	1.63	0.80	.428
Age : gender (male)					0.27	0.28	0.94	.354
SATAQ-4 media : age : gender (male)					-0.09	0.11	-0.79	.434

We can see that there are significant main effects of thin (Figure A1 Panel A) and athletic ideal (Figure A1 Panel B) internalisation on functional body image three months later, and a significant interaction between athletic ideal internalisation and age (Figure A1 Panel C).

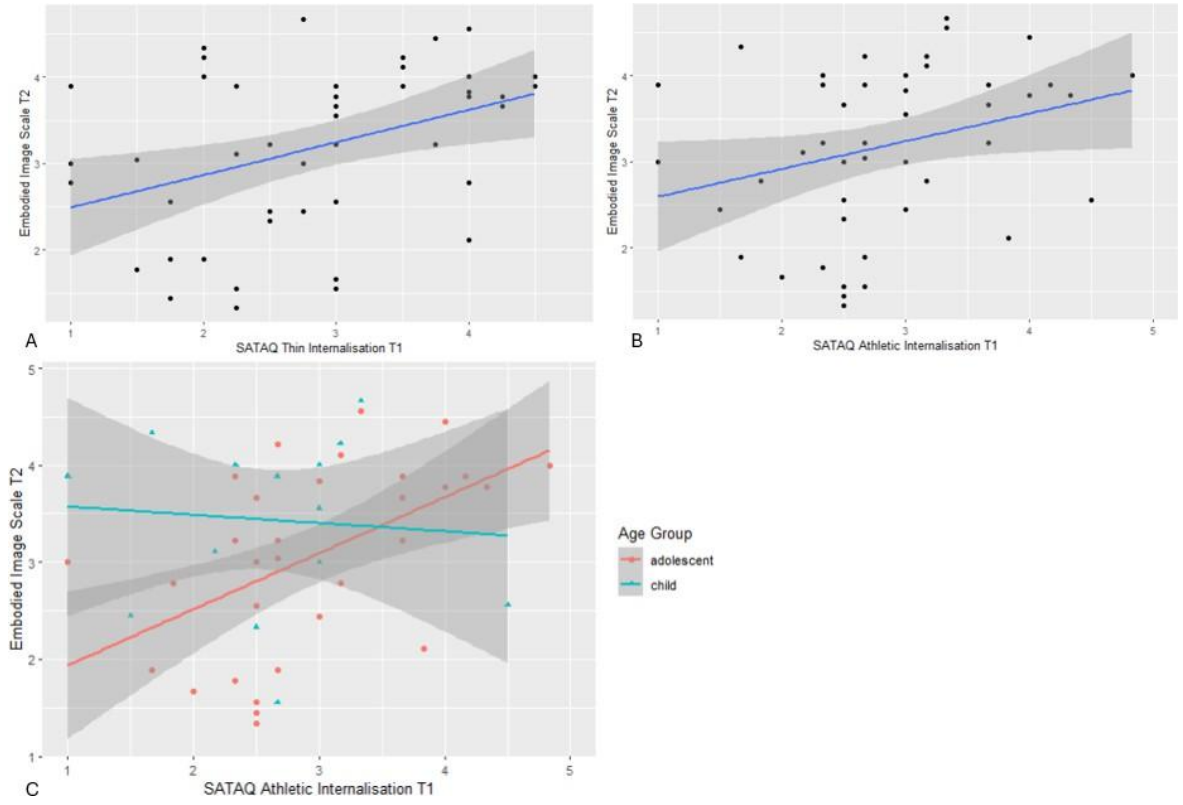


Figure A1. Scatterplots depicting the relationship between thin and athletic ideal internalisation and age on functional body image across time. Straight lines indicate the regression slope and shaped areas show 95% confidence intervals. Panel A represents the relationship between thin ideal internalisation and functional body image. Panel B represents the relationship between athletic ideal internalisation and functional body image. Panel C represents the interaction between age and athletic ideal internalisation on functional body image where children are represented by blue triangles and adolescents are in red circles.

We secondly tested if sociocultural pressure and internalisation of thin ideals predicted body esteem 3-months later. As body esteem was measured using different questionnaires, all analyses are split by age group. Linear regressions were run with body esteem as the outcome variable, and SATAQ-4 subscales as the predictor. As above, a second model was run for each regression to include the possible effect and interaction of gender. Regressions are shown in Table A3.

We found that sociocultural pressure from family, peers and the media significantly predicted decreased body esteem three months later in adolescents only, highlighting the importance of perceived pressure on body esteem in mid to late adolescence.

Table A4. Linear regression models for effects of SATAQ-4 subscales at time 1, gender, and their interaction on body esteem at time 2 by age group.

