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Use of psychotropic substances among elite athletes – a narrative review

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Summary

BACKGROUND AND AIMS: Elite athletes may use psychotropic substances for recreational reasons, (perceived) performance enhancement or self-medication. Causes can overlap. For athletes, substance use may be associated with various medical and social risks. Psychoactive substances include alcohol and nicotine, illicit and various prescription drugs, which all have a potential for abuse and dependence. This paper reviews the existing literature on the use of psychoactive substances and associated substance use disorders among elite athletes in terms of prevalence, patterns of use, as well as underlying causes and risk factors.

METHODS: Due to the heterogeneous and partially fragmentary study data, a narrative approach with selection of applicable publications of a Medline search was chosen.

RESULTS: The most commonly used psychoactive substances among elite athletes were alcohol, nicotine, cannabis, stimulants and (prescription) opioids. Overall consumption rates are lower in professional sports than in the general population, but use of several substances (smokeless tobacco products, prescription opioids, stimulants) have high prevalence in specific sports and athlete groups. Substance use is subject to multiple risk factors and varies by substance class, sport discipline, country and gender, among other factors.

CONCLUSION: Knowledge on the underlying causes and patterns of substance use, as well as the prevalence of substance use disorders in professional sports, is still limited. High prevalence of various substances (i.e., nicotine, prescription opioids) may indicate potentially harmful patterns of use, requiring further research. Specific preventive and therapeutic concepts for the treatment of substance use disorders in elite athletes should be developed.

Keywords: *elite athlete, professional sports, psychotropic substances, recreational substance use, substance use disorders, performance enhancing substances, sports medicine*

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Introduction

The mental health of elite-level athletes has attracted growing interest over recent decades [1]. However, the prevalence of psychiatric disorders in this population is still debated. Recent studies suggest rates of common mental disorders among competitive athletes equal to those in general population [2]. The psychological and physical demands of a sporting career may lead to an increased susceptibility to mental health problems and risk-taking behaviour [3]. Besides, there is an overlap between the peak competitive years in most sports and the main age of onset of mental disorders [4]. Furthermore, the use of alcohol and illicit drugs is common in the 18–29 age group, with prevalence rates of associated substance use disorders being higher than over a lifetime [5].

In substance use, recreational consumption aiming primarily at psychotropic effects is distinguished from performance-enhancing use. Recreational substance use comprises use of alcohol, cannabis, nicotine (tobacco) and non-medical, psychoactive medication (opioids, stimulants, benzodiazepines). Doping substances and methods include, among others, anabolic agents, growth factors, masking agents and blood doping. However, a strict distinction between recreational and performance-enhancing use is difficult, as psychoactive substances may be consumed for (subjectively) improving or maintaining performance. At the same time, primarily performance-enhancing substances can have psychotropic side effects.

Most scientific research on substance use among elite athletes focuses on doping; however, in recent years multiple studies exploring the prevalence of recreational substance (ab)use in different athlete populations have been conducted. With the focus on success and maximising performance in elite-level athletes, two fundamental questions regarding recreational substance use arise: First, why do elite athletes consume substances with potentially detrimental effects on both sporting performance and career (sanctions, suspension, etc.)? Second, are these causes of medical relevance and require psychiatric treatment? Existing literature has a primarily quantitative focus, with little exploration of causes and consequences of substance use for the individual athlete. Valid assertions on the prevalence of substance use

disorders are therefore limited. The present review summarises the current state of research on the prevalence of psychotropic substance use among elite athletes and outlines findings in answer to the questions raised above.

Search methods

We identified studies through a Medline search. Search terms comprised the following, either individually or combined: '(elite) athletes', 'recreational substance use', 'substance use disorder', '(substance) addiction', '(substance) dependence', 'substance abuse', 'illicit drugs', 'psychotropics', 'alcohol', 'cannabis', 'marijuana', 'tobacco', 'nicotine', 'smoking', '(prescription) opioids', 'heroine', 'benzodiazepines', 'GHB,' 'stimulants', 'cocaine', 'ketamine' and 'amphetamines'. We confined the search to articles in English and applied no date restrictions. We retrieved the articles discussing the use of psychoactive substances by elite athletes and psychiatric diagnosis of substance use disorders in athletes. We retrieved and reviewed a total of 287 articles of which we included 46 in this paper after a comprehensive study of their content, quality check and exclusion of redundancies.

