DETERMINANTS OF CHANGES IN PHYSICAL ACTIVITY LEVELS IN LATE ADOLESCENCE; PROSPECTIVE ANALYSIS IN URBAN COMMUNITIES

https://doi.org/10.5817/CZ.MUNI.P210-9631-2020-39

Natasa Zenic [1], Admir Terzic [2], Ivan Kvesic [3]

[1]*University of Split, Faculty of Kinesiology, Split, Croatia*

[2]*University of Tuzla, Faculty of Physical Education and Sport, Tuzla, Bosnia and Herzegovina*

[3]*University of Mostar, Faculty of Science and Education, Mostar, Bosnia and Herzegovina*

ABSTRACT

Purpose: Physical activity levels (PA-levels) significantly decline during adolescence, and sport participation during childhood and adolescence is frequently emphasized as protective factors of PA-decline. However, there is a lack of studies which specifically examined sport-related factors and its influence on changes in PA (PA-changes) in adolescence. This study aimed to prospectively observe sport factors as: (i) correlates of PA-levels and (ii) predictors of PA-changes in the period between 16 and 18 years of age among urban adolescents from Bosnia and Herzegovina.

Methods: The sample of participants comprised 324 adolescents (44% females) who were prospectively observed over two testing waves: (i) baseline, when participants were 16 years old; and (ii) follow-up, 20 months later (18 years of age). The variables were collected by previously validated questionnaires including questions on predictors (sociodemographic variables and various sport factors [current/former/ever participation in individual and team sports, experience in sports, competitive result achieved]), and criteria (PA level obtained at study baseline and follow up, measured by Physical Activity Questionnaire for Adolescents [PAQ-A], and difference between PA-levels at baseline and follow-up). The t-test was used to compare PA-levels. The associations between variables were evidenced by: (i) Spearman's rank order correlations (between predictors and PA-levels), and (ii) logistic regression analysis (between predictors, and PA-changes observed as binomial criterion [PA-incline vs. PA-decline] – excluding those participants who reported active sport participation at study baseline).

Results: The PA-level significantly declined over the study course (t-test: 6.60, $p < 0.01$). Sport-related predictors were significantly associated with PA at baseline (Spearman's R: 0.33–0.45, $p < 0.01$), and PA at follow-up (Spearman's R: 0.32-0.45, $p < 0.01$). Meanwhile, there was no significant correlation between studied predictors and differences in PA-levels between baseline and follow-up. Also, logistic regression did not reveal any significant influence of predictors obtained at study baseline and PA-changes observed as binomial criterion (PA-incline vs PA-decline).

Conclusion: While studied sport-related predictors significantly influence the PA-levels in the age of 16 and 18, with the higher level of PA among those adolescents who are actively involved in sports, sport-participation do not predict changes in PA-levels over the observed period of life. Knowing the influence of PA on overall health status, future studies should provide additional details on possible predictors of PA-changes in adolescence.

Keywords: physical activity; adolescents; sport participation; changes; logistic regression

Introduction

Physical activity (PA) is an important determinant of overall health status and consequently it is a widely recognized public health concern (Haskell, Blair, & Hill, 2009; Kohl 3rd et al., 2012). Most of the lifelong patterns related to health behavior are established during childhood and adolescence, and promotion of PA should begin at an early age (Best, Ball, Zarnowiecki, Stanley, & Dollman, 2017). One of the approaches which showed promising results is identification of the factors which may be potentially related to PA-levels in different age groups. In general, the idea is to evidence factors which may be negatively related to PA (in order to control it as "risk factors"), as well as to find factors that may be positively related to PA (in order to proclaim it) (Miljanovic Damjanovic, Obradovic Salcin, Zenic, Foretic, & Liposek, 2019).