	Child								**Adolescent**							
	Model 1				**Model 2**				**Model 1**				**Model 2**			
	β	**SE**	***t***	***p***	**β**	**SE**	***t***	***p***	**β**	**SE**	***t***	***p***	**β**	**SE**	***t***	***p***
Thin ideal internalisation																
(intercept)	16.95	4.63	3.66	.003	12.47	9.70	1.29	.225	3.31	0.41	8.09	<.001	2.90	0.55	5.28	<.001
SATAQ-4 thin	-1.93	1.65	-1.17	.263	-1.16	3.04	-0.38	.709	-0.22	0.13	-1.66	.107	-0.12	0.18	-0.66	.515
Gender (male)					2.02	11.27	0.18	.861					1.03	0.83	1.25	.223
SATAQ-4 thin : gender (male)					0.82	3.80	0.22	.833					-0.23	0.26	-0.88	.385
Athletic ideal internalisation																
(intercept)	13.81	4.35	3.17	<.001	8.17	6.35	1.29	.224	3.61	0.49	7.37	<.001	3.26	0.70	4.65	<.001
SATAQ-4 athletic	-0.80	1.60	-0.5	.625	0.23	2.11	0.11	.915	-0.32	0.16	-1.99	.055	-0.24	0.23	-1.04	.306
Gender (male)					6.26	8.73	0.72	.489					0.78	0.99	0.79	.439
SATAQ-4 athletic : gender (male)					-0.55	3.20	-0.17	.867					-0.15	0.32	-0.48	.634
Pressure from family																
(intercept)	8.74	4.41	1.98	.071	5.58	7.71	0.72	.486	3.45	0.31	10.99	<.001	3.37	0.39	8.68	<.001
SATAQ-4 family	1.18	1.66	0.71	.491	1.47	3.37	0.44	.671	-0.40	0.15	-2.72	**.011**	-0.42	0.18	-2.31	**.028**
Gender (male)					8.71	9.52	0.92	.382					0.24	0.67	0.36	.723
SATAQ-4 family : gender (male)					-1.63	3.88	-0.42	.684					0.05	0.31	0.16	.878
Pressure from peers																
(intercept)	12.92	3.44	3.75	.003	16.27	5.96	2.73	.021	3.62	0.28	12.87	<.001	3.63	0.34	10.81	<.001
SATAQ-4 peers	-0.56	1.45	-0.38	.708	-3.64	2.77	-1.32	.217	-0.42	0.11	-3.72	**<.001**	-0.52	0.15	-3.53	**.001**
Gender (male)					-2.23	6.98	-0.32	.756					0.36	0.57	0.64	.528
SATAQ-4 peers : gender (male)					3.57	3.12	1.14	.280					0.08	0.22	0.39	.703
Pressure from media																
(intercept)	13.74	3.43	4.01	.001	14.74	5.41	2.73	.020	3.98	0.27	14.50	<.001	4.01	0.37	10.69	<.001
SATAQ-4 media	-0.96	1.51	-0.63	.538	-2.63	2.26	-1.16	.270	-0.40	0.08	-5.15	**<.001**	-0.42	0.10	-4.47	**<.001**
Gender (male)					-2.31	6.59	-0.35	.733					-0.12	0.59	-0.21	.836
SATAQ-4 media : gender (male)					3.24	2.84	1.14	.278					0.06	0.18	0.31	.757

