Research Square

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Development of Body Image Preference in Children 6 – 12 years old

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Abstract

Background:

Several studies have investigated children's body image using figure rating scales, and found females' selection of IDEAL (ideal body image) was significantly thinner than SELF (perceived current body image) and males' selection of IDEAL. However, no studies have investigated children's body image using virtual reality avatars. This study examined whether the discrepancy between SELF and IDEAL is greater in female than in male children aged 6 to 12 years using photorealistic figure rating scales.

Methods:

Female and male photorealistic body size scales based on Body Mass Index (BMI) were created using MakeHuman and Blender, and children rated their SELF and IDEAL body images using these scales.

Results:

Discrepancy between SELF and IDEAL body image was present among younger female (6.3–8.5 years) and older (10.3–12.5 years) elementary school children, but not among middle elementary school children (8.3–10.5 years).

Conclusion:

These findings suggest that body dissatisfaction, similar to that observed in adult females, emerges or is already formed at an early age.

Trial registration:

Not applicable.

Introduction

Body image comprises perceptions, attitudes, and beliefs about one's own body and can be conscious [1]. Most body image studies have focused on body dissatisfaction [2], typically examining sex differences between adult females and males [3-5] using drawing-based scales.

Previous body image studies [6-7] developed a silhouette method to compare current and ideal body images. These studies used nine silhouettes ranging from very thin to very fat. Participants selected silhouettes that best represented their parents' body size at age 15. The selected figures were found to correlate with their parents' measured BMI, supporting the method's validity [7]. Using nine outline

drawings, Fallon and Rozin [8] compared current and ideal body images among male and female undergraduates. They found that males' current and ideal figures were nearly identical, whereas females' current figures were heavier than their ideal figures. Recently, Brizzi et al. [9] developed the Body Image Virtual Reality Assessment (BIVRA), a virtual reality-based figure rating scale for assessing body image in both males and females. The results revealed that BIVRA effectively assessed body image and captured both low and high levels of body representation.

Several studies have investigated children's body image using figure rating scales. Replicating the procedure used by Fallen and Rozin [8], Cohn et al. [10] examined body size preferences in female and male adolescents aged 10.5–15 years. The females showed a bias toward thinness, whereas males preferred larger figures. Building on the work of Stunkard et al. [7], Collins [11] developed a pictorial instrument featuring child figures. The results indicate that females' selection of IDEAL was significantly thinner than SELF and males' selection of IDEAL, suggesting sensitivity to thinness as early as six to seven years of age. Using the figure rating scales developed by Collins [11] and Stunkard et al. [7], Kostanski et al. [12] examined the prevalence of body image dissatisfaction during childhood and adolescence. Participants completed self-reported measures of global body image dissatisfaction. Females showed a significant increase in body dissatisfaction with body weight, reflecting a predominant desire to be thinner. However, males showed a different pattern: overweight participants wanted to be thinner, whereas underweight participants wanted to be larger. Overall, body image dissatisfaction was evident in both sexes during childhood and adolescence. However, no studies have investigated children's body image using virtual reality avatars.

Recently, children's photorealistic body size scales have been demonstrated to be valid and reliable [13]. They developed a set of photorealistic body size scales for boys and girls aged 4–5 and 10–11 years. Adults evaluated these scales by rating each figure's adiposity and ranking the figures from least to most adipose, accurately judging relative adiposity. In that study, adults rated their children's photorealistic body-size scales, whereas in the current study, children rated their own photorealistic body-size scales.

The study aimed to examine whether the discrepancy between SELF (perceived current body image) and IDEAL (ideal body image) is greater in female children than in male children aged 6 to 12 years. Female and male photorealistic body size scales based on BMI were created using MakeHuman and Blender. The children rated their SELF and IDEAL body images using these scales. We hypothesized that females' IDEAL body image BMI would be lower than their SELF BMI, whereas no such difference would be observed between males.