Sport-factors are frequently observed as being related to PA levels of children and adolescents (Van, Paw, Twisk, & Van, 2007). Naturally, sport participation is in most cases "physically demanding", and consequently the overall PA-levels of children involved in sport is logically higher than PA of those children who are not engaged in sport activities. Collectively, studies regularly confirmed strong positive correlation between sport participation and PA-levels in children and adolescents, emphasizing the importance of sport participation in reaching appropriate levels of PA in youth. The importance of such investigations is accentuated by the simple fact that PA-levels significantly decrease during late adolescence, and therefore knowledge on factors which reduces such negative trends is additionally important (Kohl 3rd et al., 2012). However, while there is no doubt does the sport participation positively influence PA levels in children and adolescents, the association between sport-participation and PA-changes which occur later (i.e. when children are not actively involved in sport) are not known. The most probable reason for the lack of such knowledge is the fact that answering actually requires prospective analyses, which are more complex and challenging than cross-sectional studies. Theoretically, even cross-sectional findings on "higher PA in athletic children" could be questioned with regard to its causality. In short, while there is a logical possibility that "sport increases PA", there is still a chance that the cause-effect relationship should be observed in "opposite direction" (i.e. those children who naturally tend toward high levels of PA are more inclined toward sport participation).

This study aimed to prospectively observe the influence of sport factors on (i) PA-levels, and (ii) changes in PA-levels, in older adolescents from urban communities. We hypothesized that sport participation in earlier adolescence (i) will have positive impact on PA and (ii) will prevent PA-decline in late adolescence.

Methods

The participants were adolescents from urban communities from three cantons in Bosnia and Herzegovina (B&H; Tuzla-, Western Herzegovina-, and Herzegovina-Neretva Canton). Participants were attending their 3rd year of high-school (approximately 16 years of age) at study baseline, and the follow-up testing was commenced at the end of their 4th year of high school (approximately 18 years of age), approximately 20 months after baseline testing (2nd wave). Since previous studies identified clear influence of community (urban/rural) on changes in PA levels (Miljanovic Damjanovic et al., 2019), in this study we were specifically focused on urban children.

In the first phase of the sampling procedure we stratified all the high schools in selected cantons into two groups according to their size. Second, we randomly selected one-third of the 3rd-year classes from two defined groups. Then, the investigators residing in B&H (please see authors of the paper) visited schools and distributed the consent forms, which were duly signed by one of the parents/responsible adults. The baseline testing was performed in the following week. The testing was anonymous, but we asked participants to use self-defined confidential code to pair the responses at two testing waves. They were instructed about the study aims, that testing was absolutely anonymous, and that they could leave the questionnaire unanswered. After testing, participants placed the questionnaire form in the closed box. The procedure and study fulfilled ethical guidelines and was approved by ethical board of University of Split, Faculty of Kinesiology (Split, Croatia).

The variables included participants' sociodemographic characteristics (gender, age [in years]), sport factors, and PA levels. The PA levels were tested by the Physical Activity Questionnaire for Adolescents (PAQ-A). In short, PAQ-A was repeatedly found to be a reliable and valid questionnaire in samples similar to one observed herein (Pojskic & Eslami, 2018; Samaržija & Mišigoj-Duraković, 2013). The questionnaire consists of nine items asking participants to provide seven-day self-report recall, with a final theoretical score ranging from 0 (minimum) to 5 (maximum PA level). The first 8 items include questions on various types of PA (i.e., PE activity during sports, physical education, sports, active transportation). Generally, the PAQ-A provides a composite PA score derived from eight items (the 9th item does not contribute to the overall score). On the basis of this instrument we observed three variables: (i) PA-level at study baseline, (ii) PA-level at follow-up, and (iii) PA-changes (obtained as the difference between baseline and follow-up PA levels). Consequently, we were able to identify two categories of adolescents: (i) those whose PA levels declined and (ii) those whose PA levels inclined during the study period, which was later used as the criterion variables in logistic regression calculation. Sport factors were tested at baseline, and included questions asking students about their sport participation: (i) involvement in competitive team sports and (ii) involvement in competitive individual sports (both reported as never involved, quit or currently involved), (iii) highest competitive sport-achievement/result (never involved/competed, locally, nationally/internationally), (iv) duration of sport involvement (never participated, <1 year, 2–5 years, > 5 years) (Zenic et al., 2019)