Results

Causes and risk factors

Various explanations for recreational substance use among elite athletes have been evaluated [6–8]. A simple explanation is that reasons for drug use do not differ substantially between elite athletes and the general population. However, the question as to whether athletes hazard the negative consequences of substance use or are not aware of them remains open. More specific approaches include stressors elite athletes face during and after their career. Living in a highly competitive environment they must deal with pressure to perform, limited social support due to relocation, group dynamics in team sports, injuries and physical pain [9, 10]. Both acute and long-term stress can have a severe negative impact on psychological wellbeing and may contribute to the development of mental disorders. Recent meta-interpretations identified more than hundred distinct stressors throughout a sporting career [11]. Adolescent elite athletes are subject to an elevated risk for hazardous behaviour, including substance use. On the other hand, retirement from professional sports may also foster substance abuse [12]. The impact of the surrounding network, including family, coaches and peer athletes, on an athlete's mental health is complex and has not been conclusively examined. With regard to recreational substance use, some studies emphasise the network's protective effects, with others suggesting that those relationships, especially with peer athletes, may encourage the use, supply and demand for drugs [13, 14].

Data sources

Knowledge on substance use among elite athletes derives from two main sources: voluntary disclosure in research questionnaires and detection in anti-doping drug testing. Drug testing is performed by the World Anti-Doping Agency (WADA), its national sister organisations and sports federations. WADA publishes an annual List of Prohibited Substances and Methods. Psychoactive substances such as cannabinoids, stimulants and narcotics are banned during competition [15]. Alcohol has been removed from the prohibited list, with several sporting organisations continuing testing. WADA included nicotine on its monitoring programme in order to detect potential patterns of misuse in sport, but the conclusion is pending. Most sport federations and anti-doping agencies have introduced doping rules based on the WADA code. However, implementation of these policies and sanctioning of violations differ significantly. If WADA test results are taken as the sole source of information, recreational drug use among athletes seems rare: of 322,050 tests conducted in 2017, stimulants, narcotics and cannabinoids were found in 0.25% of all samples [16]. However, the testing system features significant gaps, especially in the youth and adolescent field. Use of alcohol and nicotine, frequent causes of substance use disorders in the general population, is not recorded by WADA. In self-report questionnaires, elite athletes report consumption rates for various psychoactive substances that are considerably higher than anti-doping test results suggest.

Specific substances

Nicotine

Nicotine is one of the most widely used psychoactive substances. It is derived from the tobacco plant for different forms of consumption. Nicotine simultaneously holds stimulant and relaxant properties and is highly addictive. Combustible and smokeless tobacco consumption can be distinguished. The most common form of nicotine uptake is through inhalation of tobacco smoke after combustion. Since the early 2000s e-cigarettes have become more widespread. Smokeless tobacco includes dry powdered snuff tobacco, chewing tobacco and snus, a moist powder tobacco product placed under the lips. Nicotine replacement therapy includes various products such as gum, transdermal patches, inhalers, etc. Smokeless tobacco products contain varying quantities of nicotine, which can reach those of combustible tobacco. Nicotine uptake via combustible and smokeless tobacco consumption holds equal addictive properties. Despite the absence of some of the deleterious effects of combustible tobacco, smokeless tobacco is associated with various adverse effects [17]. Use of smokeless tobacco products has been reported to be a relevant promoting factor for smoking initiation [18].

Compared with the general population, consumption rates of combustible tobacco among elite athletes are lower, most likely because of its detrimental effect on cardiopulmonary capacity [19]. However, there is strong evidence for common use of nicotine among elite athletes, suggesting smokeless tobacco or nicotine replacement therapy as the main route of administration. Chewing and spit tobacco became popular in the US major professional sports leagues in the 1970s, with estimates that more than a third of active MLB baseball players regularly use smokeless tobacco, in some cases publicly on-field [20]. Whereas the use of smokeless tobacco in American sports leagues has been investigated comprehensively, its prevalence outside the US is less researched. Among non-US athletes the most common smokeless tobacco product seems to be snus, with widespread use especially in winter sports [21, 22]. Analysis of urine controls conducted at the World Ice-Hockey Championships in 2009 demonstrated that between a third

and half of the tested players "actively" used nicotine right before or during competition [23]. A subsequent 1-year monitoring study with professional athletes from different sports quantified the "active" nicotine use at 15%, with significantly higher prevalence rates of up to 55% in strength-based and winter sports [24]. Athletes regularly describe beneficial effects of nicotine on psycho-physiological performance in competition, training and recreation. Studies showed short-term positive effects on cognition and reaction capacity, but could not demonstrate a physical performance enhancement [25, 26]. To date it remains largely unclear whether high consumption rates are due to the addictive properties of nicotine or result from deliberate decisions of the athletes for recreational or performance-enhancing use.