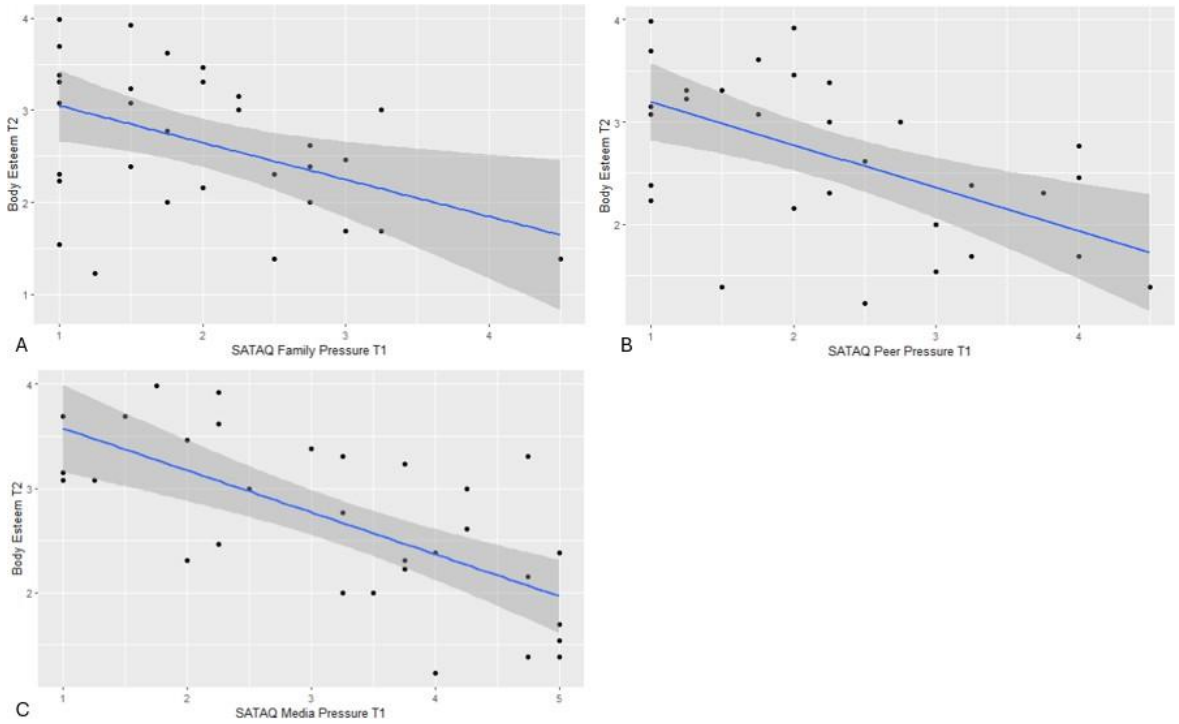


Figure A2. Scatterplots showing the relationship between perceived sociocultural pressure from family, peers, and the media on future body esteem. Straight lines indicate regression sloped and shaded areas represent 95% confidence intervals. Panel A shows the relationship between family pressure and future body esteem. Panel B shows the relationship between peer pressure and future body esteem. Panel C shows the relationship between media pressure and future body esteem.

We additionally considered the effect of functional body image and body esteem on future eating disorder symptoms. Linear regressions were conducted with ChEAT at time 2 as the outcome variable. Functional body image or body esteem (split by age group) at time 1 were entered as predictors and in Model 2 age, gender, and their interaction were also included. Results are shown in Table A5.

Table A5. Linear regression models for effects of functional body image at time 1, body esteem at time 1, age at time 1, gender, and their interactions on eating disorder symptoms at time 2.

	Model 1				Model 2			
	β	**SE**	***t***	***p***	**β**	**SE**	***t***	***p***
Functional body image								
(intercept)	8.44	6.31	1.34	.188	-119.6	62.62	-1.91	.064
EIS	0.99	1.82	0.55	.589	33.78	15.85	2.12	**.041**
Age					8.63	4.21	2.05	**.048**
Gender (male)					-3.69	108.6	-0.03	.973
EIS : age					-2.16	1.08	-1.99	.053
EIS : gender (male)					-0.61	27.93	-0.02	.983
Age : gender (male)					-0.13	7.43	-0.02	.986
EIS : age : gender (male)					0.05	1.94	0.03	.979
Children's body esteem								
(intercept)	11.77	15.44	0.76	.459	19.07	21.95	0.87	.403
BESC	-0.05	1.18	-0.04	.967	-0.46	1.77	-0.26	.798
Gender (male)					-20.00	33.56	-0.60	.563
BESC : gender (male)					1.25	2.58	0.49	.637
Adolescent's body esteem								
(intercept)	34.24	5.69	6.02	<.001	37.68	7.07	5.33	<.001
BESAA	-8.30	2.07	-4.01	<.001	-9.34	2.67	-3.50	**.002**
Gender (male)					-12.03	12.52	-0.96	.345
BESAA : gender (male)					3.59	4.45	0.81	.426

We found a main effect of past functional body image and current age on current eating disorder symptoms, indicating that increased functional body image predicted future increased eating disorder symptoms (Fig A3 Panel A), and older age predicted current eating disorder symptoms (Fig A3 Panel B). Additionally, we found a significant main effect of body esteem on future eating disorder symptoms in adolescents only, indicating that increased body esteem predicts lower eating disorder symptoms three months later (Fig A3 Panel C).

