

THE RELATIONSHIP BETWEEN SPORTS PARTICIPATION AND CIGARETTE SMOKING IN ADOLESCENTS; PRELIMINARY RESULTS OF A PROSPECTIVE COHORT STUDY

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Original scientific paper

Abstract

This prospective cohort study aimed to define gender-specific relationships that exist between participation in sports and smoking among older adolescents. The sample comprised 414 adolescents (270 females) from Bosnia and Herzegovina who were 16–17 years old at the baseline. The participants were tested over four occasions (T1, T2, T3 and T4), each divided by six months. The first test (T1) was performed at the beginning of the participants' 3rd grade of high-school, while the last test (T4) was done at the end of their high-school education. A previously validated structured questionnaire was used to define participants' involvement in sports and the prevalence of cigarette smoking. Although the odds ratio (OR) varied between time points, sports participation was found to be generally protective against cigarette smoking in males (T1: OR=3.83; 95%CI:1.89-7.09, T2: OR=1.31; 95%CI:0.76-2.67, T3: OR=2.72; 95%CI:1.35-5.50, T4: OR=1.41; 95%CI:0.71-2.81) and females (T1: OR=1.32; 95%CI:0.72-2.44, T2: OR=2.64; 95%CI:1.07-6.32, T3: OR=2.02; 95%CI:0.89-4.56, T4: OR=2.07; 95%CI:1.13-3.77). Trends over time revealed that smoking initiation preceded adolescent males quitting sports. No such association was evident for adolescent females.

Key words: sport, puberty, tobacco smoking.

Introduction

Although decreasing globally, cigarette smoking is still one of the leading health risk factors and the sixth leading cause of death worldwide. Those who reach the age of 21 without smoking are less likely to smoke later in life. Therefore, special efforts are needed to define factors that directly or indirectly influence smoking habits during adolescence (Haibach, Homish, Collins, Ambrosone, & Giovino, 2014; Mays et al., 2014; Ali, Amialchuk, & Heller, 2015). Bosnia and Herzegovina is a country traditionally oriented toward tobacco growing. Consequently, cigarette smoking is socially accepted and the prevalence of smoking in this country and the wider region (i.e. the territory of former Yugoslavia) is repeatedly found to be alarming. Therefore, a precise and accurate public health strategy aimed at defining factors that could reduce cigarette smoking is needed (Zenici, Ostojic, et al., 2015; Zenici, Terzic, Rodek, Spasic, & Sekulic, 2015; Zenici et al., 2017). Participation in sports among young people has been shown to promote social well-being, physical and mental health, academic achievement, self-discipline, and socialization (Eime, Young, Harvey, Charity, & Payne, 2013). Consequently, sport is also considered to be potentially protective against cigarette smoking (Sekulic, Ostojic, Vasilj, Coric, & Zenici, 2014). However, results of those studies that have examined sports in relation to smoking to date have not been consistent (Garry & Morrissey, 2000; Mattila, Raisamo, Pihlajamaki, Mantysaari, & Rimpela, 2012). Indeed, when athletic cohorts of adolescents were compared with their peers who were not involved in sport, investigations have

mostly confirmed a lower likelihood of smoking among athletic adolescents (Peretti-Watel et al., 2003; Rodriguez & Audrain-McGovern, 2004). However, specific sport factors such as competition level achieved or kind of sport were found to be associated with increased cigarette smoking (Peretti-Watel et al., 2003; Bedendo & Noto, 2015). Some investigators found a higher level of experimentation with cigarettes among sport participants (Garry & Morrissey, 2000), or no association between sport participation and smoking (Davis et al., 1997). Also, there is evidence that the association between sport participation and smoking may differ between genders (Peretti-Watel, Beck, & Legleye, 2002; Modric, Zenic, & Sekulic, 2011; Sekulic et al., 2014). What is particularly interesting is that very recent studies indicated high risk of smoking in those children who once practiced sports and then quitted (Tahiraj et al., 2016; Sekulic et al., 2017; Zenici et al., 2017). However, there is an evident lack of knowledge on gender-specific relationships between sport participation and smoking in adolescence. This study aimed to prospectively explore gender-specific relationships between participation in sports and cigarette smoking among adolescent high-school students from Bosnia and Herzegovina.

