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Research paper

Sport participation moderates association between bullying and depressive symptoms in Italian adolescents

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ABSTRACT

Background: A high rate of bullying episodes has been reported in Italian schools, as well as its association with psychopathology in adolescents. However, information regarding moderators of this interaction are still lacking. This study explored whether gender, exercise frequency, and sport participation exerted a protective effect on the association between bullying and depressive symptoms in Italian students.

Methods: Researchers obtained data from 4,829 Italian youth ages 13 to 21 using the self-report Epidemiologia dell'Infortunistica Stradale survey (EDIT) developed by the Regional Health Agency of Tuscany, Italy. Three structural equation models were run to assess moderators of the association between bullying and depressive symptoms. Moderators examined in the models included gender, exercise frequency, and sport participation.

Results: The association between bullying and depressive symptoms was stronger for females (B = 0.95, SE = 0.04, $p < .001$) than for males (B = 0.45, SE = 0.00, $p < .001$) and for students who did not play sports (B = 0.74, SE = 0.09, $p < .001$) than for those who played sports (B = 0.61, SE = 0.06, $p < .001$). Females may be more affected by the depressive effects of bullying than males.

Conclusions: Participation in sports buffers against the effects of bullying and may prove a helpful strategy for increasing exercise, positive peer interactions, and mood in adolescents.

Limitations: The cross-sectional nature of the study, the possible role of BMI as a confounding factor and the use of a not widely used measure of depression.

1. Introduction

Understanding the consequences of adolescent bullying has become an important focus of attention around the world. The National Centre Against Bullying defines bullying as "an ongoing misuse of power in relationships through repeated verbal, physical and/or social behaviour that causes physical and/or psychological harm" (National Center Against Bullying, 2018). Being a victim of bullying is associated with a wide array of negative outcomes (Leff and Waasdorp, 2013) and has repeatedly emerged as a strong risk factor for depressive symptoms in adulthood (Bowes et al., 2015). The ramifications of being bullied have shown remarkable longevity; a meta-analysis of longitudinal studies demonstrated that individuals who were bullied in childhood were about twice as likely to meet diagnostic criteria for depression in adulthood as those who were not bullied, and these effects endured for up to 36 years (Ttofi et al., 2011). Similarly, adolescents bullied at age 13 were more than twice as likely to be depressed at age 18 than those who were not bullied (Bowes et al., 2015).

Bullying also appears to influence depressive symptoms sooner than adulthood, with depressive symptoms at age 13 predicted by bullying at ages eight (Cole et al., 2016) and seven (Zwierzynska et al., 2013). The association between bullying and depressive symptoms has also been demonstrated in high school students in the United States (US) (Brunstein Klomek et al., 2007) and Finland (Kaltiala-Heino et al., 1999). Given this association, particular attention should be paid to adolescents who are frequently exposed to bullying. A transnational survey of adolescents indicated that bullying rates in Italy were twice as high as those in England and almost three times higher than rates in

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Norway (Craig et al., 2009). Further, a separate study of Italian students revealed that one in three Italian youth reported that bullying is a problem in school (Genta et al., 1996).

Thus far, bullying has not been studied in relation to depressive symptoms in Italy as it has been in the US. Sibold, Edwards, Murray-Close, and Hudziak (Sibold et al., 2015) studied bullying, depression, and exercise using self-report data from National Youth Risk Behavior Survey (YRBS) (Centers for Disease Control and Prevention, 2013). They revealed that exercise was negatively correlated with depressed mood in bullied US adolescents, and students who exercised four or more days per week showed a reduced likelihood of suicidal ideation and suicide attempt compared to those who exercised three or fewer days per week.

Several additional studies have revealed a similar negative association between exercise and depressive symptoms in adolescents (Bursnall, 2014; Goodwin, 2003; Weyerer, 1992). Although direction of causation cannot be determined in cross-sectional samples, the positive mood effect of exercise on depressive symptoms has been demonstrated in randomized controlled trials with children (Petty et al., 2009) and young adults (Sibold and Berg, 2010). A meta-analysis of eight studies indicated moderate effect (Hedge's $g = -0.61$, $p = .007$) of exercise on depressive symptoms in adolescents (Radovic et al., 2017).

Given the high rate of bullying in Italian schools and the high rate of depressive symptoms in bullied students, close examination of bullying, exercise, and depressive symptoms in a population of Italian students is warranted. When considering the higher prevalence of depressive disorders in female adolescents than male adolescents (Kessler et al., 2003), assessment of gender differences is also an important component of understanding these phenomena in school-aged children.

The purpose of this study was to examine the moderating effects of gender and physical activity on the association between bullying and depressive symptoms in a sample of Italian adolescents. The current data originated from the database obtained by the Epidemiologia dell'Infortunistica Stradale (EDIT) project developed by the Regional Health Agency of Tuscany, Italy. The EDIT survey is the first epidemiological study of depression and bullying in Italian adolescents. As education is mandatory until 18 years of age in Italy and the EDIT survey is representative of all the schools in Tuscany, EDIT survey participants are representative of the adolescent population in the entire Tuscany region of Italy. The EDIT survey queries negative outcomes associated with a variety of youth risk behaviors.

Based on the findings of Sibold et al. (Sibold et al., 2015) in a US sample, it was hypothesized that bullied students would exhibit higher rates of depressive symptoms than non-bullied students and higher exercise frequency would be associated with reduced depressive symptoms. It was also expected that gender, exercise frequency, and sport participation would moderate the association between bullying and depressive symptoms. It was hypothesized that the association would be stronger (a) for female students than for male students, (b) for students who exercised three or fewer days per week than for those who exercised four or more days per week, and (c) for students who did not play sports than for those who did. Examining sport as a moderator adds to the existing literature by examining the effect of sport participation while accounting for the effect of exercise frequency. This hypothesis was grounded in the expectation that the social nature of sport participation may contribute an effect on mood above and beyond the physical effects of exercise (Eime et al., 2013).

2. Methods

2.1. Data and Sample

Data collection occurred between February and April 2005 and the sample consisted of students representing 3.6% of the population that attended high schools in Tuscany. The survey participants, divided into gender, age and type of school, were selected based on data obtained through the Regional Board of Studies, which supplies the total distribution of the scholastic population of all high schools in the territory. Considering the low prevalence of foreign citizens residing in Tuscany in 2005 (5.9% of the total population), non-Caucasian subjects were excluded from the analyses.

Altogether 56 schools were involved, resulting in an average of 88 students (min. 55, max. 137) per school. The EDIT survey was administered to high school students in the Arezzo, Firenze, Grosseto, Livorno, Lucca, Massa Carrara, Pisa, Pistoia, Prato, Siena provinces of Tuscany (n = 4746), as well as to a small number of students outside of Tuscany (n = 79). Four respondents did not indicate their current provinces of residency.

The final sample (45.7% female) included 4,805 students aged 13 to 20 and 24 students aged 21 or older. The latter group was not excluded from the analyses, in order to maintain the full statistical representativeness of the Italian students population attending high school in the selected sample, and to do not lose any collected information about the investigated phenomena having different trends by age. Mean age did not differ between female (M = 16.54, SD = 1.56) and male students (M = 16.53, SD = 1.66), $t(4765) = -0.21$, $p = .83$. The vast majority of students (98.4%) resided within Tuscany, and the remaining 1.6% of students resided in a region of Italy outside of Tuscany. Students attended various types of secondary schools including academic, vocational, technical, and fine arts schools. The EDIT study was part of the Italian National Surveillance of Lifestyle, which was performed according to the Helsinki Declaration for Ethical Principles of Medical Research.

2.2. Measurements

The EDIT survey is a 75-item self-report questionnaire that aimed to investigate the principal habits and lifestyles of secondary school students and to understand the prevalence and patterns of negative health outcomes associated with risk behaviors. EDIT is a multi-center study carried out by the regional health agency every three years. With the Decree of the President of the Council of Ministers of March 3, 2017, it became part of the system of "Identification of surveillance systems and registers of mortality, tumors and other pathologies". The first survey was carried out in 2005 and constitutes the base line value referred to this target population. Variables examined in the present study included demographics, bullying, depressive symptoms, and sporting activity. Bullying was queried with a dichotomous (yes/no) rating in response to the following question: “over the past year, have you ever suffered bullying from a peer?” Students were also asked about the type (s) of bullying, if any, that they had experienced. Response options included jeer, joke, exclusion, insult, threat, theft, extortion, physical aggression, or other.

