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# SPORT FACTORS AS CORRELATES OF SMOKING, DRINKING AND MULTIPLE SUBSTANCE MISUSE IN ADOLESCENCE: CROSS-SECTIONAL STUDY

# ŠPORTNI DEJAVNIKI KOT KORELATI KAJENJA, PITJA IN VEČKRATNE ZLORABE SUBSTANC V MLADOSTNIŠTVU: ŠTUDIJA PRESEKA

## ABSTRACT

Sport participation is frequently considered as protective factor against substance misuse (SUM) in adolescence, but there is an evident lack of empirical studies which examined this problem taking into account various facets of sport participation (sport factors). This study aimed to evaluate possible associations between various sport factors and SUM in older adolescents from Croatia. The sample comprised 788 adolescents (16-to 18 years of age, 45% females). Variables included sport factors (participation in individual and team sports, competitive achievement in sports, and experience in sports), and SUM data (cigarette smoking, harmful alcohol drinking (HD), and simultaneous HD and smoking [multiple-SUM]). Boys were more involved in sports, and were more likely to be engaged in HD and MSUM than girls. Logistic regressions provided no evidence about significant association between sport factors, and smoking and HD. Sport factors were significantly associated to multiple-SUM, with lower likelihood of MSUM in adolescents who achieved better sport success (OR: 0.57, 95%CI: 0.40-0.78), who were involved in individual sports (OR: 0.71, 95%CI: 0.50-0.91), and team sports (OR: 0.80, 95%CI: 0.56-0.99). Sport factors may be observed as being protective against multiple-SUM, which is explained by characteristics of the sport participation in youth (i.e. orientation toward success, age-bonding, adult supervision).

*Keywords:* psychoactive substances, physical exercise, puberty, protective factors, risk factors

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## IZVLEČEK

Udeležba v športu se pogosto šteje kot zaščitni dejavnik pred zlorabo prepovedanih substanc v mladostništvu. Do sedaj še ni bilo narejenih empiričnih študij, ki bi preučevale to težavo ob upoštevanju različnih vidikov športnega udejstvovanja. Glavni cilj študije je bil ovrednotiti možne povezave med različnimi športnimi dejavniki in zlorabo prepovedanih substanc pri starejših mladostnikih iz Hrvaške. Vzorec je zajemal 788 mladostnikov (starih med 16 in 18 let, od tega 55% mladostnikov in 45% mladostnic). Spremenljivke so vključevale športne dejavnike (udeležba v individualnih in ekipnih športih, tekmovalni dosežki v športu in izkušnje v športu), podatke o zlorabi prepovedanih substanc (kajenje cigaret, škodljivo uživanje alkohola ter sočasno uživanje alkohola in kajenje [multi-SUM]). Ugotovili smo, da se fantje več ukvarjajo s športom kot dekleta in pri njih tudi opažamo višjo konzumacijo alkohola in multi-SUM v primerjavi z dekleti. Z logistično regresijo nismo ugotovili značilnih povezav med športnimi dejavniki, kajenjem in sočasnim kajenjem ter pitjem alkohola. Športni dejavniki so bili značilno povezani z večkratnimi vsotami z manjšo verjetnostjo MSUM pri mladostnikih, ki so dosegli boljši športni uspeh (OR: 0,57, 95% IZ: 0,40-0,78) tako pri individualnih (OR: 0,71, 95% IZ : 0,50-0,91) kot pri skupinskih športih (OR: 0,80, 95% IZ: 0,56-0,99).

*Ključne besede:* psihoaktivne snovi, telesna dejavnost, mladostništvo, zaščitni dejavniki, dejavniki tveganja

## INTRODUCTION

Consumption of cigarettes (i.e. smoking) is decreasing globally, but smoking is still one of the leading preventable causes of death worldwide (Bilano et al., 2015). The problem is aggravated in those countries where smoking is culturally and socially-acceptable behavior, since in those circumstances there are no strict social boundaries against such practice. Consequently, it results even in early smoking initiation and later nicotine dependence. With approximately 30% of adolescents who smoke, Croatia is within the EU countries with one of the highest prevalence of smoking among adolescents, and there is a growing interest in developing the policy aimed at prevention of smoking in the country (Kraus & Nociar, 2016).