Methods

The cohort included 505 adolescents from Bosnia and Herzegovina at the baseline; however, because of the dropout rate, this study involved 414

adolescents (270 females) from Herzegovina-Neretva Canton and Zenica-Doboj Canton in Bosnia and Herzegovina. At the baseline, the participants were 16–17 years old and were in their third year of high school. They were randomly selected, and tested on four occasions, each separated by 6 months: T1, at the beginning of the third year of high-school (baseline); T2, at the end of the third year; T3, at the beginning of the fourth year; and T4, at the end of the fourth grade of the high school (i.e. the end of high-school education; see Figure 1 for details on sampling and testing). One week before administering the survey, we explained the full procedure and study aims to all participants and to at least one parent per participant. Passive informed consent was obtained

from parents, and none of the parents refused their child's participation. The response rate on questionnaire items was over 99%. The study was approved by the author's Institutional Ethical Board. The study participants remained anonymous (no personal data were collected), but participants were asked to use self-selected confidential codes for identification purposes in all four tests. The children were suggested to use three last digits of their e-mail password as a code for identification (i.e. such codes were easy to remember between waves while being confidential at the same time). Such identification of the participants allowed us to track and eliminate non-responders from the final statistical analyses. Study design is more precisely presented in Figure 1.

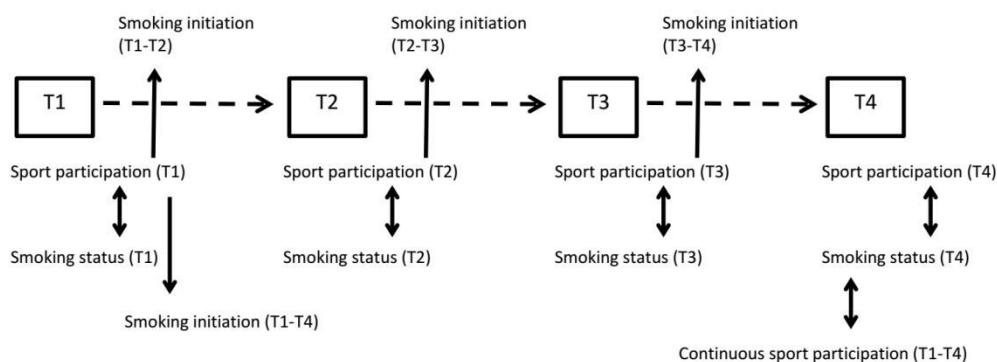


Figure 1 Study design and analytical approach.

Legend: T1 – first semester of the 3rd year of high school; T2 – second semester of the 3rd year of high school; T3 – first semester of the 4th year of high school; T4 – second semester of the 4th year of high school; arrows present calculated relationships.

Surveys were performed using a self-administered questionnaire that had been previously validated in a similar population (Modric et al., 2011; Sekulic, Ostojic, Hajdarevic, & Ostojic, 2012). Testing was strictly anonymous, meaning that no personal data were collected (e.g., date of birth, city of birth, etc.). Multiple-choice answers were offered when possible. Testing occurred in a group of at least 11 examinees. Each examinee was told that the testing was strictly anonymous, that he/she could refuse to participate and that he/she could leave some questions and/or the entire questionnaire unanswered. When testing was completed, each examinee placed the questionnaire form in the closed box. The next day, the boxes were opened by an investigator who did not test the subjects. In this study our outcome variables of interest were gender, cigarette smoking, and participation in sports. Cigarette smoking was assessed on a five-point scale ('Not smoking', 'Occasionally smoking', 'Less than 10 cigarettes per day', '10–20 cigarettes per day' and 'More than a pack per day'), but participants were later clustered as Non-smokers ('Not smoking'), and Smokers (remaining four answers). Participation in sports was assessed on a three-point scale ('Yes, I'm currently involved in sports', 'I have been involved in sport, but quitted' or 'No, have never been involved in sports').