Exercise was assessed as the number of days in a typical week during which the respondent engaged in at least one hour of exercise. One hour of daily exercise is the current national adolescent recommendation in Italy and has been endorsed by the World Health Organization (World Health Organization, 2010), the US Department of Health and Human Services (United States Department of Health and Human Services, 2008) and the American College of Sports Medicine (American College of Sports Medicine, 2015). Response options ranged from zero to seven days of exercise per week. Based upon the findings of Sibold et al. (Sibold et al., 2015) that exercise four or more days per week was associated with reduced risk of suicide, responses were dichotomized into high exercise (4-7 days per week) and low exercise groups (0-3 days per week). Sporting activity was queried with a dichotomous rating asking “in the past year, have you ever practiced a sport?” A further item investigated the frequency of the various sports activities, and response options included everyday, 3-5 times per week, 1-2 times per week, 1-3 times per month, occasionally, or never.

Depressive symptoms were queried via six separate items (hopeless, depressed, useless, nervous, restless, and feeling as though everything

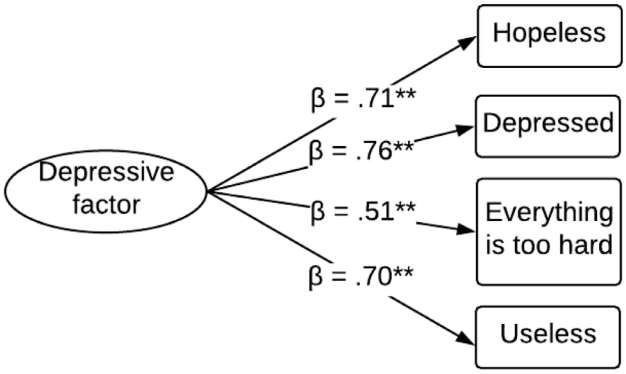

Fig. 1. Standardized factor loadings of depressive latent factor items. *Note.* ** = $p < .001$.

was too hard) using a five-point scale, with higher numbers representing higher frequency of symptoms. Students reported how often they had experienced a particular feeling in the past 30 days (*never, seldom, sometimes, often, or always*). Exploratory Factor Analysis in Mplus (Muthén and Muthén, 2017) revealed that four of the six items (hopeless, depressed, useless, everything is too hard) loaded significantly onto one factor (Figure 1), $\chi^2(2) = 0.49$, $p > .05$, CFI = 1.00, TLI = 1.00, RMSEA = .00 (90% CI = .00 - .02, probability < .05 = 1.00), and thus a depressive latent factor was used in structural equation modeling for subsequent analyses.

2.3. Procedure

All information used in the study was obtained through the administration of the anonymous EDIT questionnaire. The questionnaire was given to the students in electronic form on laptops connected to a computer server. To verify the effectiveness and reliability of the questionnaire, a pilot study was conducted in October 2004, which involved 137 pupils with participation equally distributed throughout the entire academic year. After being selected based on territorial representation, the schools were contacted to obtain permission as well as to request the necessary collaboration for survey completion. Within every school, five classes were divided into different sections to avoid a possible bias of selection connected to specific verifiable characteristics in some sections. Informed consent was collected from all participants prior to their inclusion in the study.

2.4. Statistical Analysis

Bullying status, exercise frequency, sport participation, and mean depressive factor scores were compared across groups according to demographics and other key study variables. Group comparisons were conducted using chi-square tests using the Statistical Package for the Social Sciences, Version 23.0 (SPSS) (IBM Corp., 2015) and linear regression and exploratory factor analysis was conducted using Mplus (Muthén and Muthén, 2017).

