

Help or hindrance: the relationship of physical activity with aggressiveness and self-esteem in 16-year-old adolescents

BACKGROUND

Puberty is a particularly important period for moulding one's lifestyle. Physical activity (PA) levels exhibited by teenagers remain low despite efforts to promote it, and the percentage of individuals who are exempt from taking part in physical education classes is high. In this context, the aim of the current study is to analyse the levels of aggression and self-esteem in adolescents characterised by different levels of physical activity.

PARTICIPANTS AND PROCEDURE

A total of 968 16-year-old adolescents took part in the study. Participants were divided into four subgroups: 1) a non-active group, $n = 141$ (95 girls); 2) a physical education (PE) group, $n = 514$ (322 girls); 3) a high PA group, $n = 178$ (81 girls); and 4) an athlete group, $n = 135$ (66 girls). Participants were asked to complete a socio-demographic survey and a set of questionnaires (IPAQ, KAM-RE, and SES).

RESULTS

The non-active group scored higher than the PE and high PA groups on the general aggressiveness scale. Statistically

significant differences were found between the non-active group and other groups for direct and indirect aggression, opposition, and verbal aggression. The athlete group scored higher on the indirect aggression scale than the PE group. The high PA group scored higher than the non-active group in self-esteem.

CONCLUSIONS

Undertaking compulsory physical activity in school and additional physical activity based on one's own interests is associated with lower levels of aggression in comparison to individuals who do not undertake any physical activity. For this reason, it is necessary to continue consistently promoting physical activity in school and during free time.

KEY WORDS

adolescence; physical activity; individual differences; physical education

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BACKGROUND

PUBERTY AND AGGRESSION AND SELF-ESTEEM

Forming one's identity is a key process in adolescence. It is associated with the integration of the biological, cognitive, emotional, and social domains (Brinthaupt & Lipka, 2002; Erikson, 1968). Thus, the development of individuality takes place in both the intrapsychological and interpersonal dimensions (Collins & Steinberg, 2006).

The first aspect of identity formation is biological puberty, which is associated with the acceptance of one's developing body and sexuality, stabilisation of emotions and basic beliefs, hierarchy of values and needs, and choice of life goals – the assessment of *who am I?* (Arnold, 2017). Emotional lability accompanies adolescents up until the age of about 16-17, which is why adolescents often express anger, frequently in the form of defiance towards their significant others (Lippold, Hussong, Fosco, & Ram, 2018). The change in an adolescent's social role is associated with an increase of tensions in their relationships, especially the relationship between an adolescent and their parents. The influence of hormones is a factor which may exacerbate the conflicts. Increased levels of oestradiol secretion in girls in the initial phase of puberty causes an increase in their aggressiveness and difficulties in controlling their own behaviour (Graber, Brooks-Gunn, & Warren, 2006). Increased testosterone levels in boys potentiates their externalising behaviours, a tendency which is especially strong if they have self-regulatory deficits (i.e., low conscientiousness and agreeableness; Reardon, Herzhoff, & Tackett, 2016). Thus, even if not all adolescents exhibit reactive aggressive behaviours, it is a developmental period in which aggressive behaviours in response to provocation, frustration, or threat are at their peak levels (Lickley & Sebastian, 2018).

The second dimension in identity formation refers to social identity (Ragelienė, 2016), that is defining the group an adolescent identifies with and belongs to (Brown, 2004). Functioning in the two most important environments – peers and family – is key in the context of development of one's self-esteem (Harter, 2012). Self-esteem is an evaluative – positive or negative – attitude towards one's own self, a kind of global assessment of oneself (Rosenberg, 1979). An important dimension of the global levels of self-esteem is the self-esteem regarding one's physicality (Hagger, Biddle, & Wang, 2005). Additionally, a teenager has the skills to describe themselves in terms of psychological categories concerning interpersonal relations, emotions, or beliefs (Petersen & Leffert, 1995). An adolescent's awareness with regards to being accepted by their peers and significant adults is important in the context of self-esteem. For this reason, when engaging with issues regarding adoles-