Cannabis

Cannabis, also known as marijuana, is a psychoactive drug from the Cannabis plant that is used for medical or recreational purposes. The main psychoactive component of cannabis is tetrahydrocannabinol (THC). Cannabis can be consumed by smoking, vaporising, within food or as an extract. Cannabis is the most commonly used illegal drug in the world. Regular cannabis use has a relevant potential for dependence. In the course of drug liberalisation in the western world, there is a trend towards decriminalisation and partial legalisation of cannabis, mostly for medical purpose, but also recreational use [27]. Medical cannabis refers to the use of cannabis and cannabinoids to treat disease or improve symptoms, although there is no consensual definition [28]. Effects in recreational use include relaxation, euphoria (feeling "high"/"stoned") and altered perception.

Research on prevalence rates of cannabis use among elite athletes is partially contradictory. According to WADA drug testing results, cannabis consumption is uncommon among professional athletes [16]. In contrast, self-report surveys suggest significantly higher consumption rates, but the spread of findings is large [29]. Many studies were conducted with US college athletes, reducing validity and transferability to other athlete populations [30, 31]. Cannabis use among elite athletes seems to be less frequent than in the general population; however, in a university setting group dynamics may foster consumption. Outside the US cannabis is consumed rather in winter and team sports, with reportedly low consumption rates in endurance sports [32]. Several studies showed a positive correlation between cannabis consumption and higher rates of recreational or performance-enhancing substance use in college athletes [6, 33]. With further legalisation and destigmatisation, multiple active and former elite athletes from US sports leagues have publicly spoken about a reportedly widespread use of cannabis in professional sports. They described the existent monitoring system as inefficient, potential sanctions as non-deterrent and named both recreational and medical reasons for use. Up to now, their reports remain largely anecdotal, but indicate that cannabis (ab)use among athletes may constitute a relevant issue.

Research could not demonstrate objective performance-enhancement effects of cannabis use [34]. However, despite evidence that cannabis interferes with psychomotor skills and cognitive function, some athletes report a beneficial impact on athletic performance. In recent years, self-initiated use of cannabis as an analgesic and in treating concussion among athletes, especially in contact sports, has been increasingly reported, accompanied by some athletes' demand for sports federations to reconsider their cannabis policy and permit its medical use [35, 36]. Until now there is little knowledge on potential benefits of cannabinoids in reducing rates of opioid prescription and prevention or treatment of traumatic brain injury.

Opioids

Opioids directly bind to opioid receptors, which are found principally in the central and peripheral nervous system and gastrointestinal tract. The main medical indication for opioids is pain relief. Specific opioids are used in replacement therapy for opioid use disorders. They have a significant dependence potential when consumed continuously or without medical supervision. The misuse of prescription opioid pain relievers is shown to act as a gateway for future abuse of illicit opioids [37].

As in the general population, opioid abuse among elite athletes may present as recreational consumption or as continued use of an initial prescription for pain alleviation. Pain is common in elite athletes and often accompanies sport injuries, but may also occur independently of injury or persist after the tissue healing period [38]. Despite numerous surveys on the incidence of various sport injuries, epidemiological data on pain management in elite athletes is limited. Widespread use of analgesics among competitive athletes is presumed, but most pain relief research focused on contact sports and the use of nonsteroidal anti-inflammatory agents [39]. Knowledge of use and misuse of, and dependence on, opioid medication in elite athlete is lagging behind [40]. Primarily recreational opioid abuse among elite athletes seems to be uncommon. Pursuant to WADA, potent opioids are banned in-competition, whereas low-potency opioids, such as tramadol or codeine, are not prohibited by WADA. In recent years, WADA tests identified increased prevