Chapter

SPORTS INJURIES AND RISK-TAKING BEHAVIORS IN AMATEUR ATHLETES

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ABSTRACT

Research conducted outside of the sports context has shown higher risk for all injuries (e.g., intentional injuries, injured drivers, fatal and non-fatal injuries) among persons with risk-taking behaviors (e.g., cannabis use, alcohol consumption). The purpose of this study was to investigate whether: (1) risk-taking behaviors, such as alcohol, cannabis or tobacco consumption increased the risk and the severity of sports injuries; (2) whether differences emerged between male and female athletes; and (3) whether differences emerged between recreational and competitive athletes. The sample consisted of 1,810 amateur athletes (993 men, 817 women), aged 16 to 22 years old (M=18.72; SD=2.08). Respondents completed a questionnaire, which queried frequency of risk-taking behaviors and sports injuries recorded in their lifetime. Sixty-seven percent (67%) of amateur athletes indicated at least one sports-related injury in their lifetime. For sixty-two percent (62%) of athletes, the most frequent sports injuries required ten days to three months of sport interruption. Results also indicated that risk and severity of sports injuries increased with increased alcohol consumption. Cannabis use also increased the risk but not the severity of sports injuries, while smoking was not associated with the risk but with the severity of sports injuries. Some differences were observed between males and females as well as between recreational and competitive athletes in associations between risk-taking behaviors, risk and/or severity of sports injuries. Prevention measures for risk-taking behaviors in athletic pursuits should be increased and improved to reduce the number and severity of injuries in sports played on an amateur level.

Key words: sports injuries, risk-taking behaviors, amateur level, gender, recreational and competitive athletes

1. INTRODUCTION

In recent years, the number of children and teenagers participating in sports has grown due to the increased number of children in sports, the younger ages of participation, and an increase in individuals engaged in multiple sports (Collard, Verhagen, Chin A Paw, & Van Mechelen, 2008; NSKC, 2004). Participation in sports has many health benefits. However, a drawback of an increase in athletic activity is the risk of sports-related injuries. A large proportion of reported injuries among young people occur at sports facilities during participation in a sport (Bijur, et al., 1995; Molcho, et al., 2006; Williams, Wright, Currie, & Beattie, 1998). For example, the survey of Bijur et al. (1995) conducted on 11,840 children and adolescents aged from 5 to 17 years showed that sports account for 36% of injuries from all causes.

The epidemiology of sports-related injuries is well explored in the literature. Previous research has been done on incidence of injury by sport, location of injury, type of injury (e.g., concussion, fracture, dislocation, contusion, sprain), and duration of absence (e.g., no absence, 1-7 days, 8-21 days, >21 days) (Bijur, et al., 1995; Caine, Caine, & Maffulli, 2006; Collard, et al., 2008; Cumps, Verhagen, & Meeusen, 2007; Gottschalk & Andrish, 2011; Junge, Cheung, Edwards, & Dvorak, 2004; Junge, Chomiak, & Dvorak, 2000; Langevoort, Myklebust, Dvorak, & Junge, 2007; Olsen, Myklebust, Engebretsen, & Bahr, 2006; Pikora, Braham, Hill, & Mills, 2011).

Previous research has also identified potential risk factors for sports-related injuries, including individual characteristics (e.g., age, height, weight, body mass index, previous injury, physical condition, skill level, success of treatment and rehabilitation), play characteristics (e.g., field position, sports experience, level of competition, pre-season conditioning, amount and quality of training, frequency of participation, field conditions, match intensity), protective or risky behaviors (e.g., use of protective equipment or behaviors, use of stretching exercises, technical training, rule violations), and psychological factors (e.g., stress, anxiety, social support, coping skills, neuroticism, global self-esteem, locus of control, perfectionism, mood states) (Chomiak, Junge, Peterson, & Dvorak, 2000; Collard, et al., 2008; Cumps, et al., 2007; Deroche, Stephan, Brewer, & Le Scanff, 2007; Gabbett, 2004; Iverson, Gaetz, Lovell, & Collins, 2004; Johnson, 2007; Noh, Morris, & Andersen, 2005; Tsigilis & Hatzimanouil, 2005). For example, level of play is related to incidence of injury (Cumps, et al., 2007). Incidence decreases with the play level; beginners, being less skillful and experienced, generally sustain more injuries. Jacobson (2006) showed that the overall injury incidence was 9.6 injuries / 1000 person-hours of football in the second division and 4.6 injuries / 1000 person-hours of football in the premiere league. Deroche et al. (2007) studied factors associated with perceived susceptibility to sports-related injuries were examined. The study showed that neuroticism predicted perceived susceptibility to a greater degree than global self-esteem or previous experiences with injury. Noh et al. (2005) showed that coping skills were moderately correlated with frequency of injury; in particular, peaking under pressure, goal setting and mental preparation, freedom from worry, confidence levels and achievement motivation subscales were related to injury frequency. In predicting duration of injury, negative life stress and negative sports-related stress had significant correlations, whereas higher stress levels correlated to longer recovery times. The review of Johnson (2007) showed that levels of psychosocial variables such as high competitive anxiety, low and high emotional state, high levels of life changes, low coping resources, and low levels of social support were directly or

indirectly related to injury outcome. Johnson (2007) distinguished two types of interrelated risk factors: (a) extrinsic, where risk was related to the type of sport, the way it is practiced, contextual factors, and equipment; and (b) intrinsic, where risk was related primarily to an individual's physical and psychological features. Risk-taking behaviors were rarely mentioned as risk factors in sports injuries. Nevertheless, research conducted outside of the sports context has shown associations between types of injuries (intentional injuries, injured drivers, fatal and non-fatal injuries, etc.) and risk-taking behaviors (Gmel, Kuendig, Rehm, Schreyer, & Daeppen, 2009; Macdonald, et al., 2003; McDonald, Duncan, & Mitchell, 1999; Wadsworth, Moss, Simpson, & Smith, 2006). There is sufficient evidence indicating alcohol use as a contributing causal factor for injury (Gmel, Kuendig, Rehm, et al., 2009; Macdonald, et al., 2003; Vinson, et al., 1995), while results are inconsistent for cannabis (Gmel, Kuendig, Rehm, et al., 2009; Macdonald, et al., 2003; McDonald, et al., 1999; Wadsworth, et al., 2006). Wadsworth et al. (2006) showed that cannabis use was associated with both minor injuries and accidents, particularly among those with high levels of other associated risk factors. Gmel, Kuendig, Rehm, et al. (2009) showed that cannabis use decreased risk of injury; however, the study's sample size of cannabis users was small. Macdonald et al. (2003) reviewed the results and limitations of injury studies of risk associated with cannabis and cocaine use; the majority of laboratory studies showed that being under the influence of drugs reduces psychomotor performance. However, epidemiological studies using drug testing technology have failed to find evidence that cannabis use is related to increased injury risk.

Few studies have considered risk-taking behaviors in relation to sports injuries; only a single study was found in which the focus was on alcohol consumption. According to Gmel, Kuendig, Rehm, et al. (2009), alcohol consumption increased the risk of sports injuries. However, it should be noted that the severity of sports injuries was not taken into account in the study. Because of the lack of studies surrounding risk-taking behaviors and sports injuries, the aim of this study was to focus on the three most widely used drugs in Europe: alcohol, tobacco and cannabis (Calafat, et al., 1999) and to investigate whether: (1) risk-taking behaviors, such as alcohol, cannabis or tobacco consumption, increased the risk and the severity of sports injuries; (2) whether differences emerged between male and female athletes; and (3) whether differences emerged between recreational and competitive athletes.

2. METHODS

2.1. Sample

The sample consisted of 1,920 French Swiss athletes from 24 different schools. Of 1,920 questionnaires, 90 questionnaires were incorrectly filled out and were not included in the analyses. Our final sample consisted of 1,810 athletes (993 men, 817 women, 55% vs. 45%) aged between 16 and 22 years old (M=18.7 years, SD=2.1). Sixty per cent (60%) of athletes were high school students (M=17.5 years, SD=1.5) and 40% were from institutions of higher education (university, professional schools (HES))[1] (Mage=20.6 years, SD=1.3).