Alcohol consumption is another type of substance misuse which is prevalent in Croatia. Partially, this is associated to Mediterranean style of living, where alcohol consumption (mostly wine) is regular, although drunkenness and intoxication is not socially accepted (Devcic et al., 2018). Alcohol is known to be related to significant health problems (i.e. blackouts, hallucinations, liver damage, infertility), while consumption of alcohol may result even in various negative social consequences as well (i.e. violence, unsafe sex, intoxicated driving) (Sanchez-Ramirez & Voaklander, 2018). Therefore, factors which may be directly or indirectly associated to alcohol drinking among adolescents are repeatedly investigated (Devcic et al., 2018; Zenic et al., 2019).

Scientific and professional authorities are greatly concerned about reducing the prevalence of smoking and alcohol drinking (substance misuse- SUM), globally In doing so, special attention is paid on youth, mostly because it is widely accepted that the age of 21 years is “critical” with regard to preventive efforts, simply because it is well known that those adolescents who do not initiate with smoking/drinking until the late adolescent, will likely never do so (Zenic, Terzic, Rodek, Spasic, & Sekulic, 2015). One of the globally accepted approaches in prevention is identification of the factors that can be related to SUM. Among others, factors related to participation and competitive achievement in sports (sport factors) are particularly interesting (Bjelica et al., 2016; Zenic, Terzic, et al., 2015).

Sport provides numerous benefits to youth, and among others it has also been suggested that participation in sport and exercise may prevent youth from various problematic-behaviors including smoking and drinking (Sekulic & Zenic, 2014). The idea of theoretically protective effects of sport participation against smoking and drinking in adolescence is based on simple fact that sports promote overall well-being, and participation in sport positively influence

development of various pro-social behaviors and self-discipline (Eime, Young, Harvey, Charity, & Payne, 2013). Therefore, it is expected that adolescents who are involved in sports are less likely to smoke and drink (Moore & Werch, 2005). The background of association between sport and substance misuse (SUM) in adolescence is profoundly explained by Wichstrøm & Wichstrøm, who presented protective- , but also theoretical risk-factors of sport participation with regard to SUM (Wichstrøm & Wichstrøm, 2009). In brief, authors identified age-segregation (sport is organized in age-groups), time-occupation (sport participation is time-consuming), orientation toward success, and adult supervision as factors which would prevent SUM in athletic adolescents. Meanwhile, sport is recongized as „social-activity“, which presents a factor of increased risk for SUM in adolescence (Wichstrøm & Wichstrøm, 2009).

Collectively, empirical evidences about correlation between sport participation and SUM in adolescence are not consistent. Specifically, the prevalence of smoking was regularly lower in adolescent athletes than in their non-athletic peers, but when investigations observed regions where smoking was socially acceptable (i.e. southeastern Europe and Balkan countries) the highest prevalence of smoking was found in former athletes, (Idrizovic, Zenic, Tahirajl, Rausavljevic, & Sekulic, 2015; Tahiraj et al., 2016; Zenic, Ostojic, et al., 2015). With regard to alcohol, studies more often did not than did confirm protective effects of sport participation against alcohol drinking in adolescence (Bedendo, Opaleye, Andrade, & Noto, 2013; Bjelica et al., 2016; Cerkez, Culjak, Zenic, Sekulic, & Kondric, 2015; Vest & Simpkins, 2013). Collectively, some investigators reported lower levels of alcohol consumption in athletic adolescent (Sigfusdottir, Kristjansson, Thorlindsson, & Allegrante, 2008), but a great deal of studies evidenced higher risk for alcohol consumption in those adolescences who were involved in sports (Bedendo et al., 2013; Bjelica et al., 2016; Cerkez et al., 2015; Vest & Simpkins, 2013). Generally, differences in findings may be explained regarding differences in the type of sport (i.e., individual vs. team-sports), level of sport participation (i.e. success in sport), gender-specific associations, etc. (Cerkez et al., 2015; Modric, Zenic, & Sekulic, 2011; Tahiraj et al., 2016).

Despite the increasing interest about the problem, there is a still evident lack of research where different facets of sport participation were observed as potential correlates of consumption of various psychoactive substances, especially with regard to multiple SUM (MSUM). Namely, there is no doubt that those adolescents who simultaneously consume cigarettes and alcohol are at particular risk for development of various detrimental health- consequences and social—problems associated with SUM. On the other hand, there is an evident lack of investigation

where this problem is investigated in relation to sport-factors, while to the best of our knowledge no study directly examined these issues specifically in Croatian adolescents. Therefore, the aim of this investigation was to evaluate the associations which may exist between sport factors, and cigarette smoking, harmful alcohol drinking and MSUM (simultaneous smoking and harmful drinking) in older adolescents from Croatia.

## METHODS

### Participants and design

In this study, we observed 17-to-18-year-old adolescents (n = 788, 45% females). The sample comprised adolescents from southern regions in Croatia, from three cities located on the Adriatic coast, namely Split, Makarska and Dubrovnik.- While the idea of the study was to evidence sport factors potentially related to SUM, it was necessary to obtain a sample of participants in the regions with similarity in cultural heritage, specifically, similar in social acceptance of specific substances. Multistage sampling was used. First, we selected by lottery one-third of the high schools in the studied cities. In the next phase, one-third of all high school final grades were selected via lottery from the previously selected schools, resulting in a sample of 39 classes. The survey was administered on a single day, meaning that all high school seniors who were at school on that day were invited to participate. Before the study, the complete procedure and aim of the testing were explained to all participants and at least one parent, and parental consent was obtained. Testing was strictly anonymous, meaning that no personal data were collected (e.g., date of birth, city of birth, or specific club or sport participation). Multiple-choice answers were offered where possible (see the Results for more details).

Testing occurred in a group of at least 13 examinees. Each examinee was told that the testing was strictly anonymous, that he/she could refuse to participate and that they could leave some questions and/or the entire questionnaire unanswered, and that the returning of the questionnaire will be considered as their consent for the participation in the study. Each examinee received two questionnaire forms and one envelope. When the testing was completed, each examinee placed one form (answered or unanswered) in the envelope, sealed it and placed in the closed box, while the second one was destroyed in paper shredder. On the next day, the envelopes were opened by an investigator who had not tested the participants. The study fulfilled all ethical guidelines and received the approval of the Ethical Board of University of Split, Faculty of Kinesiology.

## Variables

The previously validated questionnaires were used in order to collect data (Cerkez et al., 2015; Zenic, Peric, Zubcevic, Ostojic, & Ostojic, 2010; Zenic et al., 2019). Variables comprised gender (male – female – other), age (in years), sport factors and SUM data.

SUM data included cigarette smoking, alcohol drinking, and MSUM (derived from answers provided for smoking and drinking, please see later). Participants were asked about their smoking habits and alcohol consumption. Smoking was tested on a six-point scale ("Never smoked" – "Quit"– "From time to time, but not daily" – "Daily less than 10 cigs" – "More than 10 cigarettes daily"). For the purpose of this study and statistical calculations (see below for details) the participants were observed as "non-smokers" (first two responses) and "smokers". Alcohol consumption was measured using the AUDIT questionnaire. In this questionnaire, participants answer ten items and the scores for each item range from 0 to 4, which defines the hypothetical range of a minimum of 0 to maximum of 40. The results were later divided into "harmful drinking" (HD; scores of 11 or above) and "non-harmful drinking" (scores below 11), which allowed us to observe the results as a categorical variable (Cerkez et al., 2015; Pallesen, Josendal, Johnsen, Larsen, & Molde, 2006). Those participants who declared smoking and harmful alcohol drinking were categorized in MSUM.

The sport factors included questions on (i) involvement in team sports, such as basketball, handball, football/soccer, (ii) involvement in individual sports, such as martial arts, track and field, swimming (both asked on scale including: Never been involved, Quit, Currently involved; later dichotomized on involved – non-involved) (iii) highest competitive achievement in sports (Never competed/did not participate in sports, Local competitions, National/International level competitions); and (iv) time of involvement in sports (Never involved, <1 year, 2-5 years, >5 years).

## Statistics

Distributions of variables were checked by Kolmogorov Smirnov test, and descriptive statistics included means and standard deviations (for AUDIT scores and age), and frequencies and percentages (for remaining variables).

Gender-differences between genders in raw AUDIT scores and age were established by independent samples t-test. Mann Whitney test (MWZ) was used to calculate the differences between genders in sport-factors, and smoking prevalence observed on ordinal scale, while Chi

square test ($\chi 2$) was calculated to identify the differences in prevalence of MSUM and harmful drinking between boys and girls.

Logistic regression was used to evidence the associations between sport factors with binomial criteria (smoking [yes-no], harmful drinking [yes-no], and MSUM [yes/no]). The odds ratio (OR) and the corresponding 95% confidence interval (95%CI) were reported. The logistic analyses were calculated as crude model (Model 0), and then adjusted for gender (Model 1).

## RESULTS

No significant difference between genders was evidenced in age (17.1±1.3 and 17.0±0.9 for boys and girls, respectively; t-test = 0.09, $p > 0.05$), while alcohol consumption observed as AUDIT raw score was higher in boys (5.86±4.86 and 3.22±2.98, for boys and girls respectively; t-test: 6.03, $p < 0.001$).

Table 1 presents descriptive statistics for ordinal variables (sport factors and SUM data), with differences between genders calculated by Mann Whitney and $\chi 2$. The 12% of boys and 43% of girls have never been involved in any type of sports. Boys were more involved in sports than girls, and this was evident for participation in individual sports (MWZ = 8.97, $p < 0.001$), participation in team sports (MWZ = 10.4, $p < 0.001$), sport achievement (MWZ = 5.96, $p < 0.001$), and sport experience (MWZ = 11.45, $p < 0.001$). The 30% of boys and 26% of girls were smokers, while harmful drinking was evidenced for 12% of boys and 9% of girls. The prevalence of harmful drinking ($\chi 2 = 8.68$, $p < 0.01$), and prevalence of MSUM ($\chi 2 = 12.34$, $p < 0.001$), were higher in boys.

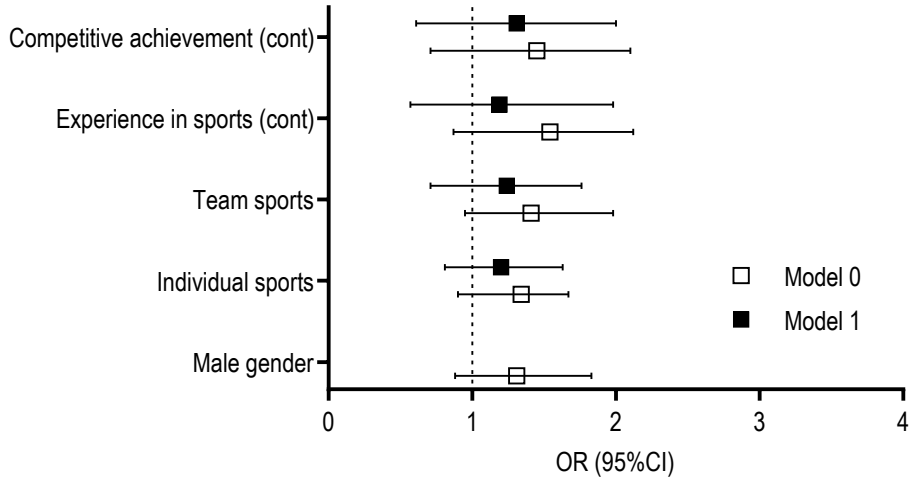
Table 1. Descriptive statistics (F – frequencies, % - percentage) and differences between genders (MWZ – Mann Whitney Z test, $\chi$2- Chi square test) in studied sport factors and substance misuse data

