

Association Between Physical Exercise And Psycho-Social Problems Among Adolescents In Secondary Education

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Abstract:

Background: Adolescence is a key period of growth in life, and the psychological development in this period is in a stage of rapid maturity without maturity, with distinct characteristics of self-contradiction. Psychosocial problems negatively affect school performance, social skills and mental development. In recent years, researchers have investigated the relationship between physical activity and psychological health. **The study aims** to examine whether physically inactive adolescents and slightly active adolescents experience more psychosocial problems compared with active adolescents. **Methods:** A school-based, cross-sectional questionnaire conducted among adolescents from January to April 2023 in KSA. To examine the association between physical exercise and psychosocial problems, multi-level linear regression was carried out. **Results:** The weighted average Strengths and Difficulties Questionnaire score of active adolescents was lower than that of inactive adolescents. Adolescents who are inactive had 12% ($\beta = 1.12$; 95% CI: 1.10–1.14; $P < 0.001$) more psychosocial problems compared with active adolescents. Further, inactive adolescents had a higher score on the subscales emotional problems ($\beta = 1.19$; 95% CI: 1.17–1.22; $P < 0.001$) and problems with peers ($\beta = 1.16$; 95% CI: 1.14–1.19; $P < 0.001$). There was no statistical significant difference in total score of the Strengths and Difficulties Questionnaire between active and slightly active adolescents. **Conclusion:** Physically active adolescents have fewer psycho^lsocial problems compared with physically inactive adolescents. Not only is this association significant, but there is an indication that it is also of clinical relevance.

Keywords: Physical exercise, Psycho-social problems, Adolescents and Secondary education.

Introduction

Physical activity (AP) refers to any body movement generated by skeletal muscles that require energy expenditure. How to encourage children and adolescents to perform an appropriate level of PA has always been a major public health concern ⁽¹⁾. According to the recommendation given by the WHO, to achieve health benefits, children and adolescents should do 60 min or more of moderate-to-vigorous-intensity PA each day ^(2,3). PA is an essential component of good health and wellbeing, and a lack of PA increases one's risk of adverse health outcomes and decreases one's life expectancy ⁽⁴⁾. The World Health Organization (WHO) recommends that children aged 5-17 years perform at least 60 minutes of moderate to vigorous-intensity PA daily. Vigorous-intensity PA that strengthens muscles and bones should be performed at least 3 days per week ⁽⁵⁾.

The WHO has identified inadequate PA as the fourth leading cause of non-

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communicable diseases (NCDs) ⁽⁶⁾. A meta-analysis of 23 studies concluded that the risk of cardiovascular diseases declines with increasing rates of PA ⁽⁷⁾. Globally, insufficient PA is responsible for an estimated 6% of the burden of disease from coronary heart disease, 7% from type II diabetes, 10% from breast cancer, and 10% from colon cancer ⁽⁴⁾. Insufficient PA was also responsible for 9% of the premature mortality from all causes (5.3 million deaths) globally ⁽⁴⁾. WHO reported an estimated 80% of adolescents aged between 11 and 17 years were inadequately physically active ^(6, 8). Several studies conducted in the Kingdom of Saudi Arabia (KSA) have reported high proportions of insufficient PA among both male (25.7-84.5%) and female adolescents (42.9-87.1%) and have recommended immediate public health interventions to prevent any future NCDs ⁽⁹⁻¹¹⁾.

Psychosocial problems can be a psychological problem as well as a social problem. These adolescents may have anxious feelings and thoughts and also may have problems in social interaction with others ⁽¹²⁾. Psychosocial problems among adolescents negatively affect school performance, social skills and mental development. Moreover, they lead to high social costs and are a major cause of increased health care use in later life ⁽¹³⁻¹⁶⁾. Researchers have investigated the relationship between physical activity and psychological health. Several cross-sectional studies have shown that regular exercise is associated with a lower risk of psychosocial problems in adults and children ⁽¹⁷⁻²⁵⁾. In a large-scale population study, however, no positive association was found between physical exercise and psychological health after controlling for several confounders ⁽²⁶⁾.

Various longitudinal studies have shown that people who exercise regularly are less likely to develop symptoms of anxiety or depression ^(17, 27-32). In contrast, some longitudinal studies found no relationship between exercise and mental health ⁽³³⁻³⁵⁾. The focus of these studies is on the association between physical exercise and psychological health instead of psychosocial problems. Therefore, this study aims to examine whether physically inactive adolescents and slightly active adolescents experience more psychosocial problems compared with active adolescents.