Three structural equation models were run using Maximum Likelihood (ML) estimator with bootstrapped standard errors to assess moderators of the association between bullying and depressive symptoms. All models included bullying as an independent variable and mean depressive factor scores as latent dependent variable. As one combined model would result in modeling of a four-way interaction, hypotheses were modeled separately to increase interpretability. Model 1 examined gender as a moderator and age as a covariate. Model 2 examined exercise frequency as a moderator, with age and gender as covariates. Model 3 examined sport participation as a moderator, with age, gender, and exercise frequency as covariates. Missing data were minimal (hopeless = 1.8%, depressed = 1.7%, everything is too hard = 1.9%, useless = 2.1%, gender = 0.0%, bullying = 1.8%, exercise frequency = 4.8%, sport participation = 2.2%). Little's MCAR test in SPSS revealed the data used in these analyses to be missing completely at random, $\chi^2(40) = 55.43$, $p > .05$. ML with bootstrapping uses full information maximum likelihood, the algorithm for which handles any pattern of missing data (Little and Rubin, 2002).

In evaluating model fit, the χ^2 statistic, the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR) were assessed. χ^2 values represent the difference between the observed data matrix and the model-implied matrix. Typically, non-significant χ^2 values indicate good fit; however, large sample sizes and complex models can often result in significant χ^2 values even when a model otherwise performs well. Good fit is indicated by CFI and TLI values above .90, RMSEA values below .06, and SRMR values below .08.

3. Results

3.1. Bullying

Of the entire sample, 18.7% of students reported being bullied in the past year. Rates across gender and exercise/sport engagement levels are presented in Table 1. Bullying rates did not significantly differ across ages, $\chi^2(8) = 14.97$, $p = .06$. Several different types of bullying were endorsed by students. Of those who reported being bullied in the past year, the following frequencies emerged (students instructed to select all that apply): jeers = 88.8%, jokes = 67.0%, exclusion = 61.0%, insults = 70.5%, threats = 53.9%, theft = 50.9%, extortion = 41.7%, physical aggression = 50.4%, and "other" = 41.3%. Female students were significantly more likely to endorse exclusion (67.5%) than male students (53.9%), $\chi^2(1) = 17.60$, $p < .001$. No other significant gender differences emerged with regard to bullying type. Bullied and non-bullied students showed no difference in BMI, $t(1192) = -4.8$, p = .63.

3.2. Exercise

In the given sample of Italian students, 36.7% of students reported engaging in exercise for at least one hour on more days than not during a typical week, and only 6.8% reported meeting Italy's national adolescent recommendation of at least one hour every day. Female students were significantly less likely than male students to exercise 4-7 days per week, (26.3% versus 45.6%, respectively), $\chi^2(3) = 183.90$, $p < .001$. Bullied students were less likely than non-bullied students to exercise 4-7 days per week, (33.3% versus 37.5%, respectively), $\chi^2(1) = 5.42$, $p < .05$. Students who played sports were much more likely than those who did not play sports to exercise 4-7 days per week (43.0% versus 15.1%, respectively), $\chi^2(1) = 265.56$, $p < .001$.

3.3. Sport participation

Of the overall sample, 77.8% of students participated in sports within the past year. Male students were more likely than female students to have participated in sports (82.1% versus 68.8%, respectively,

Table 1
Rates of bullying compared across gender, exercise, and sport participation subgroups

Stratification Variable	Subgroup	Bullied in past year (%)	χ^2	*p*
Gender	Females	21.5		
	Males	17.0	15.61	< .001
Exercise frequency	0-3 days/week	19.8		
	4-7 days/week	16.9	5.42	.02
Sports participation	Yes	18.8		
	No	19.6	0.28	.60

Table 2
Regression coefficients predicting depressive factor score

	B	*SE*	*β*	SE	*t*	*p*
Gender	0.58	0.04	0.28	0.02	16.69	< .001
Exercise frequency	-0.25	0.03	-0.12	0.02	-7.38	< .001
Bullying status	0.64	0.05	0.24	0.02	12.11	< .001
Sports participation	-0.27	0.04	-0.11	0.02	-6.31	< .001

Note. Regression coefficients represent group differences on mean depressive factor. SE = standard error. Gender: 1 = male, 2 = female. Exercise frequency: 0 = 3 or fewer days per week, 1 = 4 or more days per week. Bullying status: 0 = not bullied, 1 = bullied. Sports participation: 0 = no sports, 1 = sports.