| | Boys | | Girls | | MWZ/ $\chi^2$ | |
|---|---|---|---|---|---|---|
| | F | % | F | % | MWZ/ $\chi^2$ | p |
| Smoking | | | | | | |
| Never | 276 | 64.5 | 248 | 70.1 | | |
| Quit | 24 | 5.6 | 14 | 4.0 | | |
| From time to time, but not daily | 80 | 18.7 | 64 | 18.1 | | |
| < 10 cigarettes daily | 22 | 5.1 | 12 | 3.4 | | |
| > 10 cigarettes daily | 26 | 6.1 | 16 | 4.5 | 1.68 | 0.09 |
| Harmful drinking $\chi^2$ | | | | | | |
| No | 362 | 84.6 | 324 | 91.5 | | |
| Yes | 66 | 15.4 | 30 | 8.5 | 8.68 | 0.01 |
| Multiple substance misuse $\chi^2$ | | | | | | |
| No | 51 | 11.9 | 17 | 4.8 | | |
| Yes | 377 | 88.1 | 337 | 95.2 | 12.34 | 0.001 |
| Participation in individual sports | | | | | | |
| Never | 136 | 31.8 | 28 | 7.9 | | |
| Quit | 146 | 34.1 | 108 | 30.5 | | |
| Yes, still participating | 146 | 34.1 | 218 | 61.6 | 8.97 | 0.001 |
| Participation in team sports | | | | | | |
| Never | 146 | 34.1 | 40 | 11.3 | | |
| Quit | 194 | 45.3 | 122 | 34.5 | | |
| Yes, still participating | 88 | 20.6 | 192 | 54.2 | 10.4 | 0.001 |
| Competitive achievement in sports | | | | | | |
| Not participated/never competed | 180 | 42.1 | 232 | 65.5 | | |
| Local competitions | 212 | 49.5 | 98 | 27.7 | | |
| National/International competitions | 36 | 8.4 | 24 | 6.8 | 5.96 | 0.001 |
| Time of the involvement in sports | | | | | | |
| Never involved | 54 | 12.6 | 154 | 43.5 | | |
| < 1 year | 82 | 19.2 | 90 | 25.4 | | |
| 2-5 years | 140 | 32.7 | 72 | 20.3 | | |
| > 5 years | 152 | 35.5 | 38 | 10.7 | 11.45 | 0.001 |

The results of the logistic regression calculations, where sport factors were correlated with dichotomized smoking prevalence are presented in Figure 1. In brief, some of the sport factors

were significantly associated with smoking prevalence in crude model (Model 0). However, the higher prevalence of smoking and greater involvement in sport among boys actually resulted in non- significant associations between sport factors and smoking evidenced in Model 1. In other words, none of the sport factors was correlated with smoking when gender was included in regression calculation as covariate (model 1).

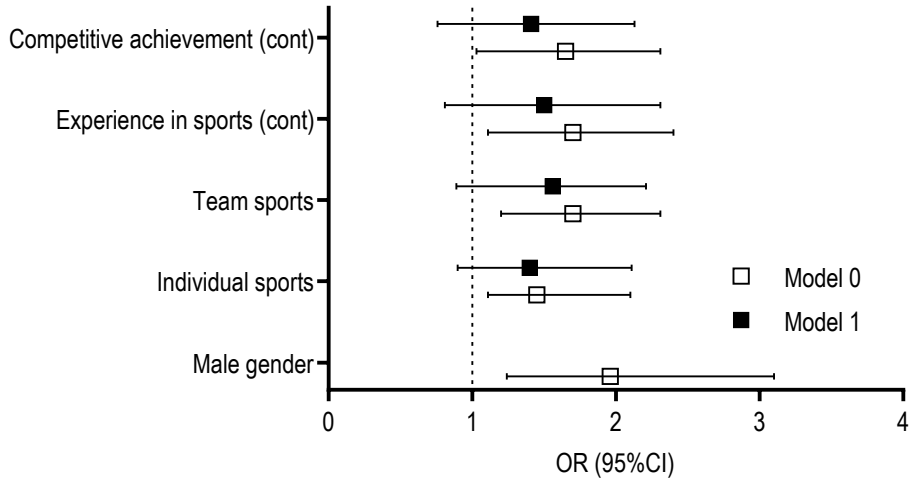
Figure 1. Correlates of cigarette smoking among studied adolescents (OR – Odds Ratio, CI – Confidence Interval, Model 0 – crude logistic regression calculation, Model 1 – logistic regression calculation including "gender" as confounding variable)




Legend: Individual sports – participation in individual sports (yes – no), Team sports – participation in team sports (yes – no), Experience in sports (time of the involvement in sports – observed as continuous variable). Competitive achievement (competitive achievement in sports – observed as continuous variable)

When regressions were calculated for harmful alcohol drinking criterion, gender was once again a strong confounding factor of the associations between sport-factors and criterion (Figure 2). In brief, there was no single significant correlation between predictors and occurrence of harmful drinking in studied adolescents for Model 1 (regression model which included "gender" as covariate).

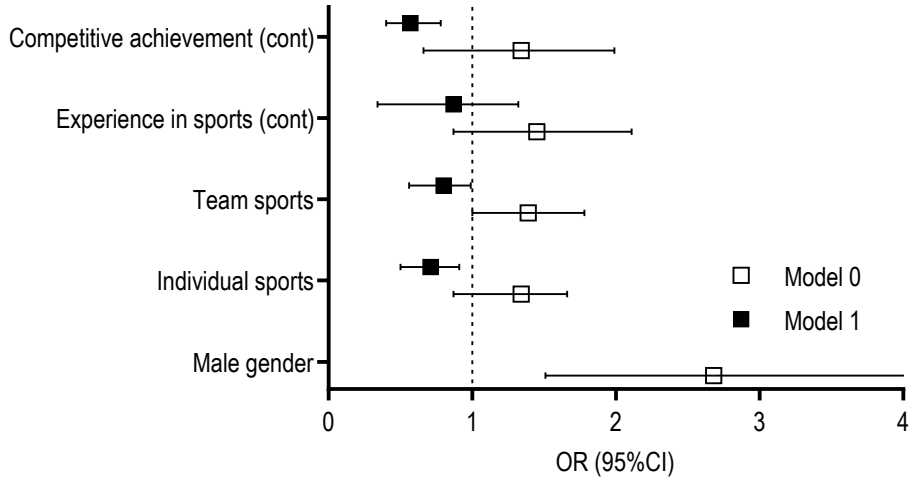
Figure 2. Correlates of harmful alcohol drinking among studied adolescents (OR – Odds Ratio, CI – Confidence Interval, Model 0 – crude logistic regression calculation, Model 1 – logistic regression calculation including "gender" as confounding variable)




Legend: Individual sports – participation in individual sports (yes – no), Team sports – participation in team sports (yes – no), Experience in sports (time of the involvement in sports – observed as continuous variable). Competitive achievement (competitive achievement in sports – observed as continuous variable)

Sport factors were significantly associated to MSUM (Figure 3). Specifically, variables explaining sport engagement were correlated with criterion – MSUM in Model 1 (logistic regression calculation which included "gender" as covariate). The strongest correlation was evidenced for "sport achievement" (OR: 0.57, 95%CI: 0.40-0.78), followed by "participation in individual sport" (OR: 0.71, 95%CI: 0.50-0.91), and "participation in team sports" (OR: 0.80, 95%CI: 0.56-0.99), all indicating certain level of protective effect of sport participation against MSUM.

Figure 3. Correlates of multiple substance misuse (simultaneous smoking and harmful alcohol drinking) among studied adolescents (OR – Odds Ratio, CI – Confidence Interval, Model 0 – crude logistic regression calculation, Model 1 – logistic regression calculation including "gender" as confounding variable)




Legend: Individual sports – participation in individual sports (yes – no), Team sports – participation in team sports (yes – no), Experience in sports (time of the involvement in sports – observed as continuous variable). Competitive achievement (competitive achievement in sports – observed as continuous variable)

## DISCUSSION

There are several most important findings of this study. First, sport factors were not associated with cigarette smoking and alcohol drinking in studied adolescents when two types of substances were observed separately. Second, there was relatively consistent association between sport factors and MSUM, with lower likelihood of MSUM in athletic adolescents, especially those who achieved better sport success. Third, participation in individual sports seems to be stronger protective factor of MSUM than participation in team sports.