Methods

This study is a school-based cross-sectional questionnaire conducted among adolescents in the second and fourth grade of regular secondary education in KSA. The sampling frame consisted of all regular secondary schools in KSA enlisted with the ministry of education. A stratified sampling procedure was used. A proportional number of schools by educational level was randomly selected (N = 567). In total, 376 of the 567 contacted schools enrolled (66%). The schools that did not participate were too busy or had no interest. A total of 600 adolescents completed the online self-report questionnaire in the period from January to April 2023.

The monitor consists of 75 questions (189 items). The following are examples of topics were included in the questionnaire: grade, age, level of education, sex, family composition, living environment, perceived health, perceived happiness, psychosocial health, height and weight, physical exercise, nutrition, smoking, alcohol, drugs, school experience, bullying, social media, gaming and sexuality. The questionnaire includes validated instruments such as the Strengths and Difficulties Questionnaire (SDQ) and several questions about health and lifestyle. The version of the SDQ was used to measure the degree of psychosocial problems ⁽³⁶⁾.

The SDQ consists of 25 items with three possible answers: not true, somewhat true and certainly true. The SDQ is divided into five subscales: emotional problems, conduct problems, hyperactivity, peer problems and pro-social behavior. The total SDQ score is a fully dimensional measure: an increase in the total SDQ score corresponds with an increase in the risk of mental health disorder ⁽³⁷⁾. Compared with the other scales, an opposite interpretation applies for the pro-social behavior scale. Hence, a higher score means more pro-social behavior. Researchers translated questionnaire into Arabic language.

In this study, physical exercise was measured with a single-item question: 'For how

many days per week do you practice a sport or engage in physical exercise for at least one hour? Include all kinds of sports or exercise you do in a day.' Response choices were: (Almost) Never, 1 day per week, 2 days per week, 3 days per week, 4 days per week, 5 days per week, 6 days per week and every day. Adolescents were considered active, by answering 'every day' to this question⁽³⁸⁾. In this study, adolescents were considered inactive if they exercised <3 days a week. With regard to the respondents' psychosocial health, we compared the respondents who answered 'every day' (active), as a reference group, with those who answered '3–6 days per week' (slightly active) and with those who answered '<3 days a week' (inactive).

Probable sources of confounding were identified in the literature^(19, 23, 28, 35, 39, and 40). The following covariates and related categories (between brackets) were included in the analysis: gender, grade (2 or 4), age (12–13, 14–15, 16–17) household situation (parents living together vs. other answers), urbanization (highly, moderately, not urbanized), educational level (low, intermediate, high), and being bullied in the past 2 months (no/yes). These covariates are divided into three categories: demographic, social economic and lifestyle covariates.

All analyses were conducted in SPSS version 28. To examine the adjusted associations between physical exercise and psychosocial problems, multi-level linear regression was carried out with random effects to account for clustering of adolescents within schools. The total SDQ score and the categorical variable physical exercise were included in the model. A second multi-level model was fitted for the adjusted association between physical exercise and psychosocial problems with a fixed effect for the following demographic covariates: gender, grade, age, household situation, and urbanization. A third multi-level model was fitted for the above-mentioned association with fixed effects for the demographic covariates and the following socio-economic covariate: educational level. A fourth multi-level model was fitted with fixed effects for demographic, socioeconomic.

These four models were also fitted in a multi-level model to determine the association between the five sub-scale scores of the SDQ and physical exercise. The logarithmically transformed regression coefficients of the total SDQ score corrected for demographic, socioeconomic and lifestyle covariates appeared to be most relevant in this study. The relative differences between the regression coefficients in total SDQ score of inactive and active adolescents presented in this model were considerable compared with the other models. Therefore, both adjusted and unadjusted models are presented in table (3).

The normality of the primary outcome measures was visually inspected. The outcome variables were log transformed because they were positively skewed. The distribution of the total SDQ score ranges from 0 to 40. It is not possible to logarithmically transform zeros. For that reason we added a constant to each answer on the 25 items [$\log(x + 1)$] to make all results positive and not zero^(41, 42). No imputation technique was used. The fractions of missing values of the outcome variables and independent variables were very small (<0.5%). The influence of missing values on the association between physical exercise and psychosocial problems was considered to be very low. A P values smaller than 0.001 was considered statistically significant.

Results

Table (1) shows that most adolescents in our sample were 14 or 15 years old (44%), living with both their parents (76%), had a low educational level (52%). More girls than boys were inactive (19% vs. 15%). Other noteworthy differences in this sample were that older adolescents were more often inactive than younger adolescents (23% vs. 14%).

Table (2) shows the weighted average total SDQ score of active adolescents [9.33 5.05 (SD)] was lower that of the inactive adolescents (10.97 5.45). There is no difference between the active and slightly active adolescents (9.30 4.83).