Descriptive statistics included means and standard deviations (for numerical variables); and percentages and frequencies (for ordinal and nominal variables). Student's t-test was used to compare PA-levels. The associations between variables were evidenced by: (i) Spearman's rank order correlations (to identify correlations between sport-factors and PA-levels), and (ii) logistic regression analysis (to evidence influence of studied variables and on PA-changes observed as binomial criterion [PA-incline vs. PA-decline]; for those adolescents who did not report active sport participation at study baseline), with Odds ratios (ORs) with 95% confidence intervals (95% CIs) reported. A p-value of 95% was applied, and the statistical package Statistica ver. 13.0 (Statsoft, Tulsa, OK) was used for all calculations.

Results

Table 1 *Descriptive statistics (F – frequencies, % – percentage) for sport factors obtained at baseline*

	Total		Males		Females	
	F	%	F	%	F	%
Participation in individual sport						
Yes, still participating	70	21.60	56	32.56	14	9.21
Quit	120	37.04	62	36.05	58	38.16
No, never	134	41.36	54	31.40	80	52.63
Participation in team sport						
Yes, still participating	66	20.37	50	29.07	16	10.53
Quit	164	50.62	92	53.49	72	47.37
No, never	94	29.01	30	17.44	64	42.11
Experience in sport						
Never participated	66	20.37	22	12.79	44	28.95
< 1 year	60	18.52	22	12.79	38	25.00
2–5 years	108	33.33	62	36.05	46	30.26
> 5 years	90	27.78	66	38.37	24	15.79

	Total		Males		Females	
	F	%	F	%	F	%
Competitive achievement						
Never competed/participated	150	46.29	70	40.70	80	52.63
Local	138	42.59	86	50.00	52	34.21
National/International	36	11.11	16	9.30	20	13.16

When observed at baseline, 20% of participants were never involved in sports, with males being more involved in sports than females (13% and 29% non-involved for males and females, respectively). These figures were logically followed with higher sport competitive achievement and longer sport involvement among males (Table 1).

The PA-level significantly declined over the course of the study in total sample (t-test: 6.60, $p < 0.01$) among females (t-test: 3.51, $p < 0.01$), and males (t-test: 5.04, $p < 0.01$). Further, PA-level in males was significantly higher than in females (t-test: 8.73 and 6.71, $p < 0.01$ at baseline and follow-up, respectively) (Figure 1).

