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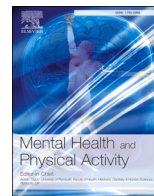
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## Moderating effect of leisure-time physical activity on the relationship between bullying victimisation and self-esteem in young Finnish men

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### ABSTRACT

**Background and aims:** The links between bullying victimisation and low self-esteem are well established. However, the relationship between physical activity (PA), bullying victimisation and self-esteem is still rather unexplored. The present study aims to investigate the moderating effect of PA on the relationship between bullying victimisation and self-esteem among young men.

**Methods:** The sample used for this study is based on registers of the Finnish Defence Forces and consists of questionnaire-based data collected from young healthy men (n = 146 767, aged 18–29 years, mean age 19 years) who started their conscript service during 2015–2021. Self-esteem was measured with the Rosenberg Self-esteem Scale and bullying victimisation and leisure-time PA (LTPA) with single questions. Unadjusted and adjusted linear regression models and the aligned rank transform Anova model were calculated.

**Results:** The findings showed that there is a dose-response association of self-esteem with bullying victimisation and LTPA. Furthermore, a significant moderating effect of LTPA was found in the relationship between bullying victimisation and self-esteem. Vigorous LTPA at least once a week seems to lessen the negative effects of bullying victimisation on self-esteem.

**Conclusions:** LTPA may have the potential to buffer against negative mental health outcomes resulting from past experiences of bullying victimisation on a young person's self-esteem. More opportunities for LTPA to support self-esteem among young people should be provided, especially for vulnerable groups and those with limited resources and possibilities to engage with PA.

### 1. Introduction

School bullying is a form of interpersonal violence between peers in childhood and adolescence and a global concern affecting the mental health and well-being of young people. Bullying victimisation is commonly defined as intentional negative actions by the peers which occur repeatedly and over time (Olweus, 1994). It is commonly classified into traditional bullying (including physical contact like pushing or hitting as well as verbal harassment, rumour spreading, intentionally excluding from a group) and electronic bullying, also known as cyberbullying, where electronic devices are used for bullying behaviour (Waansdorp & Bradshaw, 2015). Globally, bullying and physical violence affects around one in three children (UNESCO, 2018). In

Finland, eight percent of eighth and ninth graders (14–15 years) report to have been bullied in the school at least once a week and the prevalence has started to increase in the recent years (School health promotion study, 2023).

Bullying is known to affect victims in many ways. Strong evidence exists for a causal relationship between bullying victimisation and mental health problems, such as depression, anxiety, poor general health and suicidal ideation and behaviours (Moore et al., 2017). According to previous research, the effects may be long lasting persisting even into adulthood (Sourander et al., 2007; Ttofi et al., 2011; Copeland et al., 2013; Takizawa et al., 2014; Sigurdson et al., 2015; Wolke & Lereya, 2015). The systematic review and meta-analysis by Ttofi et al. (2011) showed that bullying victimisation was a significant risk factor

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for later depression. The probability of being depressed up to 36 years later was much higher for children who were bullied at school than for non-involved students. Besides mental health problems, experiences of being bullied during adolescence may cause other maladjusted developments, such as low self-esteem (Tsaousis, 2016; Choi & Park, 2021).

Self-esteem, commonly defined as a favourable or unfavourable attitude toward the self (Rosenberg, 1965), may be heavily influenced by bullying experiences in the adolescence, thus, during the critical lifespan of identity development (Patchin & Hinduja, 2010; Chang et al., 2013; Cenat et al., 2014). For example, the study of Patchin and Hinduja (2010) found that students who experienced cyberbullying both as a victim and an offender, had significantly lower self-esteem than those who had little or no experience with cyberbullying. Besides bullying victimisation (Tsaousis, 2016), however, there are also other remarkable risk factors for low self-esteem in young people, such as poor socio-economic status of the family (Twenge & Campbell, 2002; Veselska et al., 2009), body dissatisfaction (van den Berg et al., 2010) and obesity (Dale et al., 2019; Kiviruusu et al., 2016). Self-esteem, as an overall favourable attitude towards self, is an important factor in general well-being and quality of life for each of us. Previous studies have found that higher self-esteem is related to better psychosocial well-being, for example, in terms of occupational success, academic achievement, social relationships, psychological well-being, and coping skills (Boden et al., 2008; Trzesniewski et al., 2003). Vice versa, lower self-esteem has been found to be associated with a broad range of mental and social problems (Nguyen et al., 2019; Keane & Loades, 2017).