Table (3) shows the logarithmically transformed coefficients of the unadjusted and adjusted models that estimate the association between the frequency of physical exercise and psychosocial problems. Both unadjusted as adjusted coefficients between active and inactive

adolescents are significant.

Table (4) shows that after the antilog procedure, the average total SDQ score of adolescents who were inactive was 1.12 times higher than that of adolescents who were active ($\beta = 1.12$; 95% CI: 1.10–1.14; $P < 0.001$). In other words, inactive adolescents were likely to have psychosocial problems compared with active adolescents. Additionally, it was relatively more common for inactive adolescents to have emotional problems ($\beta = 1.19$; 95% CI: 1.17–1.22; $P < 0.001$), conduct problems ($\beta = 1.03$; 95% CI: 1.01–1.05; $P < 0.001$), hyperactivity ($\beta = 1.03$; 95% CI: 1.00–1.05; $P < 0.001$), problems with peers ($\beta = 1.16$; 95% CI: 1.14–1.19; $P < 0.001$) and exhibit less pro-social behavior ($\beta=0.94$; 95% CI: 0.93–0.95; $P < 0.001$) compared with active adolescents.

The association between the average SDQ score of active adolescents and that of slightly active adolescents was almost statistically significant according to our threshold of 0.001 ($\beta = 1.01$; 95% CI: 1.00–1.03; $P = 0.0012$). Emotional problems ($\beta = 1.08$; 95% CI: 1.06–1.09; $P < 0.001$) were more common in slightly active adolescents compared with active adolescents. The weak but statistically significant association of conduct problems and problems with peers between these groups: 0.97 (95% CI: 0.96–0.98; $P < 0.001$) and 1.02 (95% CI: 1.01–1.04; $P < 0.001$), respectively.

Table (1): Adolescents demographic, socio-economic and lifestyle characteristics in relation to physical exercise levels, N (%)

Covariates	Physical exercise		
	Active %	Slightly active %	Inactive %
Gender			
Male	21	64	15
Female	18	63	19
Age			
12–13	20	66	14
14–15	19	64	17
16–17	19	59	23
Grade			
Second class	20	65	15
Fourth class	19	63	18
Household situation			
Living with two parents	20	65	15
Other answers	18	60	22
Urbanization			
(Very) highly urbanized	18	62	20
Moderately urbanized	19	64	17
Not urbanized	20	66	14
Level of education			
Low	19	60	21
Intermediate	19	67	13
High	20	70	10
Being bullied			
No	19	64	16

Covariates	Physical exercise		
	Active	Slightly active	Inactive
	%	%	%
Yes	18	61	21

Table (2): Total SDQ and subscale scores in relation to physical exercise levels, mean (SD)

	Scale	Inactive	Slightly active	Active	Total	
	Range	Mean(SD)	Mean (SD)	Mean (SD)	Mean	(SD)
Total difficulties score	0–40	10.97 (5.45)	9.30 (4.83)	9.33 (5.05)	9.59	(5.02)
Emotional problems	0–10	2.87 (2.29)	2.33 (2.09)	2.08 (2.04)	2.37	(2.13)
Conduct problems	0–10	1.86 (1.63)	1.54 (1.38)	1.70 (1.54)	1.63	(1.46)
Hyperactivity	0–10	4.28 (2.40)	4.02(2.36)	4.16 (2.48)	4.09	(2.39)
Peer problems	0–10	1.97 (1.65)	1.41 (1.44)	1.39 (1.48)	1.50	(1.50)
Pro-social behavior	0–10	7.54 (1.91)	7.92 (1.68)	8.00 (1.75)	7.87	(1.74)

Table (3): Multi-level linear regression for five subscales of the SDQ

	<u>Slightly active (ref. Inactive (ref. active) active)</u>				<u>Slightly active (ref. Inactive (ref. active) active)</u>			
	Unadjusted model				Adjusted model^a			
SDQ-score	β	95% CI	β	95% CI	β	95% CI	β	95% CI
Total SDQ score	0.012 0.013	-0.001 to .025	0.152*	-0.000 to 0.026	0.132 to 0.172	0.111*	0.091 to 0.131	
Emotional problems	0.090*	0.073*	0.074 to 0.106	0.057 to 0.089	0.251*	0.228 to 0.274	0.178*	0.155 to 0.201
Conduct problems	-0.047*	-0.060 to -0.033	0.032*	0.025*	0.012 to 0.052	0.005 to 0.045		
Hyperactivity	-0.016	-0.032 to 0.000	0.032**	0.028*	0.012 to 0.052	0.005 to 0.051	-0.010	
Peer problems	0.025*	0.009 to 0.041	0.203*	0.183 to 0.223	0.023*	0.007 to 0.039		
Pro-social behavior	-0.008*	-0.015 to -0.001	-0.063*	-0.073 to -0.053	-0.056*	-0.066 to -0.046		

a: Adjusted for gender, grade, household situation, urbanization, level of (secondary) education.

