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## RESEARCH

# The Associations between Physical Activity and Body-Esteem in 15-Year-Old Adolescents: A Cross-Sectional Study from Finland

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**Purpose:** Physical activity promotes a positive physical self-image, but less is known about whether the positive effect covers the general self-evaluation of adolescent appearance. This study aimed to further explore the associations between physical activity and body-esteem in Finnish adolescents, via a country-representative cross-sectional study design.

**Methods:** The data for the study were drawn from the Finnish component of the Health Behaviour in School-aged Children (HBSC) study (2014), using surveys from 15-year-old adolescents ( $n=1956$ , mean age 15.8 years) from 122 schools. Self-evaluations of body or appearance were measured by the Body-Esteem Scale for Adolescents and Adults (BESAA). A mixed effects linear regression analysis for body-esteem was conducted separately for boys and girls. The explanatory variables were (i) self-reported moderate-to-vigorous physical activity (MVPA), (ii) weight status, (iii) self-esteem, and (iv) socioeconomic status. The covariates used in the models were maturation state and ethnic background.

**Results:** The body-esteem score was highest among adolescents who reported engagement in MVPA corresponding to the international recommendation for adolescents' physical activity. The positive association between MVPA and body-esteem was found even when it was considered in conjunction with other body image-related factors, but only among boys. The variance in MVPA explained 5.0% of the body-esteem variance in the model for boys (Model  $R^2 = 26.3\%$ ).

**Conclusions:** The physical activity of young people should be further promoted for a variety of health reasons, including its positive association with higher body-esteem. However, consideration should be given to gender differences and other factors related in this complex association.

**Keywords:** Adolescents; body-esteem; body image; physical activity; self-esteem

## Introduction

Adolescents undergo various physical, mental, cultural, social, and psychological changes that shape their perceptions of themselves, change their attitudes towards their own appearance (Erol & Orth 2011; Ge et al. 2001; Morin et al. 2011), and influence the on-going development of body image (Voelker et al. 2015). High levels of body dissatisfaction in young people, particularly in 15-year-olds and females, are common in Europe (Ichley et al. 2020). The consequences of a negative body image among adolescents include physical activity avoidance, eating disorders, and dysfunctional exercise (Voelker et al. 2015).

Adolescents' perceived body dissatisfaction arises from a complex interplay of factors, including personal qualities such as gender, weight status, and self-esteem (van den Berg et al. 2010). Several studies have demonstrated that boys perceive their own physical appearance more positively than girls (Bucchianeri et al. 2013; Calzo et al. 2012; Kantanista et al. 2015; van den Berg et al. 2010). In general, body dissatisfaction increases when the body mass index (BMI) rises, and it generally has a stronger impact on girls than on boys (Bucchianeri et al. 2013). The observed gender differences can be associated with adolescents' physical and mental qualities, and with gendered, socially and culturally determined conceptions of the ideal body (Petrie et al. 2010). In addition, early-onset puberty in girls and late-onset puberty in boys are risk factors for a negative body image (Stojković 2012). This particularly affects adolescent a few years after the onset

of puberty. On average, females have completed puberty at the ages of 15–16 and males at ages 16–17 (Gehlbach 2014). However, the incidence of body dissatisfaction issues seems to increase with age among adolescents, with a peak at the age of 15, particularly among females (Inchley et al. 2020).

In addition to the features mentioned above, various social and cultural factors influence a young person's perception of body and appearance (Bucchianeri et al. 2013). Physical self-esteem, measured according to the evaluation of one's own looks, is lowest among overweight girls from the middle or highest social class, and highest among boys in the lowest social class (O'Dea & Caputi 2001). Wang et al. (2005) reported stronger body dissatisfaction among adolescents from non-mainstream ethnic backgrounds. However, national culture alone does not explain the differences in the body image of various ethnic groups, since intervening factors such as the media, the internalization of a muscular and slim body ideal, and bodybuilding are also influential (Ricciardelli et al. 2007). Adolescents encounter appearance-related role expectations at precisely the phase of life when their physical activity decreases. This universal drop-off phenomenon – in other words, a decrease in physical activity at the transition from childhood to adolescence – has been found to be relatively strong among Finnish adolescents (Dumith et al. 2011).