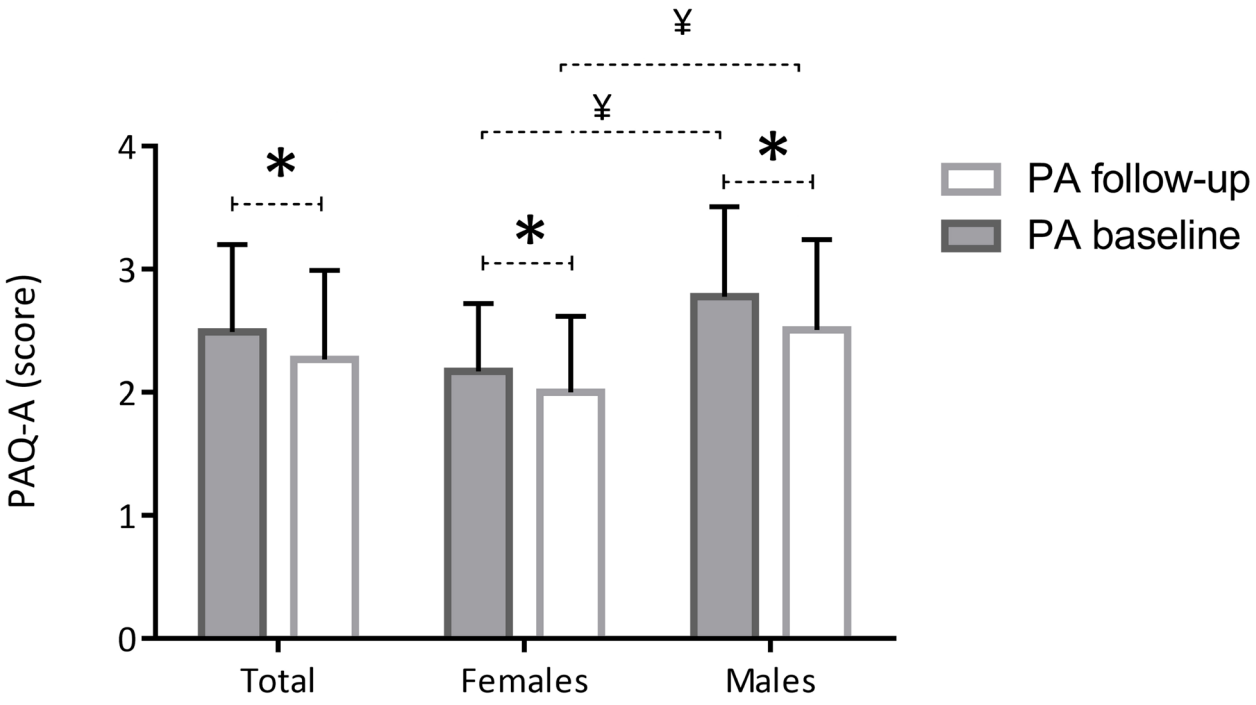

Figure 1 *Descriptive statistics (Means + Standard Deviations) for the physical activity as obtained by Physical Activity Questionnaire for Adolescents (PAQ-A) with t-test differences between groups (* indicates significance of $p < 0.05$) and within groups (¥ indicates significance of $p < 0.05$)*

Table 2 *Spearman's rank order correlation between sport factors and physical activity levels (PAQ-A) obtained at study baseline follow-up and physical activity changes over the course of the study course (differences)*

		PAQ-A (baseline)	PAQ-A (follow-up)	PAQ-A (differences)
Participation in individual sport	Total	0.39*	0.30*	0.02
	Males	0.29*	0.19*	0.05
	Females	0.31*	0.32*	0.07
Participation in team sport	Total	0.45*	0.41*	0.03
	Males	0.43*	0.41*	0.00
	Females	0.33*	0.32*	0.01
Experience in sport	Total	0.41*	0.38*	0.00
	Males	0.44*	0.37*	0.05
	Females	0.18*	0.33*	-0.10
Competitive achievement	Total	0.31*	0.45*	0.00
	Males	0.45*	0.39*	0.08
	Females	0.11	0.32*	-0.12

Sport-related factors were positively associated with PA at baseline (Spearman's R: 0.33–0.45, $p < 0.01$), and PA at follow-up (Spearman's R: 0.32–0.45, $p < 0.01$). Meanwhile, there was no significant correlation between studied predictors and differences in PA-levels between baseline and follow-up (Table 2).

The logistic regression calculated in order to identify possible association between sport factors at study baseline and changes of PA observed as binomial criterion (PA-incline vs PA-decline) did not reveal any significant influence of predictors on criterion (Figure 2)