According to previous research, physical activity (PA) and engagement in sport activities have the potential to improve both psychological and social well-being (Andersen et al., 2019; Dale et al., 2019; Ekelund et al., 2005; Liu et al., 2015; Spence et al., 2005). Sibold et al. (2015) examined the relationships among PA, sadness, and suicidality in a large sample of bullied US adolescents. They found that students who reported exercising 4–5 days a week had lower adjusted odds of sadness, suicidal ideation, or suicide attempts than students who exercised at most once a week. Existing literature indicate also the potential of PA in enhancing self-esteem. Previous reviews and meta-analyses generally support the positive association between PA or sport participation and self-esteem in young people and adults (Andersen et al., 2019; Clark et al., 2015; Liu et al., 2015; Ekelund et al., 2005). Furthermore, a study using the same sample of Finnish young men as in the present study found that self-esteem was higher among those engaging more active in PA in their leisure-time (Appelqvist-Schmidlechner et al., 2023). Self-esteem has been suggested to be strengthened through PA especially in a sub-domain of physical self-concept and self-worth (Dale et al., 2019; Liu et al., 2015). This is explained by the skills development hypothesis (Sonstroem et al., 1994) suggesting that an improved physical self-concept through participation in physical activities may lead to improved general self-esteem. Indeed, the systematic review by Nguyen Ho et al. (2023) on the mechanisms linking PA with psychiatric symptoms found that self-esteem, self-concept and self-efficacy were the only consistent paths through which PA influences psychiatric symptoms across the lifespan. Furthermore, existing literature (Waasdorp et al., 2019; Mendez et al., 2019) suggest that youth who participate in PA and sports are also less likely to experience bullying victimisation.

The link between bullying victimisation and low self-esteem is well established. However, the relationship between PA, bullying victimisation and self-esteem is still rather unexplored. To date, there have been only relatively few studies examining the effect that PA has on the relationship between bullying and self-esteem and whether PA helps to mitigate the negative consequences associated with bullying. The present study is based on the hypothesis that leisure-time PA (LTPA) may be a moderator in the relationship between bullying victimisation and self-esteem buffering the impact of bullying victimisation on low self-esteem. Similar study was conducted by Kirklewski et al. (2023) who examined the moderating effect of PA on the relationship between

bullying and mental health among sexual and gender minority youth. The findings showed, surprisingly, that bullying moderated the effect of PA on self-esteem, instead of the predicted relationship that PA would moderate the effect of bullying on self-esteem. For non-bullied youth, higher levels of PA were positively related to self-esteem, but for youth who had been bullied, PA had little to no effect on self-esteem.

More research is needed to widen the knowledge on the complex relationship between bullying, self-esteem and PA. In order to bridge this identified knowledge gap, this study used a large national sample of young men covering about 70 percent of male target cohorts to better understand the moderating effect of PA on this relationship. Focusing on young men in emerging adulthood, which can be seen as a transitional stage between late adolescence and young adulthood, gives important insight into this critical period in the lifespan with various and rapid changes in life, where also foundation for lifelong health trajectories is usually formed (Committee on Improving the Health, Safety, and Well-Being of Young Adults et al., 2015). Identifying protective factors for psychosocial well-being in this specific period of life is crucial. The aim of the present study is to investigate the role of LTPA in the relationship between bullying victimisation and self-esteem. The study attempts to investigate whether LTPA may moderate the relationship between bullying victimisation and self-esteem buffering the impact of bullying victimisation on low self-esteem.

## 2. Material and methods

### 2.1. Data collection

The data were collected among conscripts in the beginning of their military service in each of the fifteen units across Finland during 2015–2021. In Finland, all healthy male citizens are obligated to carry out conscript or alternative civil service. In the age of 18, all men are invited to the conscription call-up in order to determine their suitability for service and to make a decision concerning the place and starting date for the service. About 70–75 % of men in each annual age cohort start their conscript service every year (Finnish Defence Forces, 2021). About 7% of each annual cohort choose to perform non-military service (civil service) and 18–23 % are exempted from the service already at the call up or they interrupt their service due to health reasons (Finnish Defence Forces, 2010). Of the annual average of 23,000 men starting their conscript service, about 82–85% complete their service (Finnish Defence Forces, 2021).

The data used for this study are based on registers of the Finnish Defence Forces. The data have been collected using questionnaires that all conscripts fill in at the beginning of their conscript service. The questionnaire has been developed originally and primarily for the purposes of the conscript training. The data collection was carried out within the first two weeks of the conscript service. The register data include responses from altogether 168 144 conscripts who had started their service during 2015–2021. Responses from female conscripts (n = 6683) and questionnaires without information on gender (n = 1679) were excluded from the sample. The sample used for the present study consisted of male conscripts who had responded all questions on self-esteem, PA and bullying (n = 146 767). This is roughly 90 % of all men who started their conscript service during the period from 2015 to 2021.