The participants were not asked about specific sport (i.e. type of sport), since in the region from which the sample was drawn there is no 'seasonality' in sport participation. Those who reported participating in sports were classified as 'athletes', with others classified as 'non-athletes'. Such classification was done for each time point - wave. After calculation of the frequencies and percentages for the observed groups and time-points, Odds Ratios (ORs) with 95% confidence intervals (95% CIs) for smoking were calculated between (i) males and females, and (ii) athletes and non-athletes. Chi square was calculated in order to compare data between time-points. The relationship between sport participation and smoking was established by means of logistic regression, and this was done (i) between baseline (T1) sport participation and smoking prevalence at the final testing (T4), (ii) between baseline sport participation (T1) and smoking initiation during the course of the study (T1-to-T4), and (iii) between sport participation for testing point (T1, T2, T3) and smoking initiation in the corresponding (next) 6-month period (T1-to-T2, T2-to-T3, and T3-to-T4). Details on analyses are presented in Figure 1. Analyses were stratified by gender. Statistica ver. 12.0 (Statsoft, Tulsa, OK) was used for all analyses, and a *p*-value of <0.05 was considered significant.

Results

The dropout rate of participants was between 2 and 18%, with the highest dropout occurring between T2 and T3 (8% and 18% for females and males, respectively) because some high-school programs end with the third year. The analysis of attrition bias showed no significant differences in baseline sport- and smoking-status between adolescents who dropped-out and those who remained in the study from T1-to-T4 (Table 1).

Table 1 Attrition bias analysis between responders (followed up) and non-responders (dropped out) for males and females; chi square comparison for sport-participation and smoking at the baseline.

	TOTAL	Followed up	Dropped out	Chi square (p)
MALES	192	144	48	
Non-athletes	117	90	27	
Athletes	75	54	21	0.59 (0.44)
Smokers	84	66	18	
Non-smokers	108	78	30	1.01 (0.31)
FEMALES	309	270	39	
Non-athletes	269	235	34	
Athletes	40	35	5	0.01 (0.98)
Smokers	124	105	19	
Non-smokers	185	165	20	1.37 (0.24)

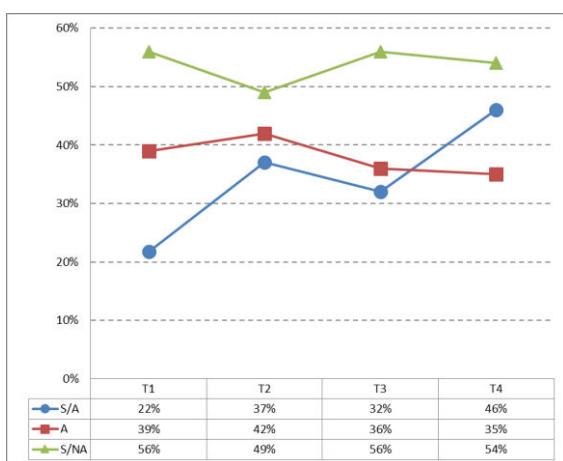


Figure 2 Trends for the smoking and athletic participation over observed period of time in boys (T1 – beginning of the 3rd grade; T2 – end of the 3rd grade; T3 – beginning of the 4th grade; T4 – end of the 4th grade).

Legend: S/A – smoking prevalence in Athletes; A – Athletes in population, S/NA – smoking prevalence in Non-Athletes

The prevalence of smoking in athletic boys increased significantly between T1 and T2 ($p < 0.05$), but slightly decreases among non-athletic boys ($p < 0.05$). Over the period between T1 and T2, the number of adolescent males involved in sports was relatively stable ($p > 0.05$).

Males participate in sport more often than females (35–42% and 11–13% athletic males and females, respectively; $p < 0.05$ for all time points). Smoking prevalence was similar in males and females (Males: T1: 44%, T2: 42%, T3: 47%, T4: 51%; Females: T1: 40%, T2: 38%, T3: 40%, T4: 42%), with no significant difference between genders in likelihood of smoking (T1: $OR = 1.21$, 95% CI = 0.79–1.81; T2: $OR = 1.31$, 95% CI = 0.86–2.01; T3: $OR = 1.15$, 95% CI = 0.76–1.72; T4: $OR = 1.46$, 95% CI = 0.97–2.19).