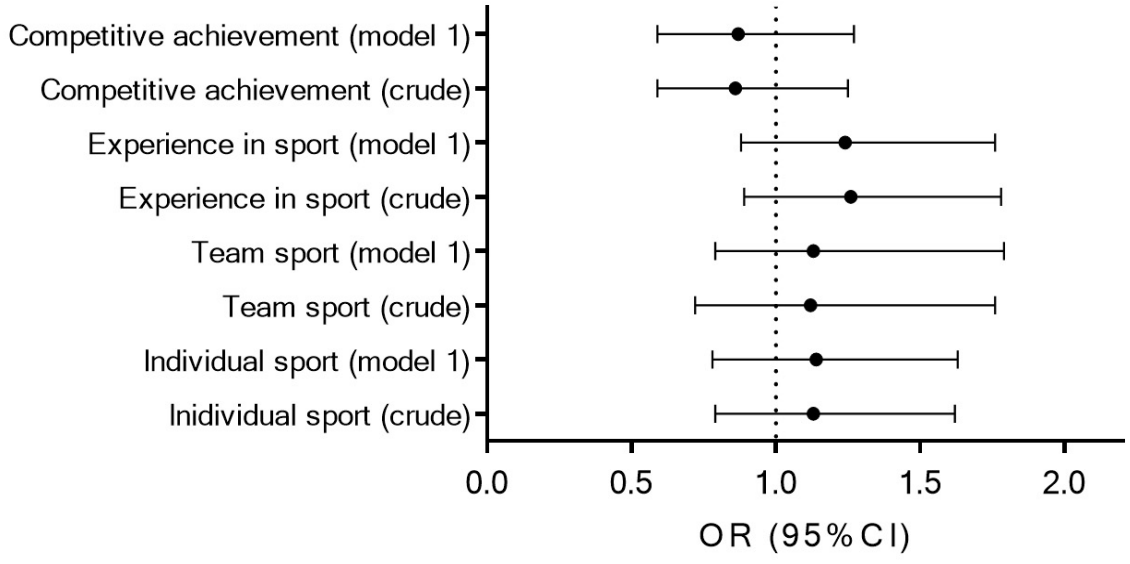

Figure 2 *Results of logistic regression calculated for binomial criterion PA incline vs. PA decline over the course of the study (model 1 – model adjusted for gender as covariate; crude – nonadjusted regression model) for those participants who did not report active sport participation at study baseline*

Discussion

It is globally confirmed that sport participation plays important role in PA in childhood and adolescence (Sallis, Prochaska, & Taylor, 2000). However, recent studies confirmed that sport participation actually increases the PS levels not only throughout sport participation "per-se", but children who are actively involved in sport are more likely to have higher levels of everyday PA than their non-athletic peers (Telford et al., 2016). The mechanism of such influence was logically explained throughout differences in fitness status between sport participants and non-exercising children. In brief, those children who were engaged in sport were more likely to have better fitness allowing them to be generally physically active (Telford et al., 2016). Although we did not observe the PA levels in details, our findings are generally supportive to such considerations, because of the evident positive correlation between different sport factors and PA in studied adolescents, irrespective of gender.

With regard to eventual differential influence of various studied sport factors on PA level, we did not evidence that some of the studied factors are more or less correlated with PA levels. However, it seems that correlation between sport factors and PA level in increases in females, while decreases in males during the course of the study (note that for females correlation coefficients are numerically higher in follow-up). For a moment we can therefore hypothesize that sport participation in females induce certain positive tendency toward physical activity, which is evidenced even after they quit organized (competitive) sports. On the other hand, such tendencies are not evidenced from males. Most probably, the differences in the original motives for sports participation between genders could explain such findings. In brief, while girls prefer fitness and sociability as motives for sport participation, boys are more oriented toward "competitive motives" (i.e. "I want to be a sport star", "To be popular", "Enjoyment in competition") (Soares, Antunnes, & van den Tillaar, 2013). As a result, with the end of "competitive sport engagement" girls are more likely to participate in other types of physical activities (i.e. fitness exercising, outdoor activities) than boys.

Our results did not confirm that sport participation in adolescence is a factor which influence changes in PA activity between 16 and 18 years of age. This is particularly important finding, since this period of life is known to be characterized by significant decrease in PA level, while sport participation is frequently observed as "preventive" against such decrease (Dumith, Gigante, Domingues, & Kohl III, 2011). Since in this analysis we included only participants who did not report active sport participation at study baseline, it is clear that results actually do not confirm the hypothesis about "protective effect" of sport participation in adolescence against decrease in PA level. From the authors' perspective, as former athletes and active sport pedagogues, the most probable explanation of such findings could be found in "orientation to success", which is dominant approach in youth sport in the country. In other words, sport programs in adolescence are mostly oriented toward competitive achievement, and therefore children are not properly educated about positive outcomes of sport participation which will be important later in life (i.e. health related fitness, positive social consequences).