Methods

Participants

A total of 127 children aged 6–12 years old (72 boys and 55 girls; M = 8.80 years, SD = 1.64) participated in this study. Data were collected on August 11–14, August 18–19, and October 25–26, 2025. Written informed consent was obtained from the parents or legal guardians of all participants. Children were

recruited and tested at the National Museum of Emerging Science and Innovation in Tokyo, Japan. This study was approved by the ethics committee of Chuo University. Parents or legal guardians reported the children's sex at birth.

The participants were divided into three age groups according to the Japanese elementary school grade system. Grades 1 and 2 were labeled as "younger (27 boys and 17 girls; mean age = 7.07 years, SD = 0.76)," Grades 3 and 4 as "middle (29 boys and 20 girls; mean age = 8.90 years, SD = 0.65)," and Grades 5 and 6 as "older (16 boys and 18 girls; mean age = 10.88 years, SD = 0.69)."

Practice trials

All participants completed the practice trials before the experimental tasks. They were instructed to move a slider marker to align with a flower picture displayed on the screen. Practice trials were concluded when participants completed three trials.

Stimuli

The same flower image (0.2 × 0.2 norm) was used in all three trials. The image was presented at the 0.3 norm on the Y-axis, while its X-axis position was randomly set to 0.25, 0.75, and − 0.25 norm.

Procedure

Participants proceeded to the experiment trials if the marker was aligned with the flower within ± 0.3 norm of the correct position in all three trials. Practice trials were repeated until the inclusion criteria were met.

Experimental trials

Before the experimental trials, participants were informed that there were no correct answers and were encouraged to respond freely. Once the instructions were understood, the experimental trials began.

Stimuli

The experimental stimuli consisted of photorealistic avatars created using two different software programs: MakeHuman to create the avatar and Blender to approximate BMI and make model clothing. For each sex, seven avatars were created with BMIs ranging from 12 to 24 in increments of two. Physical attributes such as race, sex, age, muscle, weight, height, and proportions were manipulated in MakeHuman, with parameter values selected based on their influence on overall BMI.

The midpoint avatar was set at a BMI of 18, based on the standard body weight (kg) calculation method using height [14]. Japanese 12 years old female standard body weight is 42.47 kg, and male is 41.81 kg. Based on these standard weights, we calculated the standard BMIs for male and female. Female standard BMI was 18.87, and male standard BMI was 18.58.

We used 12- and 150-cm-tall Asian female and male avatars with standard body weights (kg) (Fig. 1). Using a BMI of 18 and a height of 150 cm, the target body weight was calculated as 40.5 kg. After the avatars were created in MakeHuman, they were imported into Blender to measure their volumes. If the measured volume did not match the target value, avatar parameters were adjusted using MakeHuman until the desired volume was achieved. Once the volume was finalized, avatars were dressed in black pants and a shirt modeled in Blender to fit each body. After creating the BMI 18 avatar, avatars with BMIs of 12, 14, 16, 20, 22, and 24 were generated using the same method.

7 corresponds to the body shape with the highest BMI (extreme right), whereas 1 corresponds to the body with the lower BMI (extreme left). Lower panel shows female avatars (BMI 12 to 24), and upper panel shows male avatars (BMI 12 to 24).

Full-body front images of each avatar were captured using Blender Render. For each sex, seven avatars were arranged from left to right in ascending BMI order (12–24), labeled as the “original” scale, and in descending order (24–12), labeled as the “invert” scale.

Procedure

Two tasks were used to evaluate the children’s body image: a self-avatar rating task and an ideal avatar rating task (Fig. 2). In the self-avatar rating task, participants were shown seven avatars for each sex, representing incremental increases or decreases in BMI, and asked to “choose the avatar that best matches your body.” Participants adjusted a slider to the chosen position that they believed matched their body and pressed the space key to proceed; placement between avatars was permitted. In the ideal avatar rating task, participants were asked to “choose the avatar they would most like to have.” For both tasks, original and inverted avatar scales for each sex were presented randomly. Participants completed four repetitions of each task. All stimuli were displayed on a 13.3-inch LCD monitor (60 Hz refresh rate, 1920 × 1080 resolution). All experiments were performed using PsychoPy3. For both self and ideal avatar-rating tasks, the average BMI was calculated from the four reported values

Participants were asked to choose the avatar that best matches your body in the self avatar rating task and choose the avatar they would most like to have in the ideal avatar rating task.