Physical activity, defined as deliberate muscular activity that increases energy expenditure and usually leads to movement, brings with it several health benefits (Haskell et al. 2009). Studies have increasingly shown a positive link between physical activity and mental health (Biddle et al. 2019; Chae et al. 2017; McMahon et al. 2017; Sevidl et al. 2020). In a recent cross-sectional study, Murphy et al. (2020) reported that Irish adolescents who engaged in sports had higher levels of wellbeing and lower symptoms of anxiety and depression. Positive relationships between physical activity and body image have also been reported, and physical activity has been presented as a factor protecting adolescents against body dissatisfaction (Bassett-Gunter et al. 2017; Kantanista et al. 2015). Physical activity has been associated with higher body image mainly through improvements in body composition (Grogan, 2007). Nevertheless, the results have been somewhat inconsistent. Thus, Shiver et al. (2013) found no indication of an association between physical activity and higher body-esteem, whereas Finne et al. (2011) did discover a correlation between body dissatisfaction and low physical activity among adolescents in Finland.

Overall, the findings on the associations between body dissatisfaction and physical activity among Finnish adolescents have been limited. Most of the existing studies have concentrated on physical competence, or have used measures of body image other than body-esteem. In seeking to shed new light on the factors highlighted in previous research regarding body image and body dissatisfaction, there seems good reason to go more deeply into the associations between physical activity and adolescents' self-evaluations of their body and appearance in Finland. With this in view, we first explored the associations between body-esteem and physically active days per week among 15-year-old boys and girls. Physically active days included the number of days with at least 60 minutes of moderate-to-vigorous physical activity in school and in leisure-time activities over the past seven days. Secondly, to evaluate further this association, we studied the relationships between physical activity and body-esteem in association with factors highlighted in earlier studies on adolescents' body dissatisfaction and body image (i.e. gender, weight status, maturation, self-esteem, family wealth, and ethnic background).

## Methods

Empirical data on Finnish 15-year-old adolescents were obtained from the Health Behaviour in School-aged Children (HBSC) study, conducted in 2014. The HBSC study is an international World Health Organization collaborative study using nationally representative cross-sectional surveys performed every fourth year among adolescents. HBSC uses findings at both national and international level, (i) to gain new insights into young people's health and wellbeing, (ii) to understand the social determinants of health, and (iii) to inform policy and practice with a view to improving young people's health. Physical activity has been one of the HBSC research areas since the first survey in 1984. Further details on HBSC study procedures can be accessed elsewhere (Currie & Alemán-Díaz 2015).

The population of this study consisted of Finnish 9<sup>th</sup> graders (15-year-olds) attending normal education in schools in which the teaching language was Finnish. The stratification in the sampling was based on the European Union (Nomenclature of Territorial Units for Statistics) classification. The strata applied in this case consisted of (1) the capital city area, (2) Southern Finland (i.e., the provinces of Uusimaa, Itä-Uusimaa, Varsinais-Suomi, Kanta-Häme, Päijät-Häme, Kymenlaakso, and Etelä-Karjala), (3) Central Finland (i.e. Etelä-Pohjanmaa, Pohjanmaa, Satakunta, Pirkanmaa, Keski-Suomi, Etelä-Savo, Pohjois-Savo, Pohjois-Karjala, and Kainuu), and (4) Northern Finland (i.e. the provinces of Lappi and Pohjois-Pohjanmaa). The other stratum basis consisted of the division between urban, semi-urban, and rural municipalities. The sample was chosen on 28<sup>th</sup> of August 2013,

using the Finnish school register. This acted as the sampling frame, and provided the number of pupils for each school, and for the grade in question (9<sup>th</sup>). A probability-proportional-to-size sampling method (PPS) was applied in the school selection, and the number of pupils in the schools was used as the measure of size. The primary sampling unit (PSU) was the school ( $n = 122$ ), and within the school, the class was randomly selected.

The participants responded voluntarily and anonymously to a standardized paper-and-pen questionnaire during a school class, after being informed (verbally and in writing) of the confidentiality of the data, and of the fact that only group-level results would be reported. The students had the opportunity to refuse to answer by leaving a blank form in a closed envelope. In 2014, the study obtained ethical approval according to Finnish national guidelines. The school principals gave school-level approval. Parental or guardian consent was obtained in the form of passive consent, i.e., with the option to withdraw the adolescent from participation.

Participants were included in such a way that 90% of the respondents were aged 15.5 years  $\pm$  6 months ( $n=1956$ ; 949 boys, 1007 girls), as per the HBSC protocol. The response rate for boys was 84%, and for girls 86%. The characteristics of the participants are presented in **Table 1**.

**Table 1:** Descriptive statistics.

Variables	Boys (n = 949)	Girls (n = 1007)
Age, years M (SD)	15.8 (0.3)	15.8 (0.3)
Height, cm M (SD)	175.9 (7.6)	165.3 (6.1)
Weight, kg M (SD)	67.5 (12.5)	58.2 (10.1)
Body mass index, kg/m <sup>2</sup> M (SD)	21.7 (3.4)	26.8 (5.8)
Weight status <sup>a</sup>		
underweight %	6.8	9.2
normal weight %	75.2	77.0
overweight %	13.9	11.6
obese %	4.1	2.3
Self-esteem scale RSES, M (SD)	29.6 (5.6)	26.8 (5.8)
Body-Esteem Scale for Adolescents and Adults BESAA, M (SD)	36.8 (7.4)	31.5 (7.8)
Maturation <sup>b</sup>		
yes %	94.6	98.5
no %	5.4	1.5
Ethnic background <sup>c</sup>		
Finland %	96.2	97.0
other than Finland %	3.8	3.0
Physically active days/week <sup>d</sup>		
low active 0–2 days/week %	18.1	22.1
light active 3–4 days/week %	33.4	36.5
active 5–6 days/week %	26.9	27.9
very active 7 days/week %	21.6	13.4
Family Wealth <sup>e</sup>		
below average %	8.0	10.6
average %	26.3	30.8
good %	65.7	58.5

Note: M means; SD standard deviation.

<sup>a</sup>Weight status by international (IOTF) gender- and age-specific body mass index cut-offs for thinness, overweight, and obesity.

<sup>b</sup>Maturation: yes: had had an ejaculation for boys; had begun to menstruate for girls.

<sup>c</sup>Ethnic background other than Finland: the respondent was born outside Finland, or had one or both parents born outside Finland.

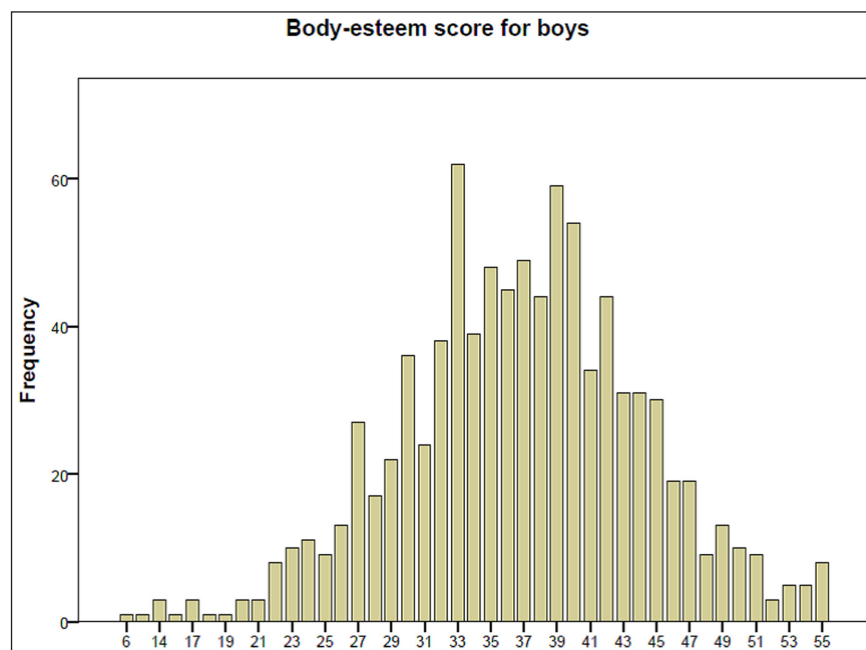
<sup>d</sup>Physically active days/week based on moderate-to-vigorous physical activity (MVPA) 'Over the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day?'

<sup>e</sup>Self-evaluated family wealth based on the question 'What do you think of your family's financial situation?' with responses: My family is doing very well financially/ My family is doing quite well financially/ My family's financial situation is about average/ My family is not doing very well financially/ My family is doing very poorly financially.

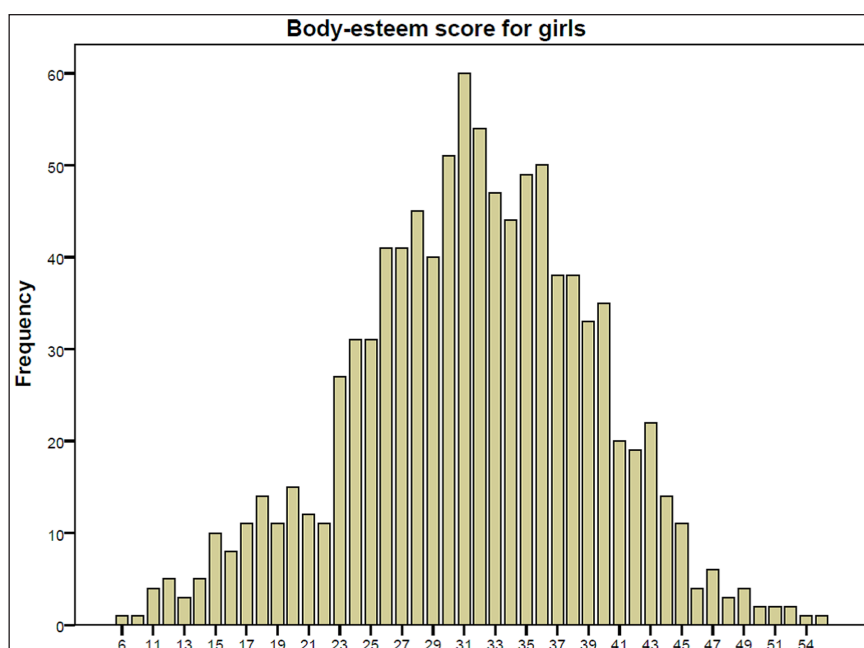
## Measures

### Body-Esteem

Body-esteem relates to self-evaluations of one's body or appearance. It was measured using the Body-Esteem Scale for Adolescents and Adults (BESAA) (Mendelson et al. 2001). The original measure was pre-tested in Finland in the autumn of 2013, and an abbreviated 11-statement measure (Cronbach  $\alpha = 0.87$ ) was selected for this study. Young people were asked to evaluate how often they agreed with the statements provided (Appendix 1). The response options were never, rarely, sometimes, often, and always. The sum score of the variables was generated in such a way that a more positive body estimate was represented by a higher sum variable (Range 11–55). In total, 94% of the respondents responded to all the BESAA statements. The internal consistency of the abbreviated version was high, and the distribution of the scores was approximately normal (Figures 1 and 2).



**Figure 1:** Distribution of body-esteem sum scores for 15-year-old boys.



**Figure 2:** Distribution of body-esteem sum scores for 15-year-old girls.

### ***Moderate-to-Vigorous Physical Activity***

Moderate-to-vigorous physical activity (MVPA) was assessed by asking students ‘Over the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day?’ (Mendelson et al. 2001). To ensure that respondents considered the whole range of physical activity and took into account the intensity, the item was accompanied by the following introductory instruction: ‘Physical activity is any activity that increases your heart rate and makes you get out of breath some of the time. Physical activity can be done in sports, school activities, playing with friends, or walking to school. Some examples of physical activity are running, brisk walking, rollerblading, biking, dancing, skateboarding, swimming, slalom, cross-country skiing, soccer, basketball, or Finnish baseball.’ The MVPA was categorized into four groups according to the distribution of the responses: low active 0–2 days; light active 3–4 days; active 5–6 days; very active 7 days (**Table 1**). The last category matches the global WHO recommendation for sufficient physical activity (World Health Organization 2020).

### ***Self-Esteem***

Self-esteem was assessed via the Rosenberg self-esteem scale (RSES) (Rosenberg 1965). The exact statements of the RSES were: I feel that I am a person of worth, at least on an equal plane with others; I feel that I have a number of good qualities; All in all, I am inclined to feel that I am a failure; I am able to do things as well as most other people; I feel I do not have much to be proud of; I take a positive attitude toward myself; On the whole, I am satisfied with myself; I wish I could have more respect for myself; I certainly feel useless at times; At times I think I am no good at all. The response options were strongly disagree, somewhat disagree, somewhat agree, and strongly agree. The mean values on the RSES with standard deviations by gender are shown in **Table 1**.

### ***Body Mass Index***

The BMI was calculated according to self-reported height and weight (**Table 1**). Weight status was defined by international (IOTF) gender- and age-specific body mass index cut-offs for thinness, overweight, and obesity (Cole & Lobstein 2012).

### ***Maturation***

The short measure of maturation – based on the self-reported occurrence (yes/no) and time of first ejaculation for boys, and menarche for girls – was developed and adapted for use in the HBSC survey, starting with the 2001/02 survey (Currie et al. 2014). The measure was dichotomized; hence, the young people were placed in a positive category if (for girls) they had begun to menstruate (98.5%), or (for boys) they had had an ejaculation (94.6%) (**Table 1**).

### ***Ethnic Background***

Following the established and validated practice of the Health Behaviour in School-aged Children survey regarding Ethnic Background Indicators (HBSC-EBI) (Nordahl et al. 2011), migration status was assessed by asking about the country of birth of the adolescent and his/her parents. For ethnic background, the dichotomy was set according to whether the respondent was born outside Finland, or had one or both parents born outside Finland (**Table 1**).

### ***Family Wealth***

The perceived family wealth measure was designed in the early 1990s to assess young people's perceptions of their own family's socioeconomic circumstances as one of the subjective indicators of socioeconomic position for children and adolescents (Currie et al. 1997). Family wealth was assessed by asking ‘What do you think of your family's financial situation?’ with responses: My family is doing very well financially/ My family is doing quite well financially/ My family's financial situation is about average/ My family is not doing very well financially/ My family is doing very poorly financially. For the statistical analysis, the variable was classified as falling into three categories, the proportions of which are shown in **Table 1**.

## **Statistical Analyses**

The effects of different categories of MVPA on body-esteem were analysed via mixed effects linear regression. Regression coefficients with 95% confidence intervals (CIs), p-values, and R squares ( $R^2$ ) were calculated.

The associations between MVPA, weight status, self-evaluated family wealth, self-esteem, and body-esteem were examined by a mixed effects linear regression, adjusting for the potential modifying effects of maturation and ethnic background. In addition to  $\beta$ -coefficients, there was calculation of 95% CIs, p-values, the  $R^2$  for the individual variables, and cumulative models. The statistical analyses were conducted separately for the girls and the boys, and were performed by SPSS statistical software (version 24.0) and Stata (version 15).



## Results

Boys exhibited higher body-esteem scores (**Figures 1 and 2**) and engaged in more MVPA than girls (**Table 1**). In both genders, the body-esteem score increased with physically active days (**Table 2**). Body-esteem was highest among adolescents who reported having been engaged in MVPA for a minimum of 60 minutes on the seven days of the week that preceded the inquiry. The positive association between physically active days and body-esteem emerged when there were more than two physically active days, and was extremely significant at above four days. The positive association between physically active days and body-esteem was stronger for boys than for girls.

**Table 2:** Associations between physically active days and body-esteem. Mixed effects linear regression.

Physically active days/week	Boys			Girls		
	Coefficient	95% CI	p	Coefficient	95% CI	p
0–2	1.00			1.00		
3–4	1.65	0.31–2.99	0.016	1.56	0.27–2.85	0.018
5–6	2.93	1.53–4.33	<0.001	2.63	1.27–3.99	<0.001
7	4.40	2.91–5.89	<0.001	2.77	1.07–4.46	0.001
Model R <sup>2</sup> %		4.32			1.72	

In the multilevel model assessing the associations between body-esteem, MVPA, weight status, self-evaluated family wealth and self-esteem, and adjusted for maturation state and ethnic background, approximately one quarter (26.3%) of the observed variation was explained by the model's inputs among the boys (**Table 3**).

MVPA was a significant factor for body-esteem among the boys (**Table 3**). The positive association between body-esteem and MVPA occurred in the groups doing MVPA for a minimum of 60 minutes on 5–6 and 7 days per week. Among boys, the size of the R-squared measure for MVPA (5.0%) corresponded to the magnitude of the weight status (5.2%) and to perceived family wealth (4.9%). Boys with thinness, overweight, or obesity had a lower body-esteem score than boys with normal weight. The negative association between body-esteem and weight status was significant in overweight and obesity. Boys perceiving their family wealth as average or good had higher body-esteem than those who assessed their family as not doing very well or doing very poorly financially. In the model for boys, the association between general self-esteem and body-esteem was clear, and the variance of the self-esteem scale explained 20.8% of the variance of body-esteem (**Table 3**).

**Table 3:** Multilevel mixed effects linear regression analysis for the body-esteem of 15-year-old boys.

	Coefficient	95% CI	p	R <sup>2</sup> %
Physically active days/week				5.0
0–2	1.00			
3–4	0.52	–0.75–1.78	0.425	
5–6	1.83	0.52–3.16	0.006	
7	2.61	1.19–4.02	<0.001	
Weight status				5.2
normal weight	1.00			
thinness	–1.13	–2.90–0.64	0.209	
overweight	–2.60	–3.82–1.38	<0.001	
obese	–6.05	–8.31–3.79	<0.001	
Family wealth				4.9
under the average	1.00			
average	1.80	0.08–3.50	0.040	
good	2.65	1.07–4.23	0.001	
Self-esteem scale	0.54	0.46–0.61	<0.001	20.8
Model R <sup>2</sup> %				26.3

Adjusted for maturation state and ethnic background.

In multilevel mixed effects linear regression analysis for the body-esteem of girls assessing the associations between body-esteem, MVPA, weight status, self-evaluated family wealth and self-esteem, approximately half (46.8%) of the observed variation was explained by the model's inputs (**Table 4**). The variance of the self-esteem scale explained most of the body-esteem variance in the model for girls ( $R^2 = 39.2\%$ ). The variance of the weight status explained 8.0% of the variance of body-esteem, and constituted the second largest proportion in the model. Girls with overweight and obesity had lower body-esteem than girls with normal weight or thinness.

**Table 4:** Multilevel mixed effects linear regression analysis for the body-esteem of 15-year-old girls.

	Coefficient	95% CI	p	R <sup>2</sup> %
Physically active days/week				1.3
0–2	1.00			
3–4	0.69	–0.29–1.66	0.166	
5–6	0.93	–0.11–1.97	0.079	
7	0.89	–0.41–2.19	0.179	
Weight status				8.0
normal weight	1.00			
thinness	0.94	–0.33–2.20	0.152	
overweight	–4.53	–5.67–3.39	<0.001	
obese	–5.39	–7.98–2.80	<0.001	
Family wealth				2.2
below average	1.00			
average	0.01	–1.28–1.29	0.990	
good	0.77	–0.46–2.00	0.220	
Self-esteem scale	0.79	0.73–0.85	<0.001	39.2
Model R <sup>2</sup> %				46.8

Adjusted for maturation state and ethnic background.

## Discussion

In the present study, body-esteem was highest among those 15-year-old adolescents who reported engagement in MVPA for at least 60 minutes daily. Our results concerning a positive association between body-esteem and MVPA are in line with e.g. Kantanista et al. (2015), who reported a correlation between positive body image and higher physical activity among 14–16-year-olds, and with Fernández-Bustos et al. (2019) who found physical activity to improve body satisfaction and the physical self-concept among 12–17-year-olds. According to our study, the positive association of MVPA with body-esteem emerged as soon as there were more than two physically active days per week. However, when exploring the association between MVPA and body-esteem along with other factors (i.e. weight status, self-evaluated family wealth and self-esteem, maturation state and ethnic background), the association was statistically significant only for boys, and did not occur until there were at least five physically active days per week. There were other differences between genders in our results, even though general self-esteem explained most of the variance in body-esteem for both genders. In line with several previous studies (Bassett-Gunter et al. 2017; Kantanista et al. 2015), our study demonstrated higher engagement in physical activity and also higher body image among boys.

According to our results, the association of MVPA with body-esteem differed by gender. For boys, the significant effect of physically active days per week on body-esteem remained in the model, even when it was considered in conjunction with other body image-related factors. In our study, among boys but not girls, MVPA explained roughly the same proportion of the variance in body-esteem as weight status and perceived family wealth. The effect of self-esteem on body-esteem was most pronounced in both genders, but the association between weight status and body-esteem was slightly different in girls and boys. Boys with thinness, overweight, or obesity had a lower body-esteem score than boys with normal weight, but in girls, only overweight and obesity had a negative association.



Above results imply that gender shapes the association between body image and physical activity. Kopcakova et al. (2014) found that perceptions of the body and appearance among girls did not affect their engagement in physical activity; by contrast, a poor body image among boys was associated with a lower probability of reaching the recommended level of physical activity. Spencer et al. (2015) concluded that girls' relationship with physical activity is complex. The complexity arises, for example, in relation to notions of femininity, involving girls' concern about their appearance when they engage in physical activity. A national study revealed that among Finnish adolescents the most common reasons to be physically active were related to good feelings – of trying one's best, joy and play, health and fitness, and being together with friends (Koski & Hirvensalo 2019; Koski & Hirvensalo 2021). However, the desire to look good because of exercise increases in parallel with age during secondary school, and losing weight has been found to be a relatively common motive for adolescent girls (Aaltonen et al. 2015; Kopcakova et al. 2015). In this context, it should be noted that exercise frequency is related to positive body image, but high levels of appearance-based exercise motivation might actually weaken the positive relationships between physical activity and higher body image among young women (Homan & Tylka 2014).

The negative association of overweight and obesity with body image has been found in previous studies (Bucchianeri et al. 2013; Calzo et al. 2012; Inchley et al. 2020; Kantanista et al. 2015), and our study sought to assess it in the same context as physical activity. In our analyses, overweight and obesity had a negative effect on body-esteem in both genders. This emphasizes further the importance of weight management and obesity prevention in promoting the health and wellbeing of young people. Adequate physical activity plays a particularly important role here. Promoting physical activity can also be important in particular local or global circumstances. During the COVID19-pandemic, adolescents' engagement with physical activity has decreased, with an increase in sedentary behaviour (Vasankari et al. 2020). Adolescents are likely to have spent more time in front of their screens. In a previous study, Tiggemann and Slater (2013) found that among 13–15-year-old girls, body image concerns increase in proportion to time spent on the Internet. Intensive exposure to social media images of ideal body and appearance might even tend to inhibit exercise participation.

The positive effects of physical activity – such as improved physical endurance, mood, and self-esteem (Chaput et al. 2020; Eime et al. 2013; Janssen & LeBlanc 2010) – provide a feasible explanation for why the body-esteem of physically active participants was higher in our study. The association may also indicate a virtuous circle, with high body-esteem promoting physical activity, and vice versa. The positive association between MVPA and body-esteem suggests that improved body image can be used as an additional argument in encouraging adolescents to engage in exercise. However, when one takes into account other factors related to body image in adolescents, the positive association of physical activity with body-esteem appears to be weaker than the association of weight status particularly among girls. As indicated also by our study, MVPA, body-esteem and self-esteem appear to be complex phenomena with mutually interacting associations. Ouyang et al. (2020) has recently found body image and self-esteem to be significantly positively correlated with sports participation, with the mediating effects of self-efficacy and self-esteem emerging as significant in the relationship between body image and sports participation.

### **Limitations**

The present study has several strengths, the most important being the existence of a representative sample with high response rates. The carefully apportioned and comprehensive sample was representative of the population in each stratum. The high response rates (84% for boys, 86% for girls) were achieved through the anonymous and voluntary nature of the survey. Young people completed the questionnaire in a supervised situation without any external person seeing the individual answers; this could be expected to minimize the influence of the group and to produce personal, honest answers on matters of a sensitive nature. However, the fact that the results are based on information given by the adolescents themselves may raise questions concerning reliability of the data. Prochaska et al. (2001) note that the MVPA scale correlates somewhat weakly with results on objective physical activity, but that it is a good and reliable indicator for surveys because of its repeatability. The reliability of the scale is supported by Ridgers et al. (2012). Another target of criticism has been the use of the BMI in determining weight status and obesity. In this regard, there is evidence that the heights and weights reported by 15-year-old adolescents are sufficiently reliable for BMI-based classifications in extensive surveys (Dalmasso et al. 2010). It is true that, particularly among boys who engage in sports, the BMI does not indicate the proportion of muscles that are heavier than fat. Yet even if exceptional cases do exist, our findings may be considered broadly sound, based as they are on an extensive, nationally representative sample covering the entire age group.

The cross-sectional design of our study does not allow conclusive inferences on the causal nature of our findings. A longitudinal study would permit research into the development of the phenomenon, and on the possible gendered differences and mechanisms that operate. In addition, the associations between physical activity and body-esteem depend on various other factors, such as personal qualities and the amount and type of physical activity. A qualitative research approach would be useful in refining these associations.

## Conclusions

The present study provides an additional insight on the complex association between physical activity and body image among adolescents. There was positive associations between MVPA and body-esteem among 15-year-old adolescents in Finland, and the body-esteem score was highest among adolescents who reported engagement in MVPA corresponding to the international recommendation for adolescents' physical activity. However, the association between MVPA and body-esteem seems to be influenced by gender, and by other factors that are significant for body image.

## Additional File

The additional file for this article can be found as follows:

- **Appendix 1.** Modified Body-Esteem Scale for Adults and Adolescents. DOI: <https://doi.org/10.5334/paah.107.s1>

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## Competing Interest

The authors have no competing interests to declare.

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