cents' development of self-esteem, one should take into account the broader context of their functioning and the environment they live in by, for example, analysing coexisting internalising or aggressive behaviours and reinforcing school attendance and accomplishments (Smokowski et al., 2016). Faced with the threat of failing at school, a teenager may often take a passive, apathetic, or overly aggressive attitude (Simpson, Peterson, & Smith, 2010). Social self-esteem is a mediator of the relationship between malevolent aggression and school achievements (Soomro & Clabour, 2012). This is why development of self-esteem is a factor that may protect one from experiencing a downward spiral which often triggers aggressive behaviours in response to school failures.

Physical activity and individual differences

FREE TIME AND SPENDING TIME IN A PEER GROUP – AN OPPORTUNITY OR THREAT?

Interactions with peers are an opportunity for adolescents to form friendships and intimate relationships, which can be both an opportunity and a risk for a teenager's development. On one hand, adolescents who have opportunities to form positive relationships with their peers assess their health and well being as better (Moreno et al., 2009) and report fewer complaints of a psychological character (Zambon et al., 2010). On the other hand, especially in the case of non-organised groups, there is a higher probability of co-participation in behaviours that are against social norms. Research shows that the frequency of spending evenings with peers is related to the use of marijuana (Kuntsche et al., 2009). Peers make teenagers try cigarettes (Simons-Morton & Farhat, 2010) and alcohol (Osgood et al., 2013). Peer pressure causes teenagers to exhibit higher levels of externalising behaviours and engage in risky sexual behaviours (Allen, Porter, & McFarland, 2006). Research on a representative group of teenagers found that the selected groups of friends were uniform in terms of school results, presented social behaviours, and sense of psychological closeness and structure (Cook, Deng, & Morgano, 2007). Because of this, the peer group with which a teenager spends time should be curated in some way, because friendships and behaviour may depend on the types of activities one engages in.

An important source of support for teenagers is a wide variety of ways to spend free time and organised forms of education where teenagers have the opportunity to form positive relationships not only with their peers, but also with significant adults (Jones & Deutsch, 2012). Various forms of volunteer work are a great form of mobilisation and source of sensitivity in adolescents, by making them work for their environment – the prosocial behaviours of a peer group encourage this type of behaviour in

teenagers (Farrell, Thompson, & Mehari, 2018), as do extracurricular art classes (Ersing, 2009) and taking part in organised physical activity (Larson, Hansen, & Moneta, 2006).

RESEARCH FRAMEWORK – ADOLESCENTS' PHYSICAL ACTIVITY IN RELATION TO AGGRESSIVENESS AND SELF-ESTEEM

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It is important to note that physical activity level is connected with psychological variables and that over half of the Polish 15-year-old population is reported to have an insufficient level of physical activity (Koło, Guskowska, Mazur, & Dzielska, 2018). The positive effects of physical activity can be analysed in the context of both physical health and mental health. Playing sports can improve cognitive functions associated with learning (Chen, 2012; Stroth, Hille, Spitzer, & Reinhardt, 2009) and school achievements (Howie & Pate, 2012). Research shows that any physical activity (regular/irregular, high or low intensity, independently of its form) brings health benefits (Poitras et al., 2016).