Results

Figure 3 shows the mean BMI values for SELF and IDEAL body images across age groups and sexes. We hypothesized that female participants would select a lower BMI avatar for their IDEAL than for their SELF body image, whereas no such differences would be observed in male participants. We conducted a three-way mixed-design ANOVA with body image (SELF and IDEAL) as a within-subject variable and age group (younger, middle, and older) and sex (male and female) as between-subject variables. A significant interaction was found among sex, age, and body image ($F(2,121) = 3.30$, $p = .040$, $\eta p^2 = .052$), as well as a significant interaction between sex and body image ($F(1,121) = 7.81$, $p = .006$, $\eta p^2 = .061$). Simple effects tests indicated that females selected significantly lower BMI values for IDEAL than for SELF,

whereas no significant differences between SELF and IDEAL were observed among males. Specifically, in the younger and older female age groups, the BMI of the IDEAL body image was lower than that of the SELF body image.

Mean BMI of SELF (black bars) and IDEAL (white bars) body image for the younger (grade 1–2, 6.3–8.5 years old), middle (grade 3–4, 8.3–10.5 years old), and older (grade 5–6, 10.3–12.5 years old) children. Error bars represent standard deviation, asterisks above the bars represent significant difference between mean BMI of SELF and IDEAL body image. *p < .05; ***p < .001.

Additionally, there was a significant main effect of sex ($F(1,121) = 14.59$, $p < .001$, $\eta p^2 = .108$), with females reporting significantly lower overall BMI values than males. Additionally, there was a significant main effect of body image ($F(1,121) = 13.40$, $p < .001$, $\eta p^2 = .100$), whereby IDEAL BMI values were significantly lower than SELF BMI values. No significant main effect of age was found ($F(2,121) = 2.08$, $p = .129$, $\eta p^2 = .033$). Furthermore, no significant interactions between sex and age ($F(2,121) = 1.60$, $p = .206$, $\eta p^2 = .026$) or age and body image ($F(2,121) = 1.18$, $p = .311$, $\eta p^2 = .019$) were found.

Discussion

This study examined differences in SELF and IDEAL body images between female and male children aged 6–12 years. Consistent with findings in adults, we hypothesized that females, but not males, would show a lower SELF body image than IDEAL body image. Our results suggest that, compared to males, the IDEAL body image of females was significantly lower than the SELF body image. In contrast, the SELF and IDEAL body images of men were not significantly different.

Moreover, females' mean BMI for IDEAL body image was significantly lower than that for SELF body image, which is consistent with previous studies [8, 11, 12]. Rodin et al. [15] showed that body image dissatisfaction is widespread among adolescents and adult women in modern Western societies. A meta-analysis of 142 samples comprising 128,254 participants indicated that boys and men experienced fluctuations in overall body image, with improvements generally occurring between the ages of 10 and 24 years [16]. In contrast, girls and women tended to have a declining body image from ages 10 to 16 years, followed by improvements from ages 16 to 24 years. The most significant changes occurred between ages 10 and 14, with stabilization occurring around age 24. The primary strength of our study is that it revealed body image dissatisfaction among children as young as six years of age in an Asian context.

Our second main finding was that IDEAL body image was significantly lower than the SELF body image among younger (6.3–8.5 years) and older (10.3–12.5 years) females, but not among middle-aged females. This pattern partially aligns with previous studies, although the age at which females prefer thinness varies across studies. Using a figure body image scale, Collins [11] found that females aged six to seven preferred significantly thinner figures than males, consistent with our results for younger females. In contrast, using a similar scale, Wood et al. [17] studied females aged 8–10 years and found a discrepancy between the SELF and IDEAL, which contrasts with our results for middle-aged females.