### Sport factors in relation to smoking and drinking in adolescence

When smoking and alcohol drinking were observed separately as criteria, our results didn't confirm protective effects of sport participation against SUM in studied adolescents. In explaining such findings a short presentation of the theoretical influence of sport on SUM in adolescence is needed. In one of the most comprehensive overviews about theoretical framework for the association between sport and SUM Wichstrøm and Wichstrøm explained

several facets that may positively or negatively affect the risk of SUM in the athletic context (Wichstrøm & Wichstrøm, 2009). The first protective aspect is related to age segregation. Briefly, age segregation is common in sports and children often participate in training and competition exclusively with their age-matching peers. It logically reduces the possibility to be accompanied with older adolescents who (more frequently) consume substances. Second protective aspect is related to time occupation (i.e. sports training and competitions take time, and therefore, there is less time for activities associated with SUM). Third, sport is regularly characterized by adult supervision (adult coaches are regularly involved), and this may limit any type of problem behavior. Fourth, in sport strong orientation toward success is present. Since consumption of cigarettes and alcohol reduces the physical capacities, it logically alters the sport results and achievement, and consequently athletic adolescents would avoid it. However, apart from all these "protective effects of sport participation", potential risk should also be emphasized. In brief, there is no doubt that sport is a "social activity", and therefore may present a certain risk of a higher likelihood of SUM. Collectively, many but not all characteristics of sports may reduce the risk of SUM in adolescents, which may help even in explaining our findings.

When it comes to alcohol, some previous studies pointed to higher levels of alcohol consumption in athletic adolescents than in their non-athletic peers (Lisha & Sussman, 2010; Modric et al., 2011; Peretti-Watel, Beck, & Legleye, 2002). However, some authors evidenced sports participation as being protective against alcohol use (Donato et al., 1994). Since previous studies were inconsistent with regard to association between sport and alcohol drinking, it is not surprising that we foundnonsignificant association between sport participation and alcohol drinking. (Donato et al., 1994; Lisha & Sussman, 2010; Modric et al., 2011; Peretti-Watel et al., 2002). In explaining, the findings of the recent report when authors prospectively examined alcohol consumption and alcohol initiation in adolescents are particularly interesting (Zenic et al., 2019). In this study, athletic adolescents started to consume alcohol earlier than their non-athletic peers (i.e. before 16 years of age), but alcohol consumption in non-athletic adolescents increased in the forthcoming period of life (from 16 to 18 years of age). Such dynamic were explained by „social context of sport participation and alcohol consumption in post-sport social gatherings" (Zenic et al., 2019). If we accept such tendencies even for our participants, it is not surprising that we found no correlation between sport factors and alcohol consumption.

Previous studies have reported the presence of different associations between sport-factors and cigarettes smoking in children and youth (Sekulic, Ostojic, Ostojic, Hajdarevic, & Ostojic,

2012; Tahiraj et al., 2016). Therefore, it is not surprising that our results did not confirm protective effects of sport-participation against smoking in studied adolescents. While most of the sport factors observed herein can be contextualized it the term of "social influence of sport related gatherings" and higher possibility for cigarette smoking in such occasions, one of the sport factors which definitively deserves attention is a factor of "sport achievement". In brief, knowing the negative influence of smoking on physiological capacities (Misigoj-Durakovic et al., 2012), it was clearly expected that sport achievement will be identified as protective factor against smoking in adolescence. However, irrespective of the clear logic for "protective effect of sports against smoking", the opposite mechanism also appears. Namely, in the studies socio-cultural environment (southern Croatia), cigarette smoking is generally "socially accepted behavior" (Samardzic, Marvinac, & Prlic, 2009). According to social ecological theory in order to understand human development and lifelong changes (including behavioral changes), the entire ecological system in which growth and development occur should be taken into account (Bronfenbrenner, 1994). While adolescents must function in various environments, constantly trying to position themselves in the most comfortable one, the fact that sport participation was not protective against smoking in social environment where smoking is generally accepted, is not surprising.