$\chi^2(1) = 142.75$, $p < .001$). Of those students who participated in sports, 93.2% did so least once per week. Likelihood of sports participation did not differ between bullied and non-bullied students, $\chi^2(1) = 0.28$, $p = .60$, with 76.0% of bullied students and 77.2% of non-bullied students playing sports within the past year.

3.4. Depressive Symptoms

The depressive latent factor was regressed (separately) on gender, bullying status, exercise frequency, and sports participation to examine differences in depressive symptoms across groups. Mean differences between groups are presented in Table 2. Mean depressive factor scores were significantly higher in female students compared to male students; in bullied students compared to non-bullied students; in students who exercised 0-3 days per week compared to those who exercised 4-7 days per week; and in students who did not participate in sports compared to those who did.

3.5. Moderation Models

Three structural equation models were run to assess gender, exercise frequency, and sports participation as potential moderators of the association between bullying and depressive symptoms. Model 1, in which age, bullying, gender, and a bullying x gender interaction term predicted depressive symptoms, demonstrated excellent fit, $\chi^2(13) = 63.54$, $p < .0001$, CFI = .99, TLI = .98, RMSEA = .03, (90% confidence interval = .02 - .04, probability < .05 = 1.00), SRMR = .01.

The structural model indicated significant main effects of gender and age, with bullying demonstrating a trend towards significance (Table 3). The gender x bullying interaction term also significantly predicted depressive scores. Analysis of simple slopes revealed a stronger positive association between bullying and depressive scores for females ($B = 0.95$, SE = 0.04, $p < .001$) than for males ($B = 0.45$, SE = 0.00, $p < .001$).

Model 2, in which a bullying x exercise interaction term was included, demonstrated excellent fit, $\chi^2(16) = 56.30$, $p < .0001$, CFI = .99, TLI = .99, RMSEA = .02, (90% confidence interval = .02 - .03, probability < .05 = 1.00), SRMR = .01. The model indicated significant main effects of age, gender, bullying, and exercise on mean depressive factor scores (Table 4). Contrary to hypotheses, the bullying by exercise interaction term did not significantly predict depressive scores.

Table 3
Regression coefficients predicting depressive factor score, gender as moderator

	B	*SE B*	β	*SE β*	*t*	*p*
Age	0.06	0.01	0.07	0.01	6.60	< .001
Bullying status	0.36	0.19	0.10	0.05	1.85	.06
Gender	0.70	0.05	0.24	0.02	14.22	< .001
Bullying x gender interaction	0.33	0.13	0.14	0.06	2.56	.01

Note. SE = standard error. The *t* statistic reported corresponds to unstandardized regression coefficient. Gender: 1 = male, 2 = female. Bullying status: 0 = not bullied, 1 = bullied.

Table 4
Regression coefficients predicting depressive factor score, exercise frequency as moderator

	B	*SE B*	β	*SE β*	*t*	*p*
Age	0.06	0.01	0.06	.01	8.06	< .001
Gender	0.69	0.05	0.25	0.02	15.59	< .001
Bullying status	0.84	0.08	0.24	0.02	10.92	< .001
Exercise frequency	-0.15	0.04	-0.05	0.02	-3.74	< .001
Bullying x exercise interaction	-0.13	0.14	-0.02	0.02	-0.98	.329

Note. t statistic reported corresponds to unstandardized regression coefficient. SE = standard error. Gender: 1 = male, 2 = female. Bullying status: 0 = not bullied, 1 = bullied. Exercise frequency: 0 = 3 or fewer days per week, 1 = 4 or more days per week.

Model 3, which included a bullying x sport participation interaction term, also demonstrated excellent fit, $\chi^2(19) = 63.36$, $p < .0001$, CFI = .99, TLI = .99, RMSEA = .02, (90% confidence interval = .02 - .03, probability < .05 = 1.00), SRMR = .01. The model indicated significant main effects of age, gender, bullying, exercise frequency, and sport participation (Table 5). Sport participation emerged as a significant moderator of the association between bullying and depressive factor score. Analysis of simple slopes revealed a weaker association between bullying and depressive scores for students who participated in sports (B = 0.61, SE = 0.06, $p < .001$) than for students who did not participate in sports (B = 0.74, SE = 0.09, $p < .001$).

4. Discussion

This study replicated Sibold et al.'s (Sibold et al., 2015) findings of increased depressive symptoms in bullied students and decreased depressive symptoms in students who exercised for sixty minutes on four or more days per week. Contrary to the findings of Sibold et al., the strength of this association did not vary by exercise frequency. Whereas Sibold et al.'s study examined physical activity broadly, this study distinguished the roles of sports participation from physical activity. The current findings indicate that the association between depressive symptoms and bullying did vary based on sports participation, even when controlling for exercise frequency. Another difference between the two studies is the measurement of depressive symptoms; Sibold et al. assessed reports of sadness, suicidal ideation, and suicide attempt, and this study used a latent factor based on four symptoms of depression.

4.1. Gender

A greater prevalence of bullying emerged among females with respect to males, with a greater tendency towards the phenomenon of social exclusion. Furthermore, females showed a lower weekly exercise

Table 5
Regression coefficients predicting depressive factor score, sport participation as moderator.

	B	*SE B*	β	*SE β*	*t*	*p*
Age	0.05	0.01	0.06	0.01	7.87	< .001
Gender	0.66	0.04	0.24	0.01	16.40	< .001
Exercise frequency	-0.13	0.04	-0.05	0.01	-3.32	.001
Bullying status	1.06	0.14	0.30	0.04	7.86	< .001
Sport participation	-0.12	0.06	-0.04	0.02	-2.29	.045
Bullying x sports interaction	-0.36	0.16	-0.09	0.14	-2.19	.026

Note. t statistic reported corresponds to unstandardized regression coefficient. SE = standard error. Gender: 1 = male, 2 = female. Exercise frequency: 0 = 3 or fewer days per week, 1 = 4 or more days per week. Bullying status: 0 = not bullied, 1 = bullied. Sports participation: 0 = no sports, 1 = sports.

frequency and a lower participation in sports activities. Moderation analyses revealed a statistically significant interaction between bullying and gender in predicting depressive symptoms, indicating a stronger association in females. Furthermore, in all models the association between gender and depression remained significant net of all the other variables taken into consideration, including physical activity. In general, these results highlight how female students are particularly at risk, both in terms of greater prevalence of bullying and less exposure to potentially protective factors such as sport participation.

4.2. Exercise

Although exercise frequency did not moderate this association between bullying and depression in this sample, exercise and depressive symptoms are significantly associated. This underscores the importance providing adequate opportunities for all youth to engage in frequent physical activity. Formal sports teams become increasingly difficult to access as students age because only the most skilled players qualify for teams. This change in eligibility typically occurs during high school years, at the exact time when rates of depression tend to increase drastically and students may be most in need of the protective effects of exercise.

The percentage of students who exercised 4-7 days per week was quite low for both bullied students (33.3%) and non-bullied students (37.5%). Participation in sports only slightly increased the likelihood that students exercised 4-7 days per week (up to 43.0%), so adolescent students would benefit from means of frequent exercise aside from sports. As many high schools provide general and sexual health education during physical education courses, students would likely benefit from a curriculum that such education in a manner that complements rather than replaces opportunities for physical activity. Efforts should target exercise engagement in female students in particular, as female students were at heightened risk for both bullying and depressive symptoms, yet exercised less frequently than male students. Physicians and mental health providers should discuss the mood benefits of regular exercise with their adolescent patients and help them to develop plans for physical wellness (Eime et al., 2013).