Puberty is important for shaping one's lifestyle because this is when health behaviours developed in the socialisation process are consolidated. Among the factors that significantly influence health in adulthood are behaviours leading to harm occurring in early and late adolescence: violence and aggressive behaviours, tobacco use, alcohol consumption and substance use, risky sexual behaviours, unhealthy diet, and low levels of physical activity (Kann et al., 2016). In line with WHO guidelines, children and adolescents (up to 18 years old) should take part in physical activity for a minimum of 60 minutes a day (Start Active Stay Active, 2011). This activity should increase heart rate and lung activity, which indicates that it meets the condition to be considered moderate to vigorous physical activity. Exercises engaging large muscle groups are in this category. They are recommended as a part of sports, recreation, performed duties, transport, work, school physical activity classes, and planned exercises. Aerobic activities include jogging, basketball, football, swimming, and skiing. Research shows that, taking the recommended 60 minutes a day as a reference point, 92.50% of girls and 77.20% of boys aged 14 to 18 in Poland have low levels of physical activity (Tabak, Mazur, & Nałęcz, 2017). These indices are still not satisfactory, and continuing health-promotion activities in this area is necessary in Poland and elsewhere (Carson, Staiano, & Katzmarzyk, 2015), because despite efforts to promote physical activity (McMullen, Ni Chroínín, Tammelin, Pogorzelska, & van der Mars, 2015) the number of doctor's notes exempting students from partaking in physical activity classes is still increasing (Woynarowska, Mazur, & Oblacińska, 2015).

A positive relationship is observed between emotion regulation and levels of physical activity (Isasi, Ostrovsky, & Wills, 2013); this effect is especially visible in the case of negative emotions and aerobic exercises (Bernstein & McNally, 2017). Interestingly, in the case of adolescents, higher levels of physical activity seem to reinforce the experienced negative emotions in case of peer rejection and make the reduction of negative emotions more flexible in the case of peer acceptance (Shields, Matt, & Coifman, 2016). Research shows that partaking in physical education at school and extracurricular physical activity classes may foster the development of self-regulation and control over aggressive behaviours (Costin & Jones, 1992). Other research shows that physical education classes in school do not influence aggressive behaviours in teenagers, and extracurricular physical activity lowers levels of aggression, especially in girls (Park, Chiu, & Won, 2017). Moreover, interventions increasing physical activity do not directly influence levels of aggression – recreational screen time is the mediator of this relationship, and this is particularly the case for boys (Wade, Smith, Duncan, & Lubans, 2018). It seems important to bring attention to the forms of physical activity that are undertaken in physical education classes – one study found that engaging in play fighting lowered levels of aggressiveness in teenagers in comparison with the control group who played volleyball (Carraro, Gobbi, & Moè, 2014).

Playing sports is an important basis for self-esteem (Budnik & Kaźmierczak, 2008): it increases the positive attitude towards one's physicality (appearance and sense of competence), which leads to an overall increase in self-esteem (Bowker, 2006; Guskowska, Kuk, Zagórska, & Skwarek, 2015). Research done with a group of highly qualified athletes, as well as those with smaller successes, showed that there is a positive relationship between self-esteem and sport achievements (Owczarek, 2009). Similar results were found in another study where athletes of the Plus Women's League (the top volleyball league in Poland) were characterised by higher global levels of self-esteem in comparison to players in lower leagues (Bernacka & Tokarz, 2012). It should be mentioned that the duration of engagement in organised and intensive physical activity indirectly influences the increase in self-esteem, and support from adults mediates this relationship (Oosterhoff, Kaplow, Wray-Lake, & Gallagher, 2017). Research also shows that taking part in vigorous physical activity more than 4 times a week is associated with a lower level of self-esteem, so the intensity of physical activity is a factor which protects against low self-esteem (Hrafnkelsdottir et al., 2018).

Summarizing the above, as the results of previous studies are inconclusive, there is a need for further exploration of the role of physical activity in the context of aggressive behaviours. It is also important

to analyse the role of self-esteem in the context of physical activity of teenagers. Research focused on the relationship between self-esteem and aggressiveness presents contradictory results: some studies find a connection between low self-esteem and aggression (Boden, Fergusson, & Horwood, 2007; Walker & Bright, 2009) while others link high self-esteem to aggressive behaviour (Bushman et al., 2009). As mentioned earlier, research concerning self-esteem as a mediator of aggressive behaviour and school achievement has also been conducted (Smokowski et al., 2016; Soomro & Clarbour, 2012). Physical activity is an area of action which involves achievement motivation similar to the school context. Furthermore, as the Muller, Bushman, Subra, and Ceaux (2012) studies indicate, perceiving oneself as better or worse than a co-contestant appears to be the key factor in presenting aggressive behaviours towards them. Therefore, the relation including the intensiveness (low/high) and the organization of participation (competitive or recreational sports) in physical activity could be a potential factor modifying self-esteem and as a result aggressiveness.