[1] 3 athletes did not specify their education level.

Sixty six per cent (66%) of the 1,810 athletes were involved in a second sport in addition to their primary sport, and 30% played a third sport. In all, 50% of the athletes practiced at least one sport competitively.

2.2. Materials

Our data were collected using a self-administered questionnaire, designed by the authors of this study. Pilot surveys were conducted to ensure that the questionnaire could be understood and completed by adolescents. Our questionnaire included 21 questions concerning social and demographic information, sports practice, risk-taking behaviors and sports injuries. In this chapter, only demographic information (male/female), information concerning athletic practice (recreational/competitive sports, number of hours of sports practice per week), sports injuries and risk-taking behaviors (alcohol, cannabis and tobacco consumption) were used.

All sports injuries up until the date of the questionnaire were recorded. Only injuries requiring sport interruption were considered: *"Have you already had an injury requiring a sport interruption?"* If the athlete answered *"Yes"*, he or she was asked to specify the duration of the rest and rehabilitation period into one of several categories: "*Less than ten days*", "*From ten days to three months*", "*From three to six months*", or "*More than six months*". The duration of the rest and rehabilitation period was used as a proxy for the severity of injury.

A list of 30 substances, both legal and banned, was proposed to athletes in the following question: "*Have you already used the following substances in your sport practice?*" For each substance, athletes indicated frequency of use on a 4-point scale: "*never (1), sometimes (2), often (3), every day or almost (4)*". In this chapter, the focus is restricted to alcohol and cannabis data.

Smoking was evaluated using the following consumption categorization: "*At present, do you smoke cigarettes?*" Possible responses to the question on smoking were: "*never (1)*", "*I have stopped since … months (2)*", "*Irregularly: … cigarettes per week (3)*", or "*Regularly: … cigarettes per day (4)*".

2.3. Procedure

Permission for the study was obtained from the University of Lausanne's Research Ethics Board. Permission was also obtained from the heads of the various schools in the sample to distribute the questionnaire, and teachers were asked to set aside time during class for students to fill out the questionnaire. Before administering the survey, athletes and school administrators were informed that participation was voluntary. The 21-item self-report instrument was administered in different schools in 2008 by a survey researcher, whose role was to answer questions and ensure that there was no communication between subjects. Only students who participated in sports outside of their school were asked to fill out the survey. Athletes were reminded to answer all questions independently and honestly and that anonymity and confidentiality were guaranteed. Participants did not write their names on the surveys. Surveys were completed at the beginning of a physical education class in high schools, and at the beginning of a lecture in institutions of higher education. After completing the surveys, which took 15 minutes on average, athletes placed them in a closed box.

2.4. Data Analysis

Data was managed and analyzed using Statistica Software (Version 8.0, StatSoft, Inc., Tulsa, OK, USA). Descriptive analyses were conducted to explore relationships between risk-taking behavior, sports-related injury risk and severity in each group (global sample, male/female athletes, and competitive/recreational athletes). Bivariate comparisons of athletes with and without injury, female and male athletes, recreational and competitive athletes were made using the two-tailed Student's t-tests for continuous variables and chi-square tests for categorical variables. Correlation tests were used between two continuous variables.

3. RESULTS

In the following passage, only significant differences ($p<0.05$) and results that tend to be statistically significant ($0.05<p<0.1$) are presented.

3.1. Injury Statistics

Sixty-seven percent (67%) of amateur athletes recorded at least one sport injury in their lifetime. The most frequent sports injuries were those requiring ten days to three months of sport interruption (62% of athletes). Injuries categorized as requiring fewer than ten days or more than three months were less frequent. Forty-five percent (45%) of amateur athletes suffered at least one injury that forced them to stop playing the sport for a period of less than ten days. Twenty-two percent (22%) of athletes sustained at least one injury requiring a break of three to six months. Eleven percent (11%) of amateur athletes were concerned by an injury that required a break of more than six months.