Conclusion

While sport factors were correlated with PA levels at study baseline and follow-up indicating higher PA level in adolescents involved in competitive sports, sport factors were not identified as being significant predictors of changes in PA levels between the age of 16 and 18 years. Therefore, we may support only the first of our study hypotheses (i.e. on positive association between sport participation and PA-levels in adolescents). The most probable explanation for lack of influence of sport participation on PA-changes in late adolescence may be found in lack of "health-education approach" in adolescent sport participation. Knowing the importance of PA and globally confirmed decrease of PA-levels in late adolescence, future studies are needed in order to identify the correlates of PA-changes in this period of life.

References

Best, K., Ball, K., Zarnowiecki, D., Stanley, R., & Dollman, J. (2017). In Search of Consistent Predictors of Children's Physical Activity. *Int J Environ Res Public Health, 14*(10).

Dumith, S. C., Gigante, D. P., Domingues, M. R., & Kohl III, H. W. (2011). Physical activity change during adolescence: a systematic review and a pooled analysis. *Int J Epidemiol, 40*(3), 685–698.

Haskell, W. L., Blair, S. N., & Hill, J. O. (2009). Physical activity: health outcomes and importance for public health policy. *Prev Med, 49*(4), 280–282.

Kohl 3rd, H. W., Craig, C. L., Lambert, E. V., Inoue, S., Alkandari, J. R., Leetongin, G., . . . Group, L. P. A. S. W. (2012). The pandemic of physical inactivity: global action for public health. *The Lancet, 380*(9838), 294–305.

Miljanovic Damjanovic, V., Obradovic Salcin, L., Zenic, N., Foretic, N., & Liposek, S. (2019). Identifying Predictors of Changes in Physical Activity Level in Adolescence: A Prospective Analysis in Bosnia and Herzegovina. *Int J Environ Res Public Health, 16*(14).

Pojskic, H., & Eslami, B. (2018). Relationship Between Obesity, Physical Activity, and Cardiorespiratory Fitness Levels in Children and Adolescents in Bosnia and Herzegovina: An Analysis of Gender Differences. *Front Physiol, 9*, 17–34.

Sallis, J. F., Prochaska, J. J., & Taylor, W. C. (2000). A review of correlates of physical activity of children and adolescents. *Med Sci Sports Exerc, 32*(5), 963–975.

Samaržija, D. V., & Mišigoj-Duraković, M. (2013). Pouzdanost hrvatske verzije upitnika za procjenu ukupne razine tjelesne aktivnosti djece mlađe školske dobi. *Hrvatski športskomedicinski vjesnik, 28*(1), 24–32.

Soares, J., Antunnes, H., & van den Tillaar, R. (2013). A comparison between boys and girls about the motives for the participation in school sport. *Journal of Physical Education and Sport, 13*(3), 303.

Telford, R. M., Telford, R. D., Cochrane, T., Cunningham, R. B., Olive, L. S., & Davey, R. (2016). The influence of sport club participation on physical activity, fitness and body fat during childhood and adolescence: The LOOK Longitudinal Study. *J Sci Med Sport, 19*(5), 400–406.

Van, K. D. H., Paw, M. J., Twisk, J. W., & Van, W. M. (2007). A brief review on correlates of physical activity and sedentariness in youth. *Med Sci Sports Exerc, 39*(8), 1241–1250.

Zenic, N., Terzic, A., Ostojic, L., Sisic, N., Saavedra, J. M., Kristjansdottir, H., . . . Sekulic, D. (2019). Educational and sport factors as predictors of harmful alcohol drinking in adolescence: a prospective study in Bosnia and Herzegovina. *Int J Public Health, 64*(2), 185–194.