### 2.2. Measures

*Leisure-time physical activity (LTPA)* was measured with a single question addressing LTPA during the last two months. LTPA was defined in the questionnaire as any PA performed in the leisure time. Response alternatives were the following: 1 = “LTPA less than once a week”, 2 = “No vigorous but light/moderate LTPA at least once a week”, 3 = “Vigorous LTPA once a week”, 4 = “Vigorous LTPA twice a week”, 5 = “Vigorous LTPA 3 times a week” and “6 = Vigorous LTPA at least 4 times

a week". The question has been commonly used in various previous studies, for example, among Finnish reservists (Appelqvist-Schmidlechner et al., 2020) and conscripts (Appelqvist-Schmidlechner et al., 2023). It has been validated against fitness, showing that vigorous LTPA has a fairly consistent dose-response relationship with cardiorespiratory and muscular fitness (Fogelholm et al., 2006).

Self-esteem was measured with questions from the Rosenberg Self-Esteem Scale (Rosenberg, 1965) including ten questions addressing global self-esteem in the moment of responding: five items reflect positive and five negative feelings about oneself. For responses, a 5-point Likert scale from 1 (=strongly agree) to 5 (strongly disagree) was used instead of the original 4-point Likert scale in order to better integrate the scale with the series of other questions in the questionnaire. The mean total score ranged between 1 and 5, with higher scores reflecting higher global self-esteem.

Bullying victimisation was measured with a single question "Have you been bullied at school?" with response alternatives "No, never", "Yes, sometimes" and "Yes, frequently".

The questionnaire included also questions about the socioeconomic status of the respondents including questions about the education of the study participant and the financial situation of the family. No information about the age of each study participant was available, but it is known that conscripts in the present study were an average of 19.7 years old (range 18–29), most commonly (95%) between 18 and 21 years (Training Division of the Defence Command Finland, unpublished data).

### 2.3. Statistical analysis

Data were analysed using R Statistical Software (v. 4.2.3.; R Core Team 2023). Descriptive statistics were calculated for the following background variables: highest level of education, family structure, financial situation of the family, domicile as well as physical activity,

**Table 1**  
Characteristics of the study sample among Finnish conscripts in 2015–2021 (n = 146 767).

	Distribution (%)
Highest education	
Comprehensive school or no education	8.7
Vocational school or training	46.0
High school/university	45.3
Family structure	
Father, mother and me (and siblings)	79.3
Other family structure	20.6
NA	0.1
Financial situation of the family	
Quite low or low resources	12.2
Moderate resources	53.8
Very good or good resources	33.9
NA	0.2
Domicile	
City with over 50.000 inhabitants	37.6
City with 20.000–50.000 inhabitants	21.5
City of under 20.000 inhabitants	14.8
Countryside	26.0
Victim of bullying	
Yes, frequently	4.5
Yes, sometimes	38.1
No, never	57.4
Leisure time physical activity	
Less than once a week	13.2
No vigorous but light/moderate PA at least once a week	22.5
Vigorous activity once a week	11.7
Vigorous activity twice a week	16.8
Vigorous activity 3 times a week	18.0
Vigorous activity at least 4 times a week	17.8
Age <sup>a</sup>	Mean 19.7
Self-esteem (range 1–5)	Mean 3.9 (SD 0.7)

<sup>a</sup> Information on age is based on registers of Defence Forces, not on conscripts' self-reports in the questionnaire.

experiences of being bullied at school and the level of self-esteem. The characteristics of the sample is presented in Table 1 and the level of self-esteem according to different PA levels and bullying experiences in Table 2.

Associations between victimisation of bullying, LTPA and self-esteem were explored using linear regression models and the aligned rank transform Anova model (ART; Wobbrock et al., 2011). Linear regression models with interactions, including F-tests for statistical significance, were conducted to explore the possible moderating effect of LTPA between the association of bullying and self-esteem. Two models were formed, and they are described in Table 3. The first model was unadjusted and the second adjusted for financial situation of the family (low/moderate/high) and level of education of the study participant (comprehensive school/vocational school/high school and university) as these variables can be seen as confounding factors. Previous studies have suggested that socioeconomic inequality is associated with both low self-esteem (Twenge & Campbell, 2002; Veselska et al., 2009) and risk for being bullied (Due et al., 2009).

The normality of variables was explored by Shapiro-Wilk normality test and visual evaluation of histograms. As the measures of self-esteem or the residuals of the model did not follow a normal distribution, also nonparametric ART with ARTool package (Kay et al., 2021) was used for analysing the data. The ART analysis included also post-hoc contrast tests (Elkin et al., 2021) with Holm multiple testing procedure (Holm, 1979). The main findings remained the same, regardless whether parametric or nonparametric methods were used. The level of significance was set to  $p < 0.05$ .

### 3. Results

Most of the young men (on average 19-years-olds) in the study sample had a high school/university (45%) or vocational (46%) education and lived with both parents (79%). Three quarters (74%) of the participants were living in cities and 26 % in the countryside. The financial situation of the family was assessed as good (34%) or moderate (54%) among most of the respondents. Poor financial situation of the family was reported by 12% of the conscripts.

Of the respondents, more than half (57%) reported to have no experiences in being bullied at school. More than one third (38%) reported to have been bullied sometimes and 5 % frequently. Engaging in vigorous LTPA at least four times a week was reported by 18 % of the respondents. More than one third (36%) of the men did not have any vigorous LTPA per week or were physically active less than once a week. The mean score of self-esteem was 3.93 (SD 0.70) in the scale ranging from 1 to 5, higher score indicating higher level of self-esteem. The characteristics of the participants are presented in Table 1.

Self-esteem of the conscripts was associated both with experiences of being bullied at school ( $p < 0.001$ ) and LTPA ( $p < 0.001$ ). The more the

**Table 2**  
Self-esteem of study participants in terms of experiences of being bullied at school and the level of leisure time PA.

	Self-esteem (mean, SD)	p-value <sup>1</sup>
Victim of bullying		
Yes, frequently	3.33 (0.83)	
Yes, sometimes	3.76 (0.71)	
No, never	4.00 (0.63)	<0.001
Leisure time physical activity		
Less than once a week	3.49 (0.75)	
No vigorous but light/moderate PA at least once a week	3.75 (0.69)	
Vigorous activity once a week	3.89 (0.67)	
Vigorous activity twice a week	4.01 (0.64)	
Vigorous activity 3 times a week	4.11 (0.63)	
Vigorous activity at least 4 times a week	4.23 (0.61)	<0.001

<sup>1</sup>P-values are based on F-test for the main effects.

**Table 3**  
Summary of regression analysis ( $\beta$ ) and confidence intervals (CI) for moderating effects of physical activity in the relationship between victimisation of bullying and self-esteem.

	Model 1	Model 2
	B (CI)	B (CI)
Bullied sometimes x no vigorous, but light/moderate PA at least once a week	0.02 (-0.01-0.04)	0.01 (-0.01-0.04)
Bullied frequently x no vigorous, but light/moderate PA at least once a week	0.04 (-0.00-0.09)	0.05 (0.00-0.09) *
Bullied sometimes x vigorous activity once a week	0.05 (0.02-0.08) ***	0.05 (0.02-0.07) **
Bullied frequently x vigorous activity once a week	0.13 (0.07-0.19) ***	0.12 (0.06-0.18) ***
Bullied sometimes x vigorous activity twice a week	0.07 (0.05-0.10) ***	0.07 (0.04-0.09) ***
Bullied frequently x vigorous activity twice a week	0.13 (0.08-0.19) ***	0.14 (0.08-0.19) ***
Bullied sometimes x vigorous activity 3 times a week	0.05 (0.02-0.07) ***	0.05 (0.02-0.07) **
Bullied frequently x vigorous activity 3 times a week	0.08 (0.03-0.14) **	0.10 (0.04-0.15) **
Bullied sometimes x vigorous activity at least 4 times a week	0.04 (0.01-0.06) **	0.04 (0.02-0.07) **
Bullied frequently x vigorous activity at least 4 times a week	0.09 (0.03-0.15) **	0.11 (0.05-0.17) ***

Model 1: unadjusted model.

Model 2: adjusted with participants' level of education and financial situation of the family.