Competitive athletes had more sports injuries than recreational athletes (82% vs. 55%, $Chi2(1809)=140.30$, $p<0.0001$). Moreover, competitive athletes had more minor injuries (requiring a break of less than ten days) than recreational ones (49% vs. 41%, $Chi2(1218)=8.60$, $p=0.003$). A tendency for the injuries to last ten days to three months was observed (64% vs. 59%, $Chi2(1218)=3.33$, $p=0.07$). These results may be explained by their greater personal investment in the sport: the competitive athletes practice more hours per week than recreational athletes (11h24 vs. 7h12, $t(1808)=12.06$, $p<0.0001$). Injuries also increased with time investment: the more time investment (hours of practice per week), the higher the risk of sports-related injuries ($r(1810)=0.19$, $p<0.0001$). However, practice time was only weakly related with minor injuries (i.e. injuries lasting less than ten days, $r(1219)=-0.06$, $p=0.03$) and with more serious injuries lasting three to six months ($r(1219)=-0.07$, $p=0.01$).

Sports injuries were more frequent among males than females (72% vs. 62%, $Chi2(1809)=21.69$, $p<0.0001$). Differences in the severity of injuries were also observed. Injuries lasting three to six months were more frequent among males than females (25% vs. 18%, $Chi2(1219)=7.22$, $p=0.007$) and a similar trend was observed in injuries lasting ten days to three months (64% males vs. 59% females, $Chi2(1219) =3.21$, $p=0.07$). The more frequent

and serious sports injuries among males could be related to the difference in time devoted to practice: males practiced an average 6h49 of sports per week and females 5h14 per week ($t(1716)=-6.43$, $p<0.000001$). Moreover, males practiced more competitive sports than females (52% vs. 37%, $Chi2(1809)=41.39$, $p<0.00001$).

3.2. Associations between Sports Injuries and Risk-Taking Behaviors

Three risk-taking behaviors were evaluated among amateur athletes: alcohol, cannabis and tobacco consumption.

3.2.1. Alcohol Consumption and Sports Injuries

With increasing alcohol consumption, the risk and severity of sports injuries increased.

Athletes who had had at least once an injury that required a period of rehabilitation consumed alcohol more frequently during practice than athletes who had never had sports injuries ($t(1808)=-2.59$, $p=0.01$). The more severe injuries were associated with alcohol consumption. Athletes who had had at least once a severe injury (requiring a rehabilitation period of more than six months) drank alcohol more frequently than athletes who had never had such serious injuries ($t(1217)=2.10$, $p=0.04$).

Separating competitive and recreational athletes, the relationship between alcohol consumption and sports injuries' risk was significant among competitive athletes ($t(659)=-2.82$, $p=0.005$) but not among recreational ones ($t(1146)=-1,21$, $p=0.22$). In competitive sports, athletes who had had at least one injury lasting more than six months answered that they consume alcohol more frequently than those who had never had such serious injuries ($t(366)=2.86$, $p=0.004$). A similar trend was observed among recreational athletes ($t(849)=1.73$, $p=0.08$).

Separating males and females in analyses, the association between alcohol consumption and sports injuries' risk was significant in females ($t(811)=-2.21$, $p=0.03$) but not in males ($t(1808)=-0.68$, $p=0.49$). Similarly, the severity of injuries was associated to alcohol consumption only among females. Females who had been seriously injured (injuries lasting more than six months) consumed alcohol more frequently than females who had never had such serious injuries ($t(498)=1.94$, $p=0.05$).

3.2.2. Cannabis Use and Sports Injuries

Cannabis use increased the risk but not the severity of sports injuries. Athletes who had had at least once an injury requiring a rehabilitation period used cannabis more frequently during practice than those who had never had sports injuries ($t(1808) =-2.30$, $p=0.02$). No difference was observed concerning the severity of injuries.

Comparing competitive and recreational athletes, a significant association between cannabis use and sports-related injury risk appeared among competitive athletes ($t(659)=-2.57$, $p=0.01$) but not among recreational ones ($t(1146)=-1.21$, $p=0.22$). Nevertheless, a significant difference was shown in the severity of injury among recreational athletes only; athletes who had had at least one sports injury lasting three to six months used cannabis more frequently than those who never had such injuries ($t(849)=2.24$, $p=0.02$).