4.3. Sports Participation

Our findings suggest that sports may be a means of mitigating the effect of bullying, though the mechanism has yet to be explored. The fact that this moderating effect remained when controlling for exercise frequency reveals a unique benefit to sports engagement and suggests that for high school students, participation in sports may be more important than the frequency of physical activity. Although the low threshold for sports participation (at least once in the past year) could have resulted in a group of students who practiced sports at quite varied frequencies, (e.g., twice per year or every day), 93% of students who played sports in the past year reported practicing at least once per week. This indicates that most students received a regular “dose” of sports and may have allowed this moderating effect to emerge. Future work should examine whether the frequency of sport participation impacts the moderating effect. Depending on the country, some sports teams are community-based whereas others are typically school-based. Regardless of the affiliation, both schools and communities can collaborate to focus their efforts on (a) increasing recruitment for community-based sports teams and (b) reducing barriers to engagement, such as providing transportation and structuring school hours to accommodate after-school sports practice.

Because most sports are team-based, sports participation may buffer against depressive symptoms (Gore et al., 2001), by helping students develop a supportive social network and/or by promoting socially interactive means of behavioral activation. Participating on sports teams offers bullied students an opportunity to forge relationships with supportive peers that they may not otherwise pursue. Other social groups or clubs may pose a similar benefit above and beyond that of exercise, including theater, art, book, or political clubs, though which students may experience positive social interactions and a sense of belonging. In addition, the expectation that team members consistently show up to practice sessions may help combat depressive tendencies towards inactivity and withdrawal.

Further, the solitary nature of some forms of exercise, including running and cycling, may be less beneficial to mood than group-based exercise (Eime et al., 2013). This may be due to the increased possibility of past- or future-oriented rumination within an individual sport as well as decreased opportunities for social engagement. Participation in sports teams demands a high level of engagement in the present moment that is not required for all forms of exercise. A burgeoning literature on the positive mood effects of mindful awareness (Bueno et al., 2015; Edwards and Loprinzi, 2019; Nanthakumar, 2018; Strauss et al., 2014) lends credence to this perspective and encourages further study of mindfulness as it relates to sports.

4.4. Limitations

Because this study was cross-sectional, it was not possible to account for baseline depressive symptoms or exercise to specify direction of causality. The nature of depression often renders individuals less likely to exercise; specifically, symptoms of depression including fatigue, anhedonia, and impaired sleep may serve as barriers to exercise engagement. Given that prior studies have demonstrated a causal effect of exercise on depressive symptoms and that behavioral activation is a well-supported treatment for depression, it is likely that change in exercise would correlate with an inverse change in depressive symptoms.

In theory, body mass index (BMI) may also be a confounding variable related to exercise and bullying, but this is not supported as there was no difference in BMI between bullied and non-bullied students. In addition, our findings could be more generalizable had a widely used measure of depressive symptoms been used. The depressive factor we used in this study included several emotional and cognitive experiences associated with depression and the high factor loadings demonstrated by its items suggest that the items assess unique yet highly correlated aspects of depression. One item in particular, assessing feelings of “everything is too hard” loaded less highly (.51) than the other three factors. It is possible that this item captured aspects of fatigue and anhedonia, though imperfectly, and future versions of the EDIT survey may benefit from adjusting the wording to better align with symptoms outlined in the International Statistical Classification of Diseases and Related Health Problems (ICD)-10.

4.5. Conclusions and Implications

In conclusion, exercise and depressive symptoms are associated, yet less than 7% of surveyed Italian high school students met national exercise standards. Female students were particularly at risk, with higher rates of depressive symptoms paired with lower rate of exercise engagement. Sports participation may be an effective means of reducing the impact of bullying on depressive symptoms, and research regarding potential mechanisms, including social engagement and mindfulness, deserve thorough study. Furthermore, clinical settings should take into consideration physical activity as a fundamental tool for rehabilitation programs.

Future research will benefit from more detailed assessment of various forms of exercise (aerobic, anaerobic, group-based) to best inform exercise implications and examine hypotheses related to mindful exercise engagement. Standardized assessments of exercise, including duration, frequency, and type of exercise, will enable easier comparisons across studies and across cultures. Continued cross-cultural exploration of these processes will help shape a global perspective on physical activity as an avenue for promoting resilience during adolescence.

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Declaration of Competing Interest

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