Statistical significance: \*\*\* =  $p < 0.001$ , \*\* $p < 0.01$ , \* =  $p < 0.05$ .

study participants had experiences of being bullied and the less engagement in LTPA, the lower was their level of self-esteem (Table 2, Fig. 1)

There were significant ( $p < 0.001$ ) interaction effects between LTPA and bullying victimisation on self-esteem. Results indicated that the relationship between experiences being bullied at school and lower self-esteem was weaker with higher levels of PA (Table 3). These F-test results were similar based on all used methods: non-adjusted and adjusted

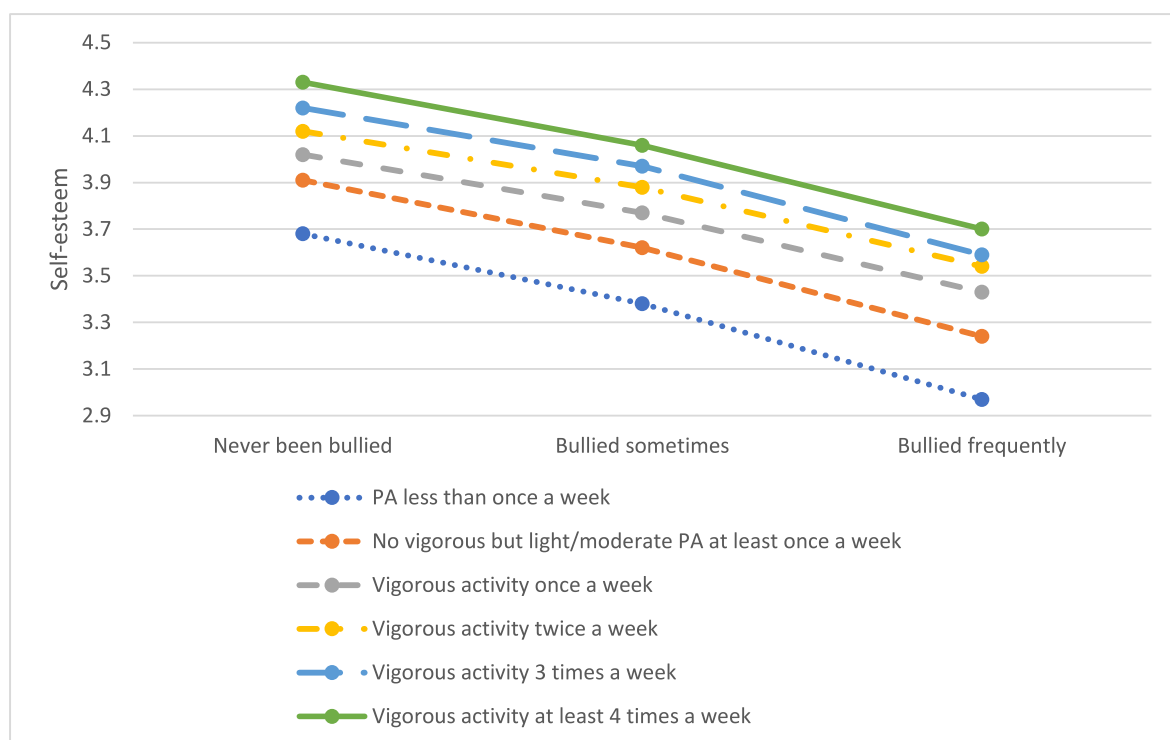
linear regressions and ART.

To understand better the moderating effect, we conducted post-hoc contrasts based on ART and Holm multiple testing procedure. The findings showed that the interaction was significant, particularly, between LTPA levels 1 and 3+ suggesting that positive moderating effects of LTPA could be observed, particularly, among those who were engaged in vigorous LTPA more than once a week. Fig. 1 shows, at the group level, the average self-esteem levels in each LTPA and bullying victimisation combination group. In each LTPA group, self-esteem is lower in cases with more experiences in bullying. Significant interaction indicates differences in the slopes of the lines that describe lower levels of self-esteem among those with more experiences in bullying victimisation.

Table 4 shows, at the group level, the average difference in lower level of self-esteem between each LTPA group when moving from "no experiences of bullying" to "bullied sometimes" group (Effect size column). For example, the drop in self-esteem is 0.051 smaller in the PA3 group compared to the PA1 group when moving from "no experiences" to "sometimes" bullying group. The effect sizes are followed by Holm adjusted p-values and significance levels of corresponding post-hoc contrasts. They are reported based on all used statistical models. Based on ART, all differences between PA1 or PA2 and PA3 or higher are significant. Regression models mostly agree with differences between PA1 and PA3 or higher. PA2 has significant differences only with PA4, based on the regression models.

Table 5 shows similar results as Table 4 but moves from the "no experiences of bullying" to the "bullied frequently" group. Based on ART, all differences between PA1 and PA3 or higher are significant, and the linear regression models support most of these contrasts. Based on the linear regression models, PA2 also has significant differences with PA4. However, none of the contrasts for PA2 are significant based on ART.