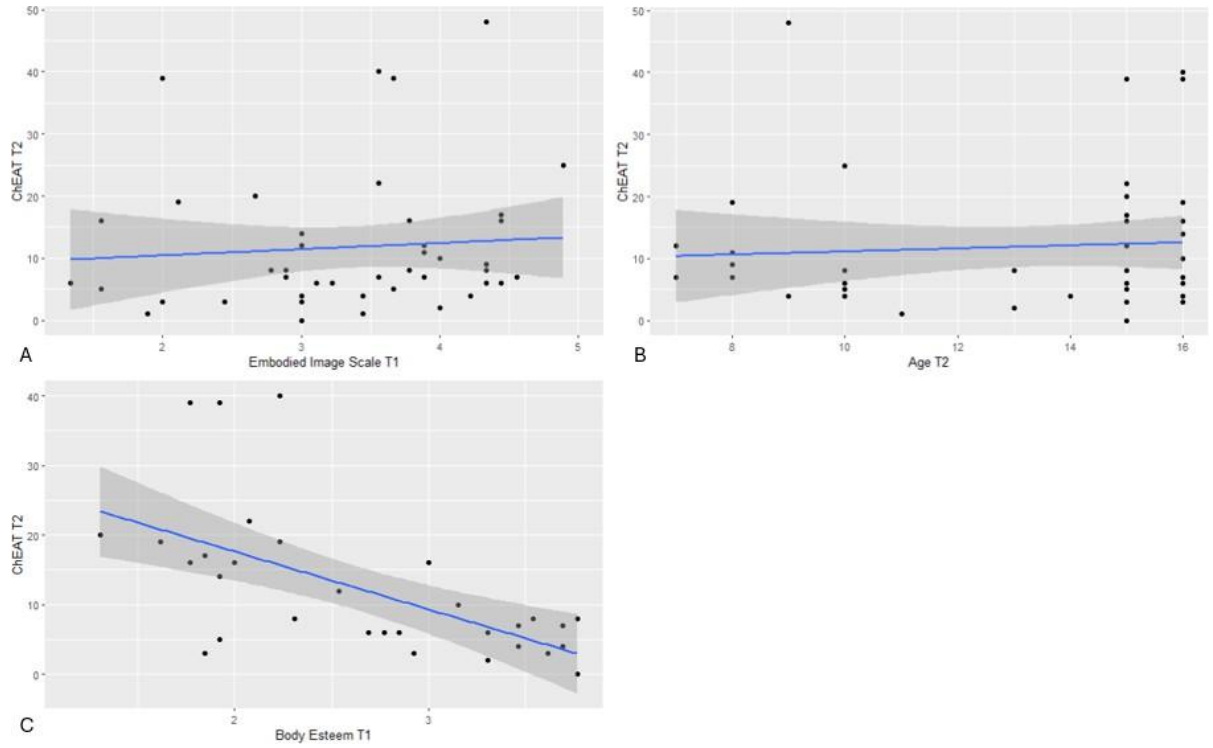


Figure A3. Scatterplots showing the relationship between functional body image, age, and body esteem on future eating disorder symptoms. Straight line represents regression slope and shaded areas represent 95% confidence intervals. Panel A shows the relationship between embodied image at time 1 and eating disorder symptoms at time 2. Panel B shows the relationship between concurrent age and eating disorder symptoms at time 2. Panel C shows the relationship between body esteem at time 1 and eating disorder symptoms at time 2 in adolescents.

Finally, we considered the effect of previous and current pubertal development on eating disorder symptoms. Linear regressions were run with ChEAT as the outcome variable and puberty at time 1 or time 2 as the predictor variable. Age, gender, and their interactions were included in model 2. No significant main effects or interactions were found, suggesting there was no effect of pubertal development on eating disorder symptoms across three months in this sample.

Appendix B: Supplementary Materials for Chapter 5

Table A6. Exploratory model with body part, age group and gender.

	β	SE	*t*	*p*
(intercept)	-2.21	0.32	-7.00	<.001
Body part (chest)	0.81	0.42	1.96	.050
Body part (head)	0.78	0.42	1.87	.062
Body part (lower legs)	-0.57	0.46	-1.25	.213
Body part (stomach)	-0.08	0.45	-0.76	.861
Body part (upper legs)	0.13	0.44	0.29	.775
Age group (child)	-0.17	0.42	-0.41	.682
Gender (male)	0.77	0.55	1.41	.160
Body part (chest) : age group (child)	-0.08	0.55	-0.14	.888
Body part (head) : age group (child)	-1.27	0.58	-2.20	**.028**
Body part (lower legs) : age group (child)	1.28	0.59	2.17	**.030**
Body part (stomach) : age group (child)	0.44	0.59	0.74	.455
Body part (upper legs) : age group (child)	0.34	0.58	0.58	.561
Body part (chest) : gender (male)	-0.67	0.75	-0.89	.371
Body part (head) : gender (male)	-1.40	0.79	-1.78	.076
Body part (lower legs) : gender (male)	-0.45	0.83	-0.54	.590
Body part (stomach) : gender (male)	-0.45	0.80	-0.56	.578
Body part (upper legs) : gender (male)	-1.13	0.82	-1.38	.169
Age group (child) : gender (male)	-0.84	0.65	-1.29	.199
Body part (chest) : age group (child) : gender (male)	0.70	0.88	0.79	.430
Body part (head) : age group (child) : gender (male)	1.90	0.94	2.02	**.043**
Body part (lower legs) : age group (child) : gender (male)	-0.54	0.96	-0.56	.576
Body part (stomach) : age group (child) : gender (male)	0.45	0.94	0.49	.628
Body part (upper legs) : age group (child) : gender (male)	1.10	0.95	1.16	.246

Table A7. H1 models with age group and gender included.