For this reason, the goal of this work is to analyse levels of aggressiveness and self-esteem in relation to levels of physical activity. The following hypotheses were made:

Hypothesis 1: Teenagers who do not engage in physical activity are characterised by higher levels of aggression in comparison to individuals who do engage in physical activity.

Hypothesis 2: Individuals who do sports are characterised by higher levels of self-esteem in comparison to individuals who are physically inactive, those who only partake in physical education (PE) classes, and those who engage in additional self-organised physical activity.

Hypothesis 3: The relationship between physical activity and aggressiveness is mediated by self-esteem.

PARTICIPANTS AND PROCEDURE

PARTICIPANTS

A total of 968 adolescents from Pomerania in Poland took part in the study. They were purposively selected from an age cohort ($M_{age} = 15.96$, $SD = 0.30$) of individuals with varying levels of physical activity (PA). Participants were divided into four subgroups according to their declaration in the Inventory of Physical Activity Objectives (IPAO; Lipowski & Zaleski, 2015): 1) a non-active group, $n = 141$ (95 girls) – teenagers who are exempt from PA classes and did not report taking part in self-organised PA; 2) a PE group, $n = 514$ (322 girls) – teenagers who only do PA in school (physical education class); 3) a high PA group, $n = 178$ (81 girls) – teenagers who participate

in PE classes and are also physically active (PA) by themselves (not involved in any organized forms of PA), engaging in physical activity for at least 60 min, 4 to 7 days a week (hours a week devoted to training: $M = 10.69$, $SD = 5.78$); and 4) an athlete group, $n = 135$ (66 girls) – teenagers who train regularly (hours a week devoted to training: $M = 14.07$, $SD = 5.16$), have valid club licences, and represent clubs in country-level competitions. The athlete group included individuals who train individual sports (sport gymnastics, swimming, track-and-field), team sports (basketball, soccer, volleyball, handball), martial arts (fencing, judo), and aesthetic disciplines (dance, artistic gymnastics).

PROCEDURE

Schools were randomly selected (10 of 12 sport schools and 25 of 381 general education schools) from the Pomeranian Office of Education database. Complete data were obtained from 35% of students from general schools and 45% of students from sport schools.

All participants and their parents gave informed consent to participate in the study and were informed that they could discontinue their participation at any time. The study was approved by the Ethics Board for Research Projects at the Institute of Psychology, University of Gdansk, Poland (decision no. 4/2014).

MEASURES

Participants were asked to complete a sociodemographic survey and a set of questionnaires.

The Inventory of Physical Activity Objectives (IPAO) by Lipowski and Zaleski (2015) was used to determine the level of involvement in PA. We used only part of the inventory that allows one to analyse the extent of engaging in physical activity. Questions regard respondents' involvement in competitive sports (both present and prior) and the forms and intensity of their physical activity (number of hours devoted to doing team and individual sports, using the gym, or fitness classes). Respondents also answered questions regarding regular engagement in PE classes and whether they have a doctor's note for long-term exemption from such classes. Taking part in physical activity in one's free time – both organised and unorganized – was also analysed, as well as participants' declarations about amount of PA in the past month. This allowed the weekly number of hours spent on PA to be analysed.

The Adolescent Aggressiveness Questionnaire – Emotional Reactivity (KAM-RE; Sajewicz-Radtke, Radtke, & Kalka, 2010) was used for the evaluation of aggressiveness in adolescents. KAM-RE measures the level of aggression in children and adolescents

aged 13–16. This questionnaire is a self-report measure, consisting of 60 items, to which participants respond on a 5-point Likert scale (1 – *definitely not*, 3 – *I don't know*, 5 – *definitely yes*), indicating how much a given statement applies to their behaviour. It contains 5 subscales: *Direct aggression*, *Indirect aggression*, *Emotional irritability*, *Opposition*, and *Verbal aggression* (Sajewicz-Radtke et al., 2010). *Direct aggression* refers to the use of physical force against other people, to cause harm when the other person or group of people is motivated to avoid it. Another scale, *Indirect aggression*, concerns behaviours aimed at harming other people, excluding physical violence; it also includes indirect aggressive behaviours (such as bursts of anger, stamping legs, malicious jokes, and gossip). *Emotional irritability* is elicited by a tendency to manifest negative emotions at the slightest provocation from others. *Opposition* refers to any behaviour directed against authority, including both opposition and the fight against applicable standards, norms, and customs. The last subscale, *Verbal aggression*, is associated with the expression of negative feelings both in form and in content of verbal expressions (screaming, curses). The result of the questionnaire is the total amount of points obtained on every subscale; moreover, it is possible to calculate the level of aggression for each of the subscales. The higher the score, the higher the level of aggression. The external validity of the KAM-RE scale was analysed by correlating it with Buss and Durke's Aggression Scale questionnaire subscales: correlations were found to be high (between .61 and .79 for the respective subscales in both questionnaires); the test-retest reliability for the KAM-RE subscales was between .80 and .87 and was .90 for the overall score (Sajewicz-Radtke et al., 2010). It should be added that Cronbach's α values in this study were as follows: .86 for direct aggression, .86 for indirect aggression, .73 for emotional irritability, .79 for opposition, and .85 for verbal aggression. The reliability (Cronbach's α) for general aggression level was .94.

The Rosenberg Self-Esteem Scale (SES; Rosenberg, 1965; The Morris Rosenberg Foundation, 2006), in the Polish adaptation by Łaguna, Lachowicz-Tabaczek, and Dzwonkowska (2007), was used in order to assess general level of self-esteem. The SES is a short, self-report questionnaire which is used to assess self-esteem and attitudes towards oneself (Dzwonkowska, Lachowicz-Tabaczek, & Łaguna, 2008; Łaguna et al., 2007; Rosenberg, 1965; The Morris Rosenberg Foundation, 2006). The SES consists of 10 items to which participants respond on a 4-point Likert scale from 1 (*I strongly agree*) to 4 (*I strongly disagree*). The sum of points obtained on all the 10 items is the final result of the SES. The range of results is between 10 and 40; the higher the score, the higher the self-esteem. The reliability of the Polish version of the SES for the youth group, measured using Cronbach's α , was high: .81. In the adaptation by Dzwonkowska

et al. (2008), factor analysis allowed the identification of one scale in the questionnaire. The SES has positive relationships with questionnaires measuring emotional dispositions, characteristics indicating readiness for action, and variables associated with goal-oriented and social functioning (Dzwonkowska et al., 2008). In this study, Cronbach's α coefficient for SES results was .60.

STATISTICAL ANALYSIS

Statistical analysis was conducted in Statistical Package for the Social Sciences (SPSS) version 25 (SPSS Inc., license purchased by University of Gdansk), using: factor structure analysis of variance (ANOVA) with post-hoc analysis (Tukey's Test Unequal N HSD), Pearson's r correlation and mediation analysis.

RESULTS

First, mean scores for aggressiveness and its subscales, self-esteem, weekly engagement in activities other than physical activity, and monthly number of days participants skipped school were calculated for every group of participants. After calculating the normalised sten scores, it was found that the analysed groups had average scores for aggressiveness ($M = 5.33$, $SD = 1.96$) and self-esteem ($M = 5.05$, $SD = 2.35$).

Then an ANOVA (2: gender \times 4: PA level) was performed, which found statistically significant gender or physical-activity-related differences in order to verify the first and the second hypotheses. Post-hoc analysis with Tukey's HSD adjustment revealed significant intergroup differences in levels of aggressiveness and self-esteem (Table 1).

A main effect of gender on *Emotional irritability* was documented ($p < .001$), where girls scored significantly higher than boys. In turn, boys scored higher than girls in terms of *Direct aggression* ($p < .001$), *Indirect aggression* ($p < .001$), and *Self-esteem* ($p < .001$).

A main effect of level of PA was also observed. The non-active group scored higher than the PE ($p = .001$) and high-intensity PA ($p = .019$) groups on the general aggressiveness scale. Moreover, the non-active group scored higher on *Direct aggression* than the PE group ($p = .016$). On the *Indirect aggression* scale, the non-active group scored higher than the PE group ($p = .001$) and the athlete group had higher scores than the PE group ($p = .035$). In the case of the *Opposition* scale, the non-active group scored higher than the PE group ($p = .001$) and the high PA group ($p = .021$). Moreover, on the *Verbal aggression* scale, the non-active group scored higher than the PE group ($p = .005$) and the high PA group ($p = .005$). One difference was found for self-esteem: the high PA group scored higher than the non-active group ($p = .016$).

Table 1

Differences in aggressiveness, self-esteem with respect to gender and sport (ANOVA)

Item	Female						Male						Gender		PA	Gender × PA			
	Non-active		PE		High PA		Athletes		Non-active		PE		High PA				Athletes		
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD			M	SD	F
Aggressiveness	145.38	30.48	129.93	31.65	133.02	30.36	132.62	26.09	143.76	27.67	133.72	27.19	135.94	31.24	143.58	24.69	3.18	6.71**	1.02
Direct aggression	21.55	7.13	18.80	6.95	20.06	7.11	19.08	6.03	24.80	6.78	22.45	6.74	23.35	7.64	24.59	6.10	56.02**	5.06*	0.86
Indirect aggression	32.34	8.83	28.16	9.37	29.89	9.12	29.44	8.50	34.24	8.90	30.53	8.17	31.29	9.84	34.41	7.44	15.34**	7.90**	1.14
Emotional irritability	28.93	6.06	27.78	5.96	27.00	6.24	27.88	5.56	25.78	5.37	25.05	4.95	25.14	5.02	25.96	4.45	32.43**	1.59	0.53
Opposition	23.71	6.19	20.71	6.12	21.22	5.87	21.20	4.99	23.39	4.86	21.42	5.26	22.07	5.23	23.04	4.17	3.28	6.81**	0.81
Verbal aggression	38.87	9.04	34.46	9.39	34.77	8.72	35.06	7.50	35.52	7.50	34.31	7.81	34.11	8.42	35.55	6.93	1.99	3.86*	1.37
Self-esteem	25.42	5.87	26.26	5.68	27.65	6.00	26.11	5.61	26.54	3.71	26.58	4.81	27.74	5.67	27.96	5.07	4.18*	3.30*	0.92

Note. PA – physical activity, * $p < .05$, ** $p < .001$ Physical activity
and individual
differences

No *gender x sport* effect was observed for the analysed dimensions.

To test hypothesis 3, that physical activity influence aggressiveness, and self-esteem will mediate the above relation, mediation analyses were conducted. Based on the PROCESS bootstrapping macro (Hayes, 2013), we included physical activity as the predictor, adolescents' self-esteem as the hypothesized mediator, and general aggression and its dimensions (direct aggression, indirect aggression, emotional irritability, opposition, and verbal aggression) as the dependent variables. The gender effect was controlled in the above analysis. The results indicated that effects of physical activity on aggressiveness and its dimensions, through the mediation effect of self-esteem, were insignificant for all levels of physical activity and also for the non-active group.

DISCUSSION

Gender differences were observed in the aggression dimensions: girls were characterised by higher emotional irritability and boys by higher direct and indirect aggression. This means that girls have a higher tendency to react with anger and negative emotions to situations perceived as a provocation or failure; similar results were observed by Caprara, Paciello, Gerbino, and Cugini (2007). Boys, in turn, respond to frustration with physical force, jeering, or emotional reactions to a higher degree (Sajewicz-Radtke et al., 2010). Research by Kumari, Kang, and Princy (2014) found boys to be more negative, verbally aggressive, and assaultive in comparison to girls. However, in that research project, levels of aggressiveness were measured using a different questionnaire.

The non-active group scored higher on most of the aggression subscales as well as on overall score, in comparison to the PE group and the high PA group, but no statistically significant differences were observed in comparison to the group engaging in sports; thus, the first hypothesis can be only partially accepted. Research suggests that taking part in obligatory physical education classes is beneficial for the development of emotion regulation skills and behaviour. It ought to be added that participation in this school class does not meet WHO recommendations regarding the amounts of physical activity per day (Start Active Stay Active, 2011). In the context of the analysed variables associated with the levels of aggression, 4 hours of obligatory PE classes seems to be the minimum amount of physical activity for fostering constructive management of frustrating situations and provocation. Physical activity at school (PE classes and sports) plays an important role in supporting continued physical activity throughout the rest of one's life, as well as development of social skills and social behaviours and pro-school attitudes

(Bailey, 2006). Research regarding the relationship between intense physical activity and aggressive behaviours is scarce. A study from the Czech Republic showed that vigorous physical activity fosters positive developmental changes, but it is also associated with higher probability of engagement in frequent fighting (Hamřík et al., 2015).

It should be stressed that the athlete group did not differ from the physically inactive teenagers in terms of levels of aggression. Research by Szmajke (1993) indicates that, in boys, partaking in sports can increase the tendencies associated with lesser need for social approval and pursuing standards of masculinity associated with aggressiveness, which are characteristic of adolescence. However, our research did not reveal differences between adolescent male and female athletes, which is why these interpretations should be considered with caution. Previous research has shown that taking part in sports protects one from engaging in problematic behaviours, however in the case of aggression, male athletes scored higher than male non-athletes, while female athletes scored lower than female non-athletes (Rhea & Lantz, 2004). In turn, a meta-analysis by Sønderlund et al. (2014) suggests that athletes are characterised by higher indices of violence than non-athletes. For this reason it is also worth noting the study by Fung and Lee (2018) which found that doing sports only reduces aggression if it is accompanied by studying Chinese martial arts and moral philosophy.

It is interesting that individuals who practise sports are characterised by higher levels of indirect aggression than are individuals who take part in physical education. For this reason, it is worth engaging in further, more detailed analyses of this phenomenon in the group of individuals who train sports, as well as in the context of their ways of perceiving rivalry and rules associated with rivalry during sport competitions. Direct expressions of anger and behaviours indicating high levels of direct or verbal aggression in a sports situation are regulated by disciplinary penalties. Thus, indirect aggression may be a more desirable strategy for expressing anger.

The mean score of the studied teenagers on the self-esteem scale is lower than the one in the normalisation sample (Dzwonkowska et al., 2008). It is worth noting the age difference between the participants of the current study and the participants of the cited study, which was between 14 and 18 – significant changes in self-esteem may occur during puberty (Kort-Butler & Hagemen, 2011). Moreover, as in the study by Dzwonkowska et al. (2008), mean scores in our study indicate average levels of this personality feature. In our study, boys were characterised by higher self-esteem than girls; similarly, the group engaging in intensive physical activity had higher self-esteem than the physically inactive group. Research by Viira (2011) indicates that