There are no significant contrasts within the moves from the "bullied sometimes" to the "bullied frequently" group. In conclusion, participants who faced bullying had lower self-esteem compared to the non-bullied. This drop in self-esteem at group level was smaller when the study participants had vigorous leisure-time PA at least once a week (PA3-



**Fig. 1.** Self-esteem (mean) among study participants in terms of different LTPA levels and experiences of being bullied at school.

**Table 4**

Moderating effect of leisure-time physical activity (LTPA) in the relationship between victimisation of bullying and self-esteem between the groups of no experiences of bullying and those who have been bullied sometimes.

LTPA paths <sup>a</sup>	Effect size	ART_p	ART_sig <sup>2</sup>	Linear regression model_1 <sup>b</sup> _p	Linear regression model_1_sig	Linear regression model_2 <sup>c</sup> _p	Linear regression model_1_sig
1 → 2	-0.016	1		1		1	
1 → 3	-0.051	0.0005	***	0.0092	**	0.0255	*
1 → 4	-0.071	0	***	0	***	0	***
1 → 5	-0.047	0	***	0.0079	**	0.0075	**
1 → 6	-0.038	0	***	0.1161		0.0523	.
2 → 3	-0.035	0.0072	**	0.1625		0.275	.
2 → 4	-0.055	0	***	0	***	0.0001	***
2 → 5	-0.031	0	***	0.1625		0.0991	.
2 → 6	-0.022	0	***	1		0.5565	.
3 → 4	-0.019	0.8592		1		1	
3 → 5	0.004	1		1		1	
3 → 6	0.013	1		1		1	
4 → 5	0.023	1		1		1	
4 → 6	0.033	1		0.2327		0.6733	
5 → 6	0.009	1		1		1	

<sup>2</sup>Statistical significance: \*\*\* = p < 0.001, \*\*p < 0.01, \* = p < 0.05.

<sup>a</sup> LTPA level ranging from 1 to 6, higher score indicating the highest level of PA.

<sup>b</sup> Model 1: unadjusted model.

<sup>c</sup> Model 2: adjusted with participants' level of education and financial situation of the family.

**Table 5**

Moderating effect of physical activity (PA) in the relationship between victimisation of bullying and self-esteem between the groups of no experiences of bullying and those who have been bullied frequently.

LTPA paths <sup>a</sup>	Effect size	ART_p <sup>2</sup>	ART_sig	Linear regression model_1 <sup>b</sup> _p	Linear regression model_1_sig	Linear regression model_2 <sup>c</sup> _p	Linear regression model_1_sig
1 → 2	-0.044	0.0684		1		1	
1 → 3	-0.127	0.0001	***	0.0008	***	0.0016	**
1 → 4	-0.135	0	***	0.0001	***	0	***
1 → 5	-0.083	0	***	0.1373		0.0276	*
1 → 6	-0.095	0	***	0.0744	.	0.0135	*
2 → 3	-0.083	0.5062		0.1312		0.2805	.
2 → 4	-0.091	0.0819		0.0277	*	0.0273	*
2 → 5	-0.039	0.2787		1		1	
2 → 6	-0.05	0.0684		1		0.9449	
3 → 4	-0.008	1		1		1	
3 → 5	0.044	1		1		1	
3 → 6	0.033	1		1		1	
4 → 5	0.052	1		1		1	
4 → 6	0.04	1		1		1	
5 → 6	-0.012	1		1		1	

<sup>2</sup>Statistical significance: \*\*\* = p < 0.001, \*\*p < 0.001, \* = p < 0.05.

<sup>a</sup> LTPA level ranging from 1 to 6, higher score indicating the highest level of PA.

<sup>b</sup> Model 1: unadjusted model.

<sup>c</sup> Model 2: adjusted with participants' level of education and financial situation of the family.

PA6). This difference is especially statistically significant when compared to the group that engaged in LTPA less than once a week (PA1).

**4. Discussion**

The present study aimed at exploring the association between bullying victimisation, self-esteem and LTPA and the potential moderating role of LTPA mitigating the negative consequences on self-esteem resulting from bullying victimisation. Firstly, the findings showed that there is a dose-response association of bullying victimisation and self-esteem among young Finnish men. More frequent victimisation in bullying was associated with lower self-esteem among study participants. This finding is in line with previous studies suggesting that young people who have experienced bullying as a victim have lower self-esteem compared to those who have had little or no experience with bullying victimisation (Patchin & Hinduja, 2010; Chang et al., 2013; Cénat et al., 2014).

Secondly, a significant moderating effect of LTPA was found in the

relationship between bullying victimisation and self-esteem. Vigorous LTPA at least once a week seemed to lessen the negative effects of bullying victimisation on self-esteem. This finding was in contrast to the study by Kirklewski et al. (2023) who found that, for non-bullied youth, higher levels of PA were positively related to self-esteem, but for youth who had been bullied, PA had little to no effect on self-esteem. However, the samples used in these two studies were different, Kirklewski et al. (2023) focusing on sexual and gender minority youth who are known to face more frequent and more severe bullying than young men in general (Hall, 2018). The present study, in turn, used a population-based sample of young healthy men. Furthermore, the large sample size used in the present study rendered even small differences between the groups statistically significant. However, the finding of the present study supports the idea that vigorous LTPA at least once a week may mitigate the negative effect on self-esteem caused by being a victim of bullying.

There are several possible explanations for this result. One of these is the skills development hypothesis (Sonstroem et al., 1994) suggesting that an improved physical self-concept through participation in physical activities may lead to improved general self-esteem buffering against

negative outcomes of being bullied. Indeed, a meta-analysis by Spence et al. (2005) showed that engagement in PA improves self-esteem depending on the change in physical fitness. Furthermore, for example, the study by Benítez-Sillero et al. (2021) found an inverse relationship between being a victim of bullying and having a better cardiorespiratory cardiovascular endurance, showing that physical fitness may be a protective factor against bullying victimisation. Similar findings can be found in the studies by García-Hermoso et al. (2019) and Greenleaf et al. (2014) suggesting that experiences of being bullied is less common among children and adolescents with higher fitness level compared to unfit counterparts. Benítez-Sillero et al. (2023) found higher rate of victimisation of bullying in 10-19-year-old inactive boys. They also found that bullying behaviour was more common in boys who practised organised PA. Previous studies have also addressed on the weight-related bullying as one of the most relevant reasons for bullying (Puhl et al., 2016). Thus, PA may both protect from being bullied and in case of bullying, buffer against the negative consequences in self-esteem.

Another possible explanation is the potential social interaction and social participation provided by engaging in LTPA, promoting the sense of belonging and being accepted by peers, and buffering, in this way, against bullying and potential negative outcomes in cases of being bullied more frequently. Extracurricular sport activities can support adolescent's psychosocial development (Fletcher et al., 2003), increase perceptions of social competence and diminish feelings of loneliness (Haugen et al., 2013). Having peer groups, other than school environment, develops social skills, increases the chances of experiencing achievement and acceptance from others, which can have a beneficial impact on general self-esteem and even mitigate the effects of bullying victimisation.

Zych et al. (2019) suggested that positive peer interaction is the strongest protective factor against being a bully or victim of bullying. Mazereel et al. (2021) investigated the bidirectional association between PA, self-esteem and belongingness in a sample of 781 adolescents and young adults. They found that higher levels of PA predict higher self-esteem and belongingness, and belongingness predicts self-esteem. Participants who had a stronger increase of self-esteem following an increase in PA, also had a concurrent stronger increase in belongingness. In a large sample of Finnish adults aged of 25–64 years (Hassmen et al., 2000), individuals who exercised at least twice a week experienced less cynical distrust and reported higher levels of a sense of coherence and a stronger feeling of social integration than their less frequently exercising counterparts. Furthermore, a systematic review by Pels and Kleinert (2016) examining PA and loneliness, found a bidirectional inverse relationship between these variables. It may be that individuals with previous experiences of being bullied at school are not so likely to seek out activities, such as team sport or group-based activities, that might expose to experiences of being bullied again.

One important aspect in discussing the potential of PA in strengthening self-esteem among bullied young people is the time, severity and environment of bullying. The present study examined the experiences of being bullied at school, thus, in the respondents' past without more detailed information about the severity, duration or environment of the victimisation. The study by Sibold, Edwards, O'Neil, Murray-Close, and Hudziak (2019), for example, found that exercise may reduce sadness and suicidality in adolescents bullied at school but not for students who were cyberbullied. Furthermore, as the reported victimisation in bullying has occurred in the past in the present study, and engaging in PA is reported from the two last months, there is no certainty of temporal coincidence of these two variables. Consequently, we don't know whether the respondent engaged in PA during the period of being bullied or if the PA was initiated after this period. In other words, might PA have supported the self-esteem of the bullied youth during the time they were being bullied, or might engaging in leisure-time PA have the potential to mend the self-esteem of those who had been victimized in bullying earlier and have already suffered from bruised self-esteem. Regardless of the situation, it seems that engaging in PA may alleviate

the negative effects of bullying, such as impacting a young person's self-esteem. Therefore, it's crucial to ensure that all young people, and particularly vulnerable groups of young people and those with limited resources and possibilities, have opportunities to engage in PA.