Cohn et al. [10] found a small discrepancy between SELF and IDEAL female adolescents aged 10.5–15 years, consistent with our findings for older females. Thelen et al. [18] examined SELF–IDEAL discrepancies across second (7.8–9.5 years), fourth (9.6–11.5 years), and sixth (11.7–13.6 years) graders. Taken together, our results and those of Thelen et al. [18] indicate no discrepancy between SELF and IDEAL for middle-aged females, but a preference for thinness among fourth- and sixth-graders.

In conclusion, we found that discrepancies between SELF and IDEAL body image were present among younger female elementary school children (6.3–8.5 years) and older elementary school children (10.3–12.5 years), but not among middle elementary school children (8.3–10.5 years). These findings suggest that body dissatisfaction, similar to that observed in adult females, may begin or already be established at an early age. Further research is needed to clarify why the SELF and IDEAL body image discrepancy appears weaker among middle-aged females, as clarifying this point may help reveal age-specific factors underlying the development of body dissatisfaction.

Declarations

Clinical trial number:

not applicable.

Ethics approval and consent to participate:

We explained the study to the children and their parents or legal guardians, and written informed consent was obtained from the parents or legal guardians prior to participation in the study. This study was conducted in accordance with the guidelines of the Declaration of Helsinki and approved by the Chuo University Research Ethics Committee (2025-052).

Authors' contributions:

H.S. conducted the software development, investigation, and formal analysis, wrote the main manuscript text, and prepared Figures 1–3. S.K. supervised the project and reviewed and edited the manuscript. M.K.Y. acquired funding for the project, supervised the project, and reviewed and edited the manuscript. All authors reviewed the final manuscript.

Consent for publication:

Not applicable.

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Data availability:

Data will be made available on request.

Competing interests:

The authors declare no competing interests.