Separating males and females in analyses, the significant association between cannabis and sports injury risk disappeared among females ($t(811)=-0.93$, $p=0.35$) and males ($t(990)=-1.59$,

p=0.11). Similar to the global sample, no associations between the severity of injuries and cannabis use were observed in male and female athletes.

3.2.3. Smoking and Sports Injuries

Smoking was not associated with risk (t(1808)=-0.15, p=0.88) but was associated with sports-related injury severity. Athletes who underwent serious injuries, requiring a rehabilitation period of three to six months (t(1217)=2.51, p=0.01) or more than six months (t(1217)=3.04, p=0.002) smoked more than those who had never had such serious injuries. Similar results were obtained when comparing competitive and recreational athletes or separating males and females: risk of injury was not associated with smoking but significant associations were observed between smoking and the severity of injury.

Recreational athletes who had had at least one injury requiring a rehabilitation period of more than six months smoked more than those who had never had such a serious injury (t(849)=2.68, p=0.007). This trend was observed in competitive athletes (t(366)=1.62, p=0.10).

Females who had had at least one injury lasting longer than six months smoked more than females who had never had such serious injury (t(498)=2.83, p=0.005). A similar trend was observed in males (t(713)=1.74, p=0.08) and a significant result was obtained for injuries requiring three to six months of rehabilitation for males only (t(713)=2.21, p=0.03).

4. CONCLUSION

Results showed that the percentage of athletes who had had at least one injury requiring rehabilitation was high (67%). This percentage was higher than results obtained in previous research. That may be explained by the fact that, in this study, all previous sports injuries leading up to the questionnaire were evaluated. In previous studies, athletes were often asked to report their injuries during a limited period (e.g., the last 24 months, during the course of the study - 10 months, in the past 12 months) (Noh, et al., 2005; Pikora, et al., 2011; Tsigilis & Hatzimanouil, 2005). Moreover, comparisons with other studies are difficult because the definition of sports injuries and of their severity differ from study to study (Junge & Dvorak, 2000). In their study on basketball injuries, Cumps et al. (2007) defined an acute injury as "*being a basketball accident with a sudden, direct cause/onset, which required at least minimum medical care including, e.g. ice, tape, etc. and which caused the injured player to miss out on at least one training or game session*" (Cumps, et al., 2007, p.205). Junge et al. (2004) defined sports injury as "*any physical complaint caused by soccer or rugby during school training and matches. The duration of absence due to an injury was categorized according to the severity grading of the National Injury Registration System (NAIRS): up to one week, 8-21 days, or more than 21 days*" (Junge, et al., 2004, p.169). Carmeli et al. (2003) defined sports injury as a single event that resulted in hospital or medical referral. The various definitions influence the incidence rates and relationships between the injury risk, severity of injuries and risk factors taken into account in studies.

Results of our study showed differences according to athletes' type of involvement in sports (recreational vs. competitive sports) and gender. Competitive athletes sustained more injuries than recreational ones. High levels of participation are significantly associated with increased risk of injury in general and in sports-related injury. In particular, injured players had

more hours of practice per week than the non-injured (Carmeli, Azencot, Wertheim, & Coleman, 2003; Tsigilis & Hatzimanouil, 2005; Williams, et al., 1998).

Concerning athletes' gender, males were injured more frequently and seriously than females in this study. According to the National Safe Kids Campaign (NSKC, 2004), among children aged 5 to 9 years old in the United States, sports injuries occurred more frequently among girls than boys. However, during puberty (ages 10 to 14), boys are injured more frequently and severely than girls. Our results were similar among amateur athletes aged 16 to 22 years old. The risk of physical injury is inherent in sports participation (NSKC, 2004). We have shown in this study that males were more invested in sports than females: they practiced more hours of sports per week and participated in more competitive sports than females. Moreover, males are more aggressive, have larger body mass, and experience greater contact compared with females (Collard, et al., 2008; Emery, 2003). They are also more likely to participate in vigorous exercise and sport (Collard, et al., 2008; Taimela, Kujala, & Osterman, 1990). Consequently, males have a greater risk of sports injuries.