**Sport factors in relation to MSUM in adolescence**

The interest in evidencing the potential differential effects of individual/team sport participation on SUM in adolescence in relatively novel in scientific literature. It is generally based on specific socio-cultural contexts of individual and team sports, which may generate the differential influence on SUM as well. Briefly, participation in team-sports regularly includes various types of post-sport social gatherings where substance are regularly consumed (Sekulic, Bjelanovic, Pehar, Pelivan, & Zenic, 2014). It logically puts team-sport athletes in danger of SUM. On the other hand, post-sport gatherings are not so frequent in individual sports. Also, some individual sports (i.e. martial arts) are organized in weight categories, while in some individual sports body mass and physique directly influence the sport outcome and result (i.e. aesthetic sport disciplines). Therefore, those athletes regularly avoid alcohol because of its energetic value (7kcal/g), and consequent caloric intake. Further, athletes in some individual sports (e.g. aesthetic sports) are highly concerned about their body weight (Pustivšek, 2019), and studies conformed positive tendencies toward smoking in such sports due to its effect on basal metabolism (e.g. smoking increases basal metabolism), and appetite suppression (Zenic

et al., 2010). Putting it all together, there is no doubt that, at least theoretically, individual and team sports should be observed separately with regard to SUM behavior.

Irrespective of mentioned differences between individual and team sports, both type of sports are found to be protective against MSUM, meaning that adolescent athletes are less likely to simultaneously consume cigarettes and alcohol. Therefore, previously specified protective mechanisms against SUM (e.g. age segregation, time occupation, adult supervision, orientation toward success) collectively dominate over "risk factor of sport participation" (i.e. sport as social activity), at least in the case of MSUM. Most likely, young athletes are generally concerned about various negative aspects of SUM and avoid such behavior irrespective of the "nature" of the type of sport they are coming from. In this context, the "nature" reflects various aspects, including organizational and socio-cultural characteristics (individual vs. team sports in the light of group-traveling, social-gatherings), psychological- (i.e. higher or lower necessity of arousal for the purpose of sport competition), or physiological-metabolic-aspects (i.e. necessity of proper body weight, importance of physiological capacities in achieving sport result). It is altogether additionally accentuated in those athletic adolescents who achieved higher competitive result.

From the authors' perspective as experienced sport pedagogues, the difference between participation in individual- and team-sports in the magnitude of their protective influence on multiple SUM is not surprising. The individual athletes are naturally more focused on their own capacities than team-sport athletes, simply because success of the individual athletes in directly and unconditionally related to their own psycho-physiological capacities. In other words, while team-sport athletes can in some circumstances achieve high sport-result on the basis of quality of their team-mates (i.e. being member of good team), this is hardly achievable in individual-sport settings. Collectively, it results even in stronger protective effect of individual-sport participation against MSUM in studied adolescents.

**Limitations and strengths**

The cross-sectional study design is the most important limitation of the investigation. Therefore, although some established associations may be logically interpreted (i.e. differential effects of individual and team sports on MSUM), for a more accurate depiction of the studied problem prospective analysis is needed. Second, the study is commenced with specific sample of adolescents in the region where some sports are particularly popular among youth, and where

smoking is socially accepted behavior even in youth. Therefore, the results are generalizable to similar samples.

This is one of the first studies where specific sport factors are observed as being associated with SUM, and MSUM. Therefore, results provide relatively accurate picture about studied problem. Also, usage of the previously validated and widely used measurement tools allowed us to precisely compare the study results with those already reported. Therefore, we believe that the study, although not being the final word on a topic, will provide certain improvement in the body of knowledge and initiate the further research.

## CONCLUSION

Study results provided no evidence about possible association between sport participation and single-type of SUM in older adolescents from southern Croatia. Most probably, while some factors may decrease the risk of smoking and harmful drinking, others may be observed as factors of increased risk of such behavior in this period of life. The "negative" influence of sport is particularly possible to occur taking into account that we observed the region where prevalence of alcohol drinking and cigarette smoking is generally alarming, and where are no clear social and/or cultural barriers against such type of SUM.

Although substance-specific analyses did not provide conclusive evidences about association between sport factors, smoking and drinking, the simultaneous drinking and smoking is evidently lower in adolescents who participate and compete in sports, than in their non-athletic peers. Since the participation in individual sports has stronger protective effect against multiple SUM than participation in team sports it is clear that sport-characteristics should be highlighted in further studies which will tend to explore the protective/risk effects of sport participation on different health-related issues.

### Declaration of Conflicting Interests

The authors declare that they have no conflict of interest.

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