	Model 1				Model 2			
	β	**SE**	***t***	***p***	**β**	**SE**	***t***	***p***
Head								
(intercept)	-1.75	0.33	-5.34	<.001	-0.94	0.45	-2.01	.037
BPSS-R-z	0.09	0.26	0.34	.732	0.17	0.37	0.45	.654
Favourite or not	-0.53	0.42	-1.26	.207	-0.58	0.40	-1.44	.150
BPSS-R-z : Favourite or not	-0.36	0.45	-0.81	.419	-0.34	0.47	-0.73	.465
Age group (child)					-1.44	0.46	-3.12	**.002**
Gender (male)					0.20	0.46	0.44	.663
BPSS-R-z : age group (child)					-0.17	0.42	-0.41	.683
BPSS-R-z : gender (male)					0.43	0.51	0.85	.394
Arms								
(intercept)	-2.69	0.19	-14.25	<.001	-2.77	0.33	-8.42	<.001
BPSS-R-z	0.02	0.16	0.10	.920	-0.31	0.29	-1.06	.289
Favourite or not	0.36	0.38	0.95	.344	0.43	0.38	1.11	.266
BPSS-R-z : Favourite or not	-0.88	0.49	-1.80	.071	-0.98	0.50	1.48	.051
Age group (child)					-0.15	0.37	-0.04	.967
Gender (male)					0.07	0.31	0.21	.833
BPSS-R-z : age group (child)					0.51	0.34	1.48	.140
BPSS-R-z : gender (male)					-0.30	0.30	-0.98	.327
Chest								
(intercept)	-1.48	0.02	-6.70	<.001	-1.43	0.44	-3.23	.001
BPSS-R-z	0.08	0.23	0.33	.744	-0.06	0.41	-0.15	.885
Favourite or not	0.18	0.33	0.56	.579	0.16	0.37	0.44	.658
BPSS-R-z : Favourite or not	-0.33	0.37	-0.89	.373	-0.35	0.38	-0.93	.353
Age group (child)					-0.20	0.42	-0.47	.638
Gender (male)					-0.03	0.39	-0.08	.940
BPSS-R-z : age group (child)					-0.05	0.43	-0.13	.899
BPSS-R-z : gender (male)					0.74	0.41	1.80	.073

Stomach								
(intercept)	-1.93	0.23	-8.44	<.001	-2.04	0.42	-4.87	<.001
BPSS-R-z	-0.23	0.20	-1.15	.249	-0.03	0.37	-0.08	.939
Favourite or not	-0.22	0.35	-0.64	.524	-0.27	0.37	-0.71	.477
BPSS-R-z : Favourite or not	0.10	0.34	0.30	.762	0.28	0.36	0.77	.443
Age group (child)					-0.05	0.43	-0.11	-914
Gender (male)					0.31	0.36	0.87	.387
BPSS-R-z : age group (child)					-0.44	0.42	-1.07	.286
BPSS-R-z : gender (male)					-0.03	0.37	-0.08	.935
Upper legs								
(intercept)	-2.20	0.19	-11.87	<.001	-2.20	0.35	-6.38	<.001
BPSS-R-z	-0.14	0.16	-0.86	.392	-0.26	0.30	-0.88	.378
Favourite or not	0.08	0.31	.252	.801	-0.16	0.35	-0.46	.648
BPSS-R-z : Favourite or not	0.08	0.31	.271	.787	0.50	0.39	1.27	.203
Age group (child)					-0.02	0.40	-0.04	.967
Gender (male)					0.12	0.32	0.37	.710
BPSS-R-z : age group (child)					0.24	0.33	0.72	.469
BPSS-R-z : gender (male)					-0.57	0.35	-1.62	.106
Lower legs								
(intercept)	-2.66	0.32	-8.20	<.001	-3.33	0.45	-7.36	<.001
BPSS-R-z	-0.16	0.31	-0.51	.610	-0.56	0.43	-1.31	.191
Favourite or not	0.03	0.37	.081	.936	-0.09	0.34	-0.26	.793
BPSS-R-z : Favourite or not	-0.11	0.37	-0.28	.776	0.07	0.30	0.24	.807
Age group (child)					1.55	0.50	3.11	**.002**
Gender (male)					-1.16	0.34	-3.40	**<.001**
BPSS-R-z : age group (child)					0.68	0.41	1.65	.098
BPSS-R-z : gender (male)					-0.55	0.35	-1.60	.111

Table A8. H2 models by age group and gender.

	Model 1				Model 2			
	β	**SE**	***t***	***p***	**β**	**SE**	***t***	***p***
Head								
(intercept)	-2.12	0.27	-7.87	<.001	-1.28	0.39	-3.26	.001
BPSS-R-z	-0.20	0.22	-0.90	.369	0.02	0.38	0.06	.953
Least favourite or not	0.39	0.62	0.63	531	0.67	0.64	1.05	.294
BPSS-R-z : Least favourite or not	0.43	0.49	0.89	.376	0.33	0.50	0.67	.504
Age group (child)					-1.48	0.46	-3.25	**.001**
Gender (male)					0.17	0.46	0.36	.362
BPSS-R-z : age group (child)					-0.25	0.48	0.59	.573
BPSS-R-z : gender (male)					0.28	0.48	0.59	.555
Arms								
(intercept)	-2.68	0.19	13.84	<.001	-2.67	0.41	-6.57	<.001
BPSS-R-z	-0.06	0.16	-0.39	.700	-0.24	0.33	-0.72	.472
Least favourite or not	0.04	0.67	.061	.951	-0.01	0.79	-0.01	.989
BPSS-R-z : Least favourite or not	-0.10	0.86	-0.11	.911	0.12	0.91	0.13	.896
Age group (child)					-0.23	0.46	-0.49	.622
Gender (male)					0.18	0.32	0.57	.569
BPSS-R-z : age group (child)					0.31	0.37	0.84	.401
BPSS-R-z : gender (male)					-0.32	0.33	-0.98	.325
Chest								
(intercept)	-1.46	0.20	-7.31	<.001	-1.30	0.31	-4.23	<.001
BPSS-R-z	-0.15	0.18	-0.82	.412	-0.03	0.35	-0.08	.934
Least favourite or not	0.05	0.30	0.18	.861	-0.03	0.34	-0.08	.932
BPSS-R-z : Least favourite or not	0.47	0.37	1.27	.205	0.58	0.37	1.58	.115
Age group (child)					-0.20	0.40	-0.49	.623
Gender (male)					-0.17	0.37	-0.45	.652
BPSS-R-z : age group (child)					-0.42	0.41	-1.01	.315
BPSS-R-z : gender (male)					0.74	0.41	1.80	.073