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Figures

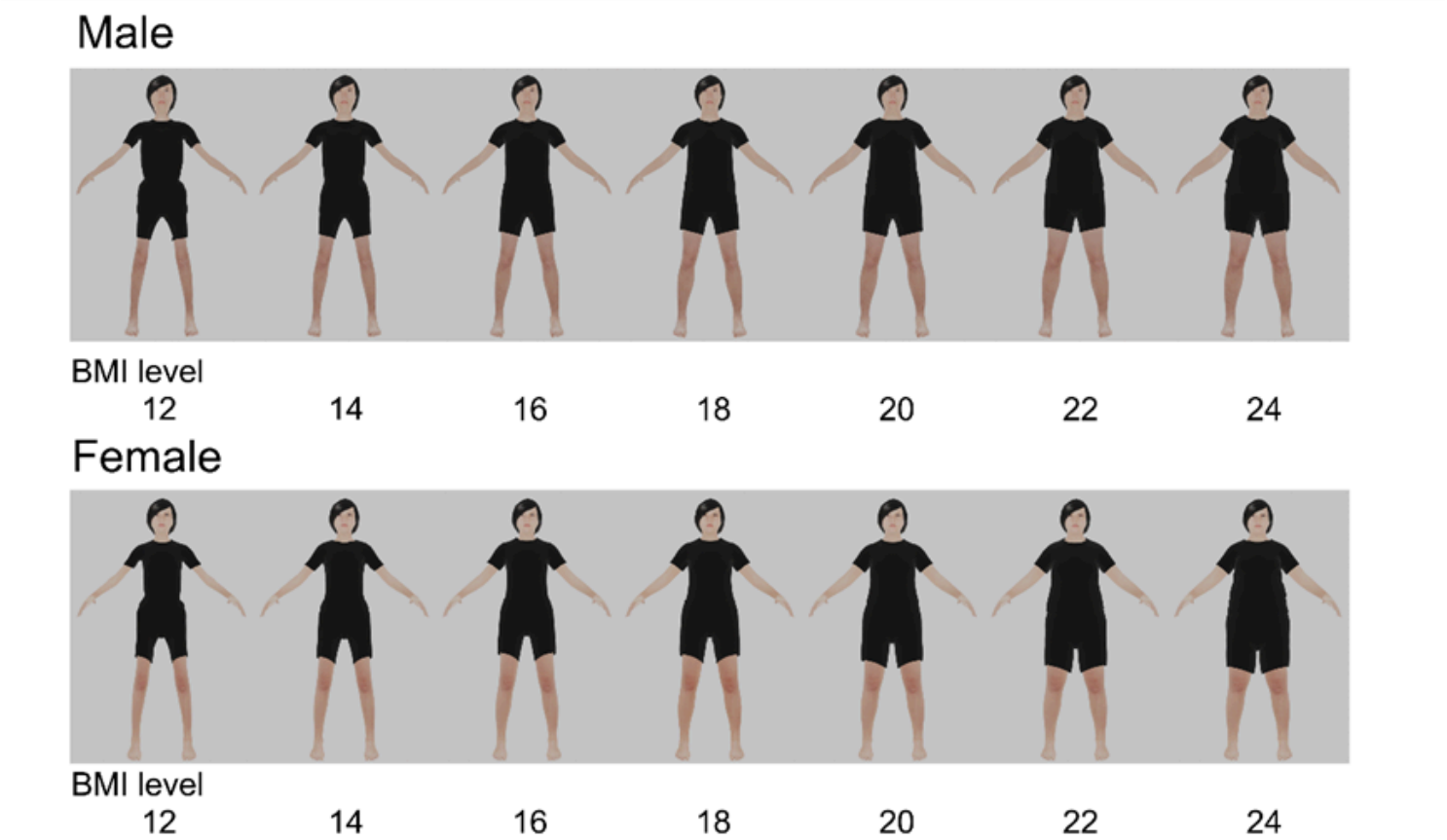


Figure 1

Examples of gender-specific avatars.