*: P < 0.001

Table (4): Multi-level linear regression after the antilog procedure, the average total SDQ score of adolescents

SDQ-score	<u>Slightly active (ref. active)</u>		<u>Inactive (ref. active)</u>		<u>Slightly active (ref. active)</u>		<u>Inactive (ref. active)</u>	
	Unadjusted model				Adjusted model^a			
	β	95% CI	β	95% CI	β	95% CI	β	95% CI
Total SDQ score	1.01	1.00 to 1.02	1.16*	1.14 to 1.19	1.01	1.00 to 1.03	1.12*	1.10 to 1.14
Emotional problems	1.09*	1.08 to 1.11	1.29*	1.26 to 1.32	1.08*	1.06 to 1.09	1.19*	1.17 to 1.22
Conduct problems	0.95*	0.94 to 0.97	1.03*	1.01 to 1.05	0.97*	0.96 to 0.98	1.03*	1.01 to 1.05
Hyperactivity	0.98	0.97 to 1.00	1.03*	1.01 to 1.05	0.99	0.97 to 1.01	1.03*	1.01 to 1.05
Peer problems	1.03*	1.01 to 1.04	1.23*	1.20 to 1.25	1.02*	1.01 to 1.04	1.16*	1.14 to 1.19
Pro-social	0.99*	0.99 to 1.00	0.95*	0.94 to	0.98	0.98 to 0.99	0.94*	0.93 to

behavior	0.96	0.95
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a: Adjusted for gender, grade, household situation, urbanization, level of (secondary) education.

*: $P < 0.001$.

Discussion

The aim of this study was to explore whether inactive and slightly active adolescents experience more psychosocial problems compared with active adolescents. Main findings of this study provide evidence of an inverse association between the physical activity level of adolescents and the extent of their psychosocial problems. Inactive adolescents experience more psychosocial problems than active adolescents. Similarly, inactive adolescents experience more emotional and conduct problems, hyperactivity, problems with peers and show less pro-social behavior. The differences between slightly active and active adolescents are less distinctive. For example, there is no statistical significant difference in total SDQ score between active and slightly active adolescents.

Clinical relevance also plays a role in the interpretation of the observed association. Beforehand, we considered a result clinically relevant if the difference in adjusted regression (β) coefficient between active and inactive adolescents was greater than one point. Depending on the baseline value, an increase in one point on the SDQ scale could imply that an adolescent will be referred to a psychologist. The difference in weighted average total SDQ score between active and inactive adolescents is more than 1.5 point (table 2). This indicates, to our standards, a clinically relevant difference in psychosocial problems.

However, due to the skewness of the distribution, we had to logarithmically transform the outcome measures. Therefore, the regression coefficients have to be interpreted as a ratio between those groups of adolescents instead of a difference. As a consequence, clinical relevance could not be deduced from these regression coefficients. The above-mentioned findings corroborates with earlier cross-sectional findings ^(20, 22, 23, 25). These studies showed that lack of exercise was associated with various psychological problems. Psychosocial problems consist partly of psychological problems, making these findings relevant.

However, these results are not in line with some longitudinal studies ^(33, 35). Furthermore, Stavrakakis et al.,(2013) ⁽⁴³⁾ focused on the onset of depressive disorders and physical activity but found no evidence of such an effect of physical activity on depression. This implies that the association we found in our data might be of limited value. On the other hand, from the same author in 2012 also studied the prospective relationship between physical activity and depressive symptoms in adolescents and found a weak statistically significant negative association ⁽⁴⁴⁾. This shows that the relationship between physical activity and psychological health is complex. Genetic and biological factors, personality traits and environmental factors such as social economic status and lifestyle habits interact and jointly affect psychosocial problems ^(43, 44).

In combination with these factors, sufficient physical exercise might prevent or mitigate psychosocial problems. It was known in advance that most studies showed that physical exercise were associated with psychological problems. However, none of these studies focused on psychosocial problems. Psychosocial health is the outcome measure of the SDQ, widely used in youth care. This research has shown that physical exercise is also associated with less of psychosocial health.

Conclusion

This study shows that physically active adolescents have fewer psychosocial problems than inactive adolescents. This association is not only statistically significant, but we think that it is also of clinical relevance. Inactive adolescents experience more emotional and conduct problems, hyperactivity, problems with peers and they show less pro-social behavior. Compared with active adolescents, slightly active adolescents experienced more emotional

problems and problems with peers. However, slightly active adolescents experienced fewer conduct problems compared with active adolescents.

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