Compared to tobacco and cannabis use, alcohol consumption was the risk-taking behavior with the highest relation to sports injuries. With increased alcohol consumption, the risk and severity of sports injuries also increased. Alcohol consumption has negative cognitive and psychomotor effects, such as deteriorations of vigilance, reaction time, eye-hand coordination, accuracy, balance and cognitive processing (Gutgesell & Canterbury, 1999). Some gender differences were observed in our study; consumption of alcohol was associated with higher risk and severity of sports injuries for females but not for males. Our results are similar to those of Gmel, Kuendig and Daeppen (2009) and Gmel, Kuendig, Rehm et al. (2009). On examining whether sports injuries were associated with alcohol consumption before the injury (acute intake) and with usual consumption patterns (chronic high intake and heavy intake on single occasions) in hospital patients, Gmel, Kuendig and Daeppen (2009) showed that with increasingly acute intake (consumption 6 h before injury), the risk of sports-related and other injuries increased. Alcohol consumption was associated with an increasingly higher risk of sports-related injuries compared with other injuries among females. Regarding typical consumption patterns, both males and females injured while exercising were more often at-risk drinkers (males: 44%; females: 25%) compared with those injured during other activities (males: 37%; females: 13%). Results indicated that both males and females, but particularly females, should not practice sports after alcohol ingestion. Biologically, females are less resistant to alcohol effects compared to males: females reach higher blood alcohol concentrations than men for the same amount of alcohol consumed because of weight differences, lower body water percentage compared with men, and differences in metabolism of alcohol (Gmel, Kuendig, & Daeppen, 2009; Graham, Wilsnack, Dawson, & Vogeltranz-Holm, 1998).

Comparing recreational and competitive athletes, associations between alcohol consumption, risk and severity of sports injuries were observed almost in competitive athletes. This result may be explained by two factors. First, in recreational sports, alcohol consumption during play may lead to a decrease in personal investment in the sport when athletes feel the effects of alcohol. In competitive sports, the decrease in personal investment is more difficult. Because training, regular practice and performance improvement are more important in competitive sports, competitive athletes may be more likely to continue to playing a sport than recreational athletes even if they have consumed substances. Second, according to Gmel, Kuendig and Daeppen (2009), competitive investment is often linked to a higher degree of

personal investment in the sport that is often accompanied by an increase in alcohol consumption due to the social occasions to drink alcohol after trainings or competitions. Nevertheless, in our sample, no differences in alcohol consumption were observed between competitive and recreational athletes.

Concerning cannabis use, results of this study showed an increase of sports-related injury risk with cannabis use but not in the severity of sports-related injuries in the global sample. The significance of the association between injury risk and cannabis use was low and disappeared when males and females were separated in analyses. Moreover, this significant relationship was only seen in competitive athletes. Concerning the severity of sports injuries, a single significant association was found in recreational athletes for serious injuries lasting three to six months. In previous studies, mostly focused on traffic injuries, the relationship between cannabis use and injury was unclear and results were inconsistent: some suggested a causal relationship between cannabis consumption and injury, while others did not (Gmel, Kuendig, Rehm, et al., 2009; Macdonald, et al., 2003; Mura, et al., 2003). Macdonald et al. (2003) reviewed the direct effects of cannabis on psychomotor performance in order to better understand how cannabis use might be related to injuries. Laboratory research has found, in general, that the cannabis use is related to performance deficits and indicated that the most deleterious effects of cannabis use were found for attention and tracking and psychomotor skills, among others. The sedative effects of cannabis use are well established, with users typically reporting mental slowness, tiredness, anxiety and paranoia as well as relaxation and euphoria (Macdonald, et al., 2003; Wadsworth, et al., 2006). These cognitive factors could influence injury risk (Macdonald, et al., 2003). These acute effects on cognition and performance have been well-documented but they are limited to periods of intoxication (Heishman, Arasteh, & Stitzer, 1997). Fewer studies have focused on the long-term effects of chronic cannabis use on cognitive performance. However, the evidence suggests that long-term cannabis use leads to subtle and selective impairments of specific higher cognitive functions (e.g., schizophrenia or depression, cognitive impairments of various types, permanent effects on memory, information processing and executive functions) (Kalant, 2004; Wadsworth, et al., 2006). Nevertheless, these associations were often weak and often observed only in regular users (Kalant, 2004). The low association between cannabis use and sports injuries observed in our study may be explained by the fact that athletes were often not regular cannabis users but only occasional users. Moreover, the timing of cannabis use in relation to sports injuries was not available in our questionnaire, which only queried frequency of cannabis use. The consumption of cannabis was perhaps too low or too temporally removed from sports practice to be highly associated with risk or severity of sports injuries. Alcohol consumption may be higher related to sports injuries because amateur athletes consume alcohol more frequently than cannabis.

Results concerning smoking showed generally that smoking was not associated with the risk but instead with the severity of sports injuries. Smoking could deteriorate the natural physical defenses of athletes, increasing the severity of sports injuries. Investigation is needed to describe and explain the relationship between smoking and sports injuries further.

Some caution is needed in interpreting our data due to several methodological limitations. First, self-reported data may have introduced bias into the results of this study. Despite of the announced confidentiality, it is possible that athletes may have under-reported risk-taking behaviors. This problem has been researched for the use of illegal substances during sports (Lentillon-Kaestner & Ohl, 2010). According to the World Anti-Doping Code (Code, 2010), alcohol is prohibited in competition only in particular sports (e.g., archery, karate,

motorcycling, aeronautics) and cannabis is prohibited in all competitive sports. Some athletes of these particular sports and competitive athletes may choose not to reveal their consumption of cannabis and alcohol, even if the anonymity and the confidentiality are guaranteed, leading to an underestimation of their consumption (Laure, 1997). In fact, the associations between cannabis use, alcohol consumption and sports injuries may be higher. This methodological problem is permanent when we focus on uses of illegal substances (Lentillon-Kaestner & Ohl, 2010).

Second, this study was limited by its retrospective data collection concerning sports injuries. In the questionnaires completed by the athletes, the incidence of injuries was significantly lower than the incidence found in weekly follow-up examinations by a physician. Comparing these two different methodologies, Junge and Dvorak (2000) found that approximately every third moderate injury and less than 10% of mild injuries were recalled retrospectively. The shorter the period of symptoms and the longer the duration since the injury occurred, the more difficult to recall. Even severe injuries, such as fractures, were not reported in the retrospective investigation.

Third, this study focused only on typical consumption patterns and not on acute alcohol and cannabis intake. Due to these limitations, associations and not causality were determined in this study. Regarding the negative effects of alcohol and cannabis use on psychomotor skills and the results of Gmel, Kuendig, Rehm et al. (2009), we can hypothesize that alcohol and cannabis increase the risk and severity of sports injuries. In future studies, it would be interesting to distinguish typical consumption patterns and acute intake for cannabis and alcohol consumption, where acute intake is defined as consumption six hours or fewer before sports-related injuries (Gmel, Kuendig, Rehm, et al., 2009).

Some previous research concluded that the number and severity of sports injuries could decrease by focusing on elements other than risk-taking behaviors: using protective equipment, safe playing conditions (e.g., field surfacing, maintenance), development and enforcement of safety rules, etc. (NSKC, 2004). The effectiveness of stretching before participation in athletic activities was also discussed as an injury prevention method; according to the review of literature of Thacker, Gilchrisit, Stroup and Kimsey (2004), there is not sufficient evidence to endorse or discontinue routine stretching before and after exercise to prevent injury among competitive or recreational athletes. Our study showed that risk-taking behaviors, mostly alcohol consumption, should be taken into account as factors that can prevent sports injuries. The increase and improvement of prevention on risk-taking behaviors in sports could help to reduce the number and severity of injuries in sports played on an amateur level.

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