Stomach								
(intercept)	-1.97	0.26	-7.49	<.001	-2.02	0.40	-5.05	<.001
BPSS-R-z	-0.27	0.21	-1.28	.201	-0.21	0.52	-0.40	.687
Least favourite or not	-0.01	0.32	-0.04	.967	-0.09	0.38	-0.24	.812
BPSS-R-z : Least favourite or not	0.15	0.32	0.45	.650	031	0.44	0.46	.643
Age group (child)					-0.12	0.45	-0.26	.798
Gender (male)					0.39	0.37	1.03	.302
BPSS-R-z : age group (child)					-0.11	0.50	-0.22	.824
BPSS-R-z : gender (male)					-0.20	0.40	-0.50	.619
Upper legs								
(intercept)	-2.09	0.17	-12.39	<.001	-2.15	0.32	-6.77	<.001
BPSS-R-z	-0.17	0.15	-1.13	.257	-0.19	0.29	-0.65	.517
Least favourite or not	-0.42	0.33	-1.27	.204	-0.37	0.35	-1.07	.285
BPSS-R-z : Least favourite or not	0.27	0.33	0.81	.420	0.27	0.36	0.35	.729
Age group (child)					0.19	0.37	0.51	.614
Gender (male)					-0.15	0.30	-0.48	.628
BPSS-R-z : age group (child)					0.12	0.35	0.35	.729
BPSS-R-z : gender (male)					-0.20	0.31	-0.65	.514
Lower legs								
(intercept)	-2.69	0.24	-11.04	<.001	-3.40	0.46	-7.42	<.001
BPSS-R-z	-0.25	0.18	-1.41	.159	-0.52	0.36	-1.45	.148
Least favourite or not	-0.05	0.57	-0.09	.928	0.20	0.42	0.47	.637
BPSS-R-z : Least favourite or not	0.49	0.81	0.60	.548	-0.25	0.54	-0.47	.638
Age group (child)					1.57	0.50	3.17	**.002**
Gender (male)					-1.18	0.35	-3.41	**<.001**
BPSS-R-z : age group (child)					0.70	0.41	1.71	.087
BPSS-R-z : gender (male)					-0.59	0.35	-1.67	.095

Table A9. H3 model with age group and gender.

	β	SE	*t*	*p*
Head				
(intercept)	-1.05	0.32	-3.26	.001
Head satisfaction	-0.25	0.32	-0.79	.432
Condition (positive)	-0.74	0.48	-1.53	.125
Age group (child)	-2.58	0.65	-3.98	**<.001**
Gender (male)	-1.63	0.93	-1.78	.075
Head satisfaction : condition (positive)	0.51	0.47	1.09	.276
Head satisfaction : age group (child)	-0.48	0.52	-0.92	.356
Head satisfaction : gender (male)	-3.59	2.13	-1.69	.092
Condition (positive) : age group (child)	0.04	0.97	0.05	.964
Condition (positive) : gender (male)	1.54	1.25	1.23	.220
Age group (child) : gender (male)	2.81	1.11	2.53	**.011**
Head satisfaction : condition (positive) : age group (child)	-0.74	0.8-	-0.93	.355
Head satisfaction : condition (positive) : gender (male)	0.36	2.89	0.13	.900
Head satisfaction : age group (child) : gender (male)	3.85	2.21	1.74	.082
Condition (positive) : age group (child) : gender (male)	-1.19	1.57	-0.76	.447
Head satisfaction : condition (positive) : age group (child) : gender (male)	-0.08	3.03	-0.03	.980
Arms				
(intercept)	-2.57	0.44	-5.90	<.001
Arm satisfaction	0.05	0.43	0.12	.909
Condition (positive)	0.73	0.57	1.29	.197
Age group (child)	0.20	0.54	0.37	.713
Gender (male)	0.87	1.72	0.51	.612
Arm satisfaction : condition (positive)	-0.09	0.57	-0.16	.873
Arm satisfaction : age group (child)	-0.53	0.69	-0.77	.444
Arm satisfaction : gender (male)	-0.70	2.24	-0.31	.753
Condition (positive) : age group (child)	-1.11	0.75	-1.49	.136
Condition (positive) : gender (male)	-1.89	2.64	-0.72	.473
Age group (child) : gender (male)	-1.15	1.77	-0.65	.515
Arm satisfaction : condition (positive) : age group (child)	0.47	0.98	0.49	.628
Arm satisfaction : condition (positive) : gender (male)	-0.58	3.41	-0.17	.864
Arm satisfaction : age group (child) : gender (male)	1.11	2.34	0.47	.636
Condition (positive) : age group (child) : gender (male)	2.34	2.70	0.87	.385