#### 4.1. Strengths and limitations

The present study used a large population-based sample of young Finnish men which can be seen as one strength of the study. In studies using questionnaires as research method, young men have been seen as a hard-to-reach group (Ryan et al., 2019). Therefore, the present study provides important knowledge on this specific age group in the emerging adulthood. Research focusing specifically on young adults is important for expanding the knowledge of this crucial developmental phase in which the foundation for lifelong health trajectories is usually formed (Committee on Improving the Health, Safety, and Well-Being of Young Adults et al., 2015). However, the study has also some limitations, which should be taken into consideration.

First, even if the large sample size used in the present study can be seen as a strength of the study, it also detects relatively small differences between groups as statistically significant. However, statistical significance does not necessarily result in clinical significance suggesting the observed difference as meaningful and noteworthy in a real life. The effect size suggesting that vigorous LTPA already once in a week might lessen the negative effects of bullying victimisation on self-esteem was very small, even if statistically significant. This finding should therefore be approached with caution.

Second, the data used in this study have been collected primarily for purposes of the Finnish Defence Forces, not for academic research. For this reason, some questions, such as the one addressing school bullying, were rather sparse and didn't provide specific information on, for instance, the nature or environment of the bullying. Furthermore, there were no data available on all potential confounding factors that could be useful for this specific research question, for example on the weight or BMI of respondents which could have been important confounding factors in the relationship between bullying victimisation, self-esteem and LTPA.

Third, self-esteem was measured with a validated scale (Rosenberg, 1965), but LTPA and bullying victimisation only with a single question, although that of LTPA was a validated question. However, the LTPA question did not provide information about the context and type of LTPA (i.e. individual, team sport etc). Different types of LTPA may lead to different effects as shown in previous studies (Andersen et al., 2019; Wan et al., 2021). Especially, information about the context of PA and whether LTPA had the possibility to provide social interaction and sense of belonging, would have been important to understand the interactions between LTPA, self-esteem and bullying victimisation. Furthermore, more precise information on the bullying and on respondents' own engagement in bullying as an actor would have provided broader insight into this topic. Further, more detailed information on the severity, duration and environment of bullying (traditional bullying vs cyberbullying) would have brought more insight into this topic.

Fourth, as a cross-sectional study, the findings do not allow conclusions about the causal relationships or long-term associations between bullying victimisation, self-esteem and LTPA. Fifth, even if the sample was population-based and large, a selection bias is to be taken into consideration. As the sample consisted of young men who have been assessed as healthy enough to carry out their conscript service, men with poorer psychosocial and health status are underrepresented in the sample. The data does not represent civil servants (7% of each annual age cohort) nor men who have been exempted from the conscript or civil service due to health reasons. Men exempted from the service due to health reasons are known to have more psychosocial problems compared to those who carry out their conscript service (Appelqvist-Schmidlechner et al., 2010).

Finally, in interpreting the results, it should be noted that the

bullying question examines the respondent's previous experience without a time limit, whereas the questions regarding self-esteem and LTPA assess the present or recent past.

## 5. Conclusions

The study showed that bullying victimisation was associated with lower self-esteem in young adult males. This association was weaker among those who engaged in vigorous LTPA at least once a week. These findings suggest that vigorous LTPA at least once a week may buffer against negative outcomes resulting from bullying victimisation on self-esteem. More opportunities for LTPA to support psychosocial well-being and self-esteem among young people should be provided, especially for vulnerable groups and those with limited resources and possibilities to engage in LTPA. Further research, especially with longitudinal study design, is needed to understand the complex relationship between bullying victimisation, self-esteem and LTPA.

## CRedit authorship contribution statement

**Kaija Appelqvist-Schmidlechner:** Writing – original draft, Visualization, Project administration, Methodology, Data curation, Conceptualization. **Risto Heikkinen:** Writing – review & editing, Methodology, Formal analysis, Conceptualization. **Tommi Vasankari:** Writing – review & editing. **Toni Virtanen:** Writing – review & editing. **Kai Pihlainen:** Writing – review & editing. **Tuomas Honkanen:** Writing – review & editing, Resources. **Heikki Kyröläinen:** Writing – review & editing. **Jani P. Vaara:** Writing – review & editing, Methodology, Data curation, Conceptualization.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Data availability

The authors do not have permission to share data.

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