Over the next period (from T2 to T3), the number of males involved in sports slightly decreased ($p > 0.05$). Moreover, the identification of the participants revealed that 87% of the males who quit sports between T2 and T3 initiated smoking between T1 and T2 (Figure 2). In general, (i) involvement in sport, and (ii) prevalence of smoking in non-athletic females remained stable, while smoking in athletic females slightly decreased over the course of the study (Figure 3). ORs for smoking between athletes and non-athletes were not significant for all time-points but smoking is generally less prevalent among athletes (Males: T1: $OR = 3.83$ (95% CI: 1.89–7.09); T2: $OR = 1.31$ (95% CI: 0.76–2.67), T3: $OR = 2.72$ (95% CI: 1.35–5.50), T4: $OR = 1.41$ (95% CI: 0.71–2.81); Females: T1: $OR = 1.32$ (95% CI: 0.72–2.44), T2: $OR = 2.64$ (95% CI: 1.07–6.32), T3: $OR = 2.02$ (95% CI: 0.89–4.56), T4: $OR = 2.07$ (95% CI: 1.13–3.77)). The prevalence of smoking at the last time-point (T4) was lower in adolescents who reported sport participation at the baseline (T1) (Males: $OR = 0.44$ (95% CI: 0.23–0.84); Females: $OR = 0.51$ (95% CI: 0.11–0.98)). Those adolescents who reported practicing sports continuously (i.e. at all waves) were less likely to smoke cigarettes (Males: $OR = 3.51$ (95% CI: 2.11–5.13); Females: $OR = 2.61$ (95% CI: 1.55–5.98)). The baseline participation in sport did not predict smoking initiation between T1 and T4

(Males: $OR = 1.04$ (95% CI = 0.52–2.08); Females: $OR = 0.62$; (95% CI: 0.31–1.23)).



Figure 3 Trends for the smoking and athletic participation over observed period of time in girls (T1 – beginning of the 3rd grade; T2 – end of the 3rd grade; T3 – beginning of the 4th grade; T4 – end of the 4th grade).

LEGEND: S/A – smoking prevalence in Athletes; A – Athletes in population, S/NA – smoking prevalence in Non-Athletes.

There was no significant association between: T1-sport –participation with T1-to-T2 smoking initiation (Males: $OR = 2.78$ (95% CI: 0.91–7.99); Females: $OR = 2.96$ (95% CI: 0.51–30.25)), T2-sport-participation and T2-to-T3 smoking initiation (Males: $OR = 1.37$ (95% CI: 0.51–3.61); Females: $OR = 1.21$ (95% CI: 0.44–3.32)), and T3-sport-participation with T3-to-T4 smoking initiation (non-significant for females: $OR = 1.75$ (95% CI: 0.55–5.53)). Those males involved in sport at T3 were more likely to initiate smoking between T3-and-T4, than their non-athletic peers ($OR = 2.56$ (95% CI: 1.04–7.21))

Discussion and conclusion

The finding from our study is consistent with previous studies showing a high prevalence of smoking in Bosnia and Herzegovina (Sekulic et al., 2012; Bjelica et al., 2016). Almost certainly, the problem is aggravated by social acceptance of smoking, the relatively low price of cigarettes (i.e. a pack rarely costs more than 3 USD), and the fact that age is not verified when cigarettes are sold. In general, cigarette smoking among athletic males and females is lower than in their peers who are not involved in sports, and this is particularly evident in those adolescents who continuously practise sports. As a result, this study supports the conclusions of previous studies that have noted a positive influence of sports participation on non-smoking in adolescents (Guo, Reeder, McGee, & Darling, 2011; Tamminen, Holt, & Crocker, 2012). But, our results show certain risk for smoking initiation among 17-year-old male athletes. Previous studies have noted that adolescent males

who practise sports and subsequently quit sport are at a high risk of smoking (Sekulic et al., 2014). However, a cause–effect relationship between quitting sports and initiating smoking has not been shown. It is possible that participants initiated smoking before they stopped practising sports. Nevertheless, it is also possible that they quit sports first, and then began to smoke. Smoking initiation preceded the quitting of sports in adolescent males in this study. There are two possible mechanisms behind such trends. First, it is possible that smoking influenced the physical capacities of the athletic males, resulting in them being incapable of participating in demanding exercise, and that they subsequently quit sports (Goic-Barisic et al., 2006; Adedoyin, Mbada, Odiachi, Adegoke, & Awotidebe, 2010; Macera et al., 2011). Second, it is also possible that because of the forthcoming sport selection in transferring between junior- and senior-age sport and the consequent stress (e.g. in most sports the most rigid selection occurs between 17 and 18 years of age), some of the males started to smoke after anticipating that they would not be able to meet the higher demands of senior-age sports (Barreiros, Cote, & Fonseca, 2014).

While the data on the association between sports and non-smoking in adolescent females are highly encouraging, it must be stressed that only 11–13% of the females studied actually practised sports, and this is consistent with previous results from the territory (i.e. former Yugoslavian territory) (Modric et al., 2011; Sekulic et al., 2012; Idrizovic, Zenic, Tahirajl, Rausavljevic, & Sekulic, 2015). Regardless, the results presented here show no influence of smoking initiation on quitting sports in adolescent females. Therefore, we can conclude that smoking initiation and quitting sports are not interrelated in females, whereas they are for males. Bosnia and Herzegovina smoking is socially accepted and widespread (Sekulic et al., 2014; Zenic, Terzic, et al., 2015). However, knowing that there is a similarity in prevalence and culture in the region, the results obtained herein are probably applicable in the surrounding countries and other territories in which the culture dictates that cigarette smoking is permissible (Modric et al., 2011). In addition, sport is regularly proclaimed as a focal point of health-related physical activity, social inclusion, and even international cooperation and political stabilization in the region.

Therefore, results on association between sport-participation and smoking-initiation in males are probably generalizable to some extent. There are several limitations and strengths of this investigation. First, the participants could have been inclined toward giving socially acceptable answers, but we believe that the strict anonymity of the testing decreased this possibility. Next, the measure of involvement in sports used here was simplistic, while the analyses did not control for some potentially important factors that might influence both smoking and sport participation (i.e. education, religion, financial status, consumption of

other drugs). Also, relatively small sample limits external validation. Therefore, in future studies, the differences between levels of involvement in sports and possible confounding factors should be explored in more detail while studying larger samples. The main strength of this investigation comes from the prospective design and relatively frequent testing (i.e. each 6 months), which allowed us to clarify the true cause-effect relationships between sports and cigarette smoking. There are indices that sport participation is a protective factor against adolescent smoking, especially for those adolescents constantly involved in sports during the observed period.

But, this study has identified the third year of high school as being very important with regard to smoking prevention efforts aimed at athletic adolescent males. While we intended to identify only relationship between sports and smoking, future studies should prospectively explore other socio-demographic, cultural, scholastic and familial factors for potential relationships with smoking among adolescents. Also, future studies should investigate younger adolescents while sport-participation should be evidenced in more details (i.e. type of sport, sport-achievement, sport-training-regime, etc.).

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POVEZANOST IZMEĐU PARTICIPIRANJA U SPORTU I PUŠENJA CIGARETA KOD ADOLESCENATA; PRELIMINARNI REZULTATI PROSPEKTIVNE KOHORTNE STUDIJE

Sažetak

Ova prospektivna kohortna studija imala je za cilj utvrditi spolno specifične povezanosti između participiranja u sportskim aktivnostima i pušenja kod starijih adolescenata. Uzorak je sačinjavalo 414 adolescenata (270 žena) iz Bosne i Hercegovine koji su na početku istraživanja imali 16 do 17 godina. Svi su ispitanici testirani u četiri vremenske točke (T1, T2, T3 i T4) s razmakom od šest mjeseci. Prvo testiranja (T1) provedeno je na početku trećeg razreda srednje škole, dok je zadnje provedeno pri kraju četvrtog razreda srednje škole. Korišten je prethodno validirani strukturirani upitnik. Premda su omjeri izgleda (Odds Ratio – OR) uz odgovarajući interval pouzdanosti (Confidence Interval - CI) varirali od točke do točke mjerjenja, participiranje u sportu se utvrdilo kao generalno protektivno u pogledu konzumiranja cigareta kod dječaka (T1: OR=3.83; 95%CI:1.89-7.09, T2: OR=1.31; 95%CI:0.76-2.67, T3: OR=2.72; 95%CI:1.35-5.50, T4: OR=1.41; 95%CI:0.71-2.81) i djevojčica (T1: OR=1.32; 95%CI:0.72-2.44, T2: OR=2.64; 95%CI:1.07-6.32, T3: OR=2.02; 95%CI:0.89-4.56, T4: OR=2.07; 95%CI:1.13-3.77). Analize trendova ukazuju kako početak pušenja generalno prethodi napuštanju sporta kod dječaka, dok takvi trendovi nisu utvrđeni kod djevojčica.

Ključne riječi: sport, pubertet, pušenje cigareta.

Received: July 16, 2017
Accepted: August 16, 2017
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