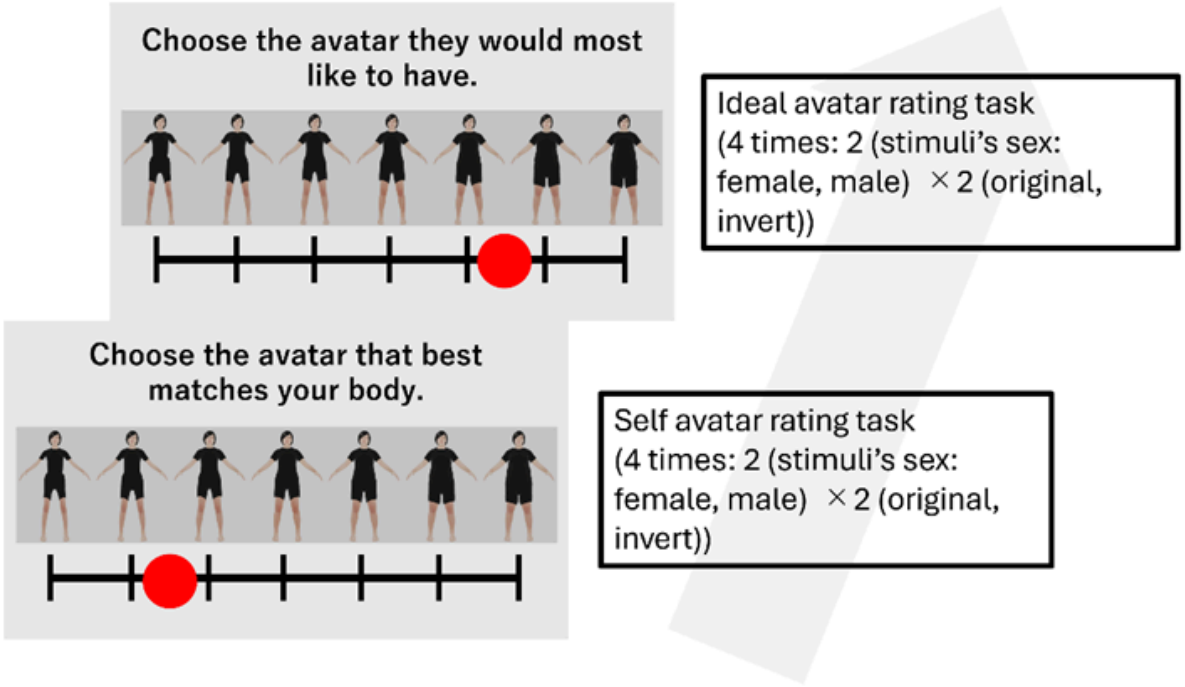


Figure 2

Schematic of the self and ideal avatar rating task. Participants were asked to choose the avatar that best matches your body in the self avatar rating task and choose the avatar they would most like to have in the ideal avatar rating task.

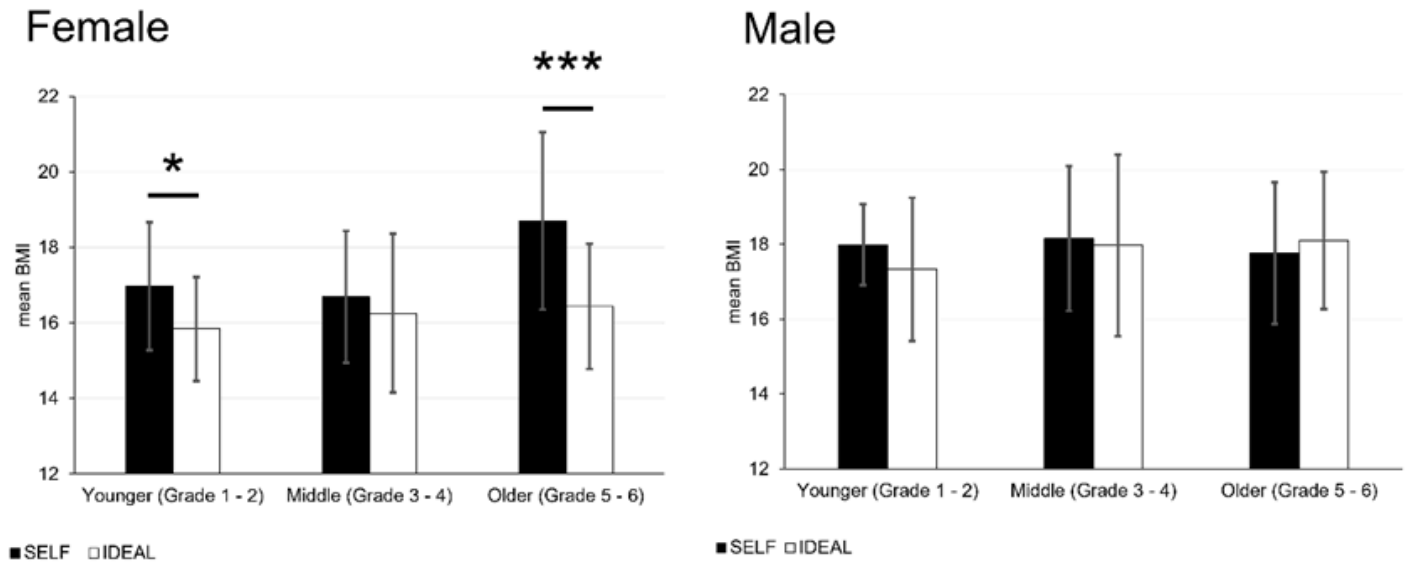


Figure 3

Results of SELF and IDEAL Body Images. Mean BMI of SELF (black bars) and IDEAL (white bars) body image for the younger (grade 1 – 2, 6.3 – 8.5 years old), middle (grade 3 – 4, 8.3 – 10.5 years old), and older (grade 5 – 6, 10.3 – 12.5 years old) children. Error bars represent standard deviation, asterisks above the bars represent significant difference between mean BMI of SELF and IDEAL body image. *p < .05; ***p < .001.