Arm satisfaction : condition (positive) : age group (child) : gender (male)	-0.20	3.55	-0.06	.955
Chest				
(intercept)	-1.31	0.30	-4.34	<.001
Chest satisfaction	-0.50	0.49	-1.01	.310
Condition (positive)	0.29	0.42	0.69	.492
Age group (child)	-0.27	0.43	-0.63	.529
Gender (male)	-0.02	0.76	-0.03	.977
Chest satisfaction : condition (positive)	0.84	0.72	1.17	.241
Chest satisfaction : age group (child)	0.58	0.59	0.97	.332
Chest satisfaction : gender (male)	-0.03	1.99	-0.01	.989
Condition (positive) : age group (child)	-0.89	0.62	-1.44	.149
Condition (positive) : gender (male)	-0.19	1.07	-0.18	.856
Age group (child) : gender (male)	0.10	0.86	0.12	.908
Chest satisfaction : condition (positive) : age group (child)	-0.35	0.88	-0.40	.690
Chest satisfaction : condition (positive) : gender (male)	-0.46	2.81	-0.17	.869
Chest satisfaction : age group (child) : gender (male)	0.17	2.03	0.09	.932
Condition (positive) : age group (child) : gender (male)	0.42	1.21	0.35	.728
Chest satisfaction : condition (positive) : age group (child) : gender (male)	-0.29	2.87	-0.10	.920
Stomach				
(intercept)	-2.25	0.44	-5.15	<.001
Stomach satisfaction	-0.14	0.25	-0.57	.570
Condition (positive)	0.05	0.60	0.08	.934
Age group (child)	0.19	0.52	0.36	.716
Gender (male)	0.96	0.89	1.08	.281
Stomach satisfaction : condition (positive)	-0.08	0.35	-0.21	.831
Stomach satisfaction : age group (child)	0.22	0.33	0.68	.499
Stomach satisfaction : gender (male)	0.39	0.80	0.50	.620
Condition (positive) : age group (child)	-0.35	0.75	-0.46	.643
Condition (positive) : gender (male)	-1.06	1.33	-0.80	.426
Age group (child) : gender (male)	-0.78	0.97	-0.80	.422
Stomach satisfaction : condition (positive) : age group (child)	0.05	0.47	0.11	.912
Stomach satisfaction : condition (positive) : gender (male)	-0.56	1.17	-0.48	.630
Stomach satisfaction : age group (child) : gender (male)	-0.27	0.87	-0.31	.757
Condition (positive) : age group (child) : gender (male)	1.12	1.45	0.77	.442

Stomach satisfaction : condition (positive) : age group (child) : gender (male)	0.52	1.27	0.41	.684
Upper legs				
(intercept)	-2.20	0.30	-7.40	.001
Upper legs satisfaction	0.55	0.42	1.32	.188
Condition (positive)	0.08	0.41	0.19	.854
Age group (child)	0.11	0.43	0.26	.794
Gender (male)	1.18	0.78	1.52	.128
Upper legs satisfaction : condition (positive)	-0.62	0.63	-0.99	.325
Upper legs satisfaction : age group (child)	-0.52	0.53	-0.99	.324
Upper legs satisfaction : gender (male)	-3.09	2.35	-1.31	.190
Condition (positive) : age group (child)	0.07	0.61	0.11	.911
Condition (positive) : gender (male)	-0.60	1.17	-0.51	.609
Age group (child) : gender (male)	-1.33	0.86	-1.54	.123
Upper legs satisfaction : condition (positive) : age group (child)	1.17	0.79	1.49	.136
Upper legs satisfaction : condition (positive) : gender (male)	-0.42	3.63	-0.12	.909
Upper legs satisfaction : age group (child) : gender (male)	3.39	2.40	1.41	.158
Condition (positive) : age group (child) : gender (male)	0.11	1.29	0.08	.933
Upper legs satisfaction : condition (positive) : age group (child) : gender (male)	-0.60	3.69	-0.16	.870
Lower legs				
(intercept)	-3.49	0.47	-7.45	<.001
Lower legs satisfaction	0.69	0.39	1.75	.081
Condition (positive)	1.02	0.57	1.79	.073
Age group (child)	1.71	0.52	3.25	**.001**
Gender (male)	1.62	0.79	2.04	**.042**
Lower legs satisfaction : condition (positive)	-0.38	0.49	-0.77	.439
Lower legs satisfaction : age group (child)	-0.74	0.47	-1.56	.119
Lower legs satisfaction : gender (male)	1.40	2.09	0.67	.504
Condition (positive) : age group (child)	-1.70	0.69	-2.45	**.014**
Condition (positive) : gender (male)	-0.03	1.01	-0.03	.975
Age group (child) : gender (male)	-3.26	0.96	-3.40	**<.001**
Lower legs satisfaction : condition (positive) : age group (child)	0.64	0.67	0.96	.336
Lower legs satisfaction : condition (positive) : gender (male)	3.74	2.90	1.29	.198
Lower legs satisfaction : age group (child) : gender (male)	-0.72	2.18	-0.33	.740