boys are characterised by higher self-assessment of their physicality and higher stability in time thereof, which may partially explain our results. Interestingly, no differences were observed in self-esteem between groups taking part in organised physical activity (PE and athletes) in comparison to non-active individuals, which is why the second hypothesis should be rejected. The data are even more interesting in the context of the finding of Nelson and Gordon-Larsen (2006) that physically active teenagers are less likely to have low self-esteem. Additionally, assessment of one's skills was associated with global self-esteem and partaking in sports gives one the opportunity for self-improvement and to prove oneself in training and competing. Moreover, research indicates that it is possible to strengthen teenagers' self-concept and self-esteem through physical activity, especially when it is an isolated intervention (not combined with developing other skills) and is directed at teenagers in a school environment (Liu, Wu, & Ming, 2015). The higher the levels of physical activity an individual has, the better their perception of their physical self, especially their sporting competence and physical condition (Niven, Fawkner, Knowles, & Stephenson, 2007). Gender is a moderator of this relationship – the correlation is stronger in boys (Babic et al., 2014). However a longitudinal study showed that both sport proficiency and physical condition are cross-sectional and longitudinal indicators of physical activity and other behaviours related to health as well as low levels of anxiety related to others' assessments of one's looks in both boys and girls (Crocker, Sabiston, Kowalski, McDonough, & Kowalski, 2006). Body image was inversely correlated with physical activity. It is worth adding that physical self-perception is both the effect of physical activity and its determinant. Thus, a positive feedback loop may be observed in the mutual influences of these two variables. Neumark-Sztainer, Paxton, Hannan, Haines, and Story (2006) recommend the development of a sense of acceptance of one's own body among teenagers, because dissatisfaction with one's looks is to a large degree correlated with behaviours that do not benefit one's health.

The analyses showed that global levels of self-esteem do not mediate the relationship between physical activity and aggression in youth, which is why the third hypothesis should be rejected. A study by Martínez-Martínez et al. (2018) showed that relational and overt aggressiveness are related to self-esteem and physical activity. However, aggression and physical activity in this study were analysed using a different theoretical construct. It should also be added that self-esteem is important for teenagers' development of identity and peer aggression, and low levels of self-esteem can lead to internalisation problems in individuals who exhibit aggressive behaviours (Ybrandt & Armelius, 2010). Thus, it may be

that self-esteem influences levels of aggressiveness in situations where it is problematic, which is why no such relationship was observed in our study.

LIMITATIONS

The main limitation of the present study was its explorative character and associated issues with unequal groups and the measurement tools used. Participants answered questions regarding the way they perceive their self-esteem and their aggressive behaviours as well as the number of hours devoted to particular types of physical activity. Using tools which collect data regarding actual physical activity, e.g. an accelerometer, would make it possible to objectively analyse both engagement in physical activity and sedentary behaviours (e.g. associated with preparing for school or watching TV series). The declarative and subjective perceptions of aggression may also bias results regarding aggressive behaviours. For this reason, future studies should take into account how teenagers' behaviours are perceived by their parents, teachers, or coaches. Such triangulation of data could allow more objective inferences to be made about actual levels of aggression.

Moreover, in future studies, selecting a different tool for measuring self-esteem should be considered, especially if one of the co-variables is to be the level of physical activity. On one hand, specific assessments of one's abilities are associated with global levels of self-esteem, and self-esteem regarding one's physical aspects influences the overall levels of self-esteem (Bowker, 2006; Guskowska et al., 2015). On the other hand, using a tool that measures self-esteem multidimensionally could allow analysis of the role of separate components of self-esteem in detail, not only in relation to physical activity, but also ways of spending one's free time and aggression levels.

Finally, in the future research, the number of participants representing various levels of physical activity should be increased. It will eliminate the problem with a potential impact of group size on the research results.

CONCLUSIONS

In summary, we observed gender differences and differences associated with physical activity levels in levels of aggression and its dimensions and self-esteem. However, no interaction effects were observed for levels of physical activity and gender. Undertaking compulsory physical activity in school and additional physical activity based on one's own interests is associated with lower levels of aggression in comparison to individuals who do not undertake any physical activity. For this reason, it is necessary to

continue consistently promoting physical activity in school and during free time. Prophylactic interventions should also be directed at adolescents' parents; the content of these interventions should concern issues related to both physical and emotional health.

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