Condition (positive) : age group (child) : gender (male)	1.67	1.23	1.36	.174
Lower legs satisfaction : condition (positive) : age group (child) : gender (male)	-5.00	3.05	-1.64	.101

Appendix C: Supplementary Materials for Chapter 6

Figure A4. Adolescent age avatars created for each condition. The top row shows the girls' avatars and the bottom row shows the boys' avatars. Top and bottom left-hand avatars are low adiposity; top and bottom middle avatars are average adiposity; top and bottom right-hand avatars are high adiposity.

Table A10. Comparison of old and new BISS items with notes on changes.

Original BISS item	**New BISS item**	**Notes**
Right now I feel: • Extremely dissatisfied with my physical appearance • Mostly dissatisfied with my physical appearance • Moderately dissatisfied with my physical appearance • Slightly dissatisfied with my physical appearance • Neither dissatisfied or satisfied with my physical appearance • Slightly satisfied with my physical appearance • Moderately satisfied with my physical appearance • Mostly satisfied with my physical appearance • Extremely satisfied with my physical appearance	How much do you like how you look with this avatar? (1-Really don't like it; 5 – Like it a lot)	Wording changed to relate to avatar. Simplified for children.
Right now I feel: • Extremely satisfied with my body size and shape • Mostly satisfied with my body size and shape • Moderately satisfied with my body size and shape • Slightly satisfied with my body size and shape • Neither dissatisfied or satisfied with my body size and shape • Slightly dissatisfied with my body size and shape • Moderately dissatisfied with my body size and shape • Mostly dissatisfied with my body size and shape • Extremely dissatisfied with my body size and shape	How much do you like your body size and shape with this avatar? (1 – Really don't like it; 5 – Like it a lot)	Wording changed to relate to avatar. Simplified for children.
Right now I feel: • Extremely dissatisfied with my weight • Mostly dissatisfied with my weight	N/A	This item was removed.

• Moderately dissatisfied with my weight • Slightly dissatisfied with my weight • Neither dissatisfied nor satisfied with my weight • Slightly satisfied with my weight • Moderately satisfied with my weight • Mostly satisfied with my weight • Extremely satisfied with my weight		
Right now I feel: • Extremely physically attractive • Very physically attractive • Moderately physically attractive • Slightly physically attractive • Neither attractive nor unattractive • Slightly physically unattractive • Moderately physically unattractive • Very physically unattractive • Extremely physically unattractive	How good looking do you feel with this avatar? (1 – Really not good looking; 5 – Really good looking)	Wording changed to relate to avatar. Simplified for children.
Right now I feel: • A great deal worse about my looks than I usually feel • Much worse about my looks than I usually feel • Somewhat worse about my looks than I usually feel • Just slightly worse about my looks than I usually feel • About the same about my looks as usual • Just slightly better about my looks than I usually feel • Somewhat better about my looks than I usually feel • Much better about my looks than I usually feel • A great deal better about my looks than I usually feel	How much do you like how you look with the avatar body compared to your normal body? (1 – Prefer the avatar body a lot; 5 – Prefer my own body a lot)	This item was reverse scored. Wording changed to relate to avatar. Simplified for children.
Right now I feel that I look:	How do you think you look now in comparison to other people? (1 – A	Wording changed to

• A great deal better than the average person looks • Much better than the average person looks • Somewhat better than the average person looks • Just slightly better than the average person looks • About the same as the average person looks • Just slightly worse than the average person looks • Somewhat worse than the average person looks • Much worse than the average person looks • A great deal worse than the average person looks	lot worse than other people; 5 – A lot better than other people)	relate to avatar. Simplified for children.

Table A11. Post-hoc pairwise comparisons between conditions on agency ratings.

Condition 1	**Condition 2**	**V**	***p***	p_{bonf}
Sync low	Async low	476.5	<.001	**<.001**
Sync low	Sync average	48.0	.294	1
Sync low	Sync high	76.5	.347	1
Sync low	Async high	581.5	<.001	**<.001**
Async low	Sync average	28.0	<.001	**<.001**
Async low	Sync high	4.5	<.001	**<.001**
Async low	Async high	55.0	.214	1
Sync average	Sync high	104.0	.056	.556
Sync average	Async high	591.5	<.001	**<.001**
Sync high	Async high	548.5	<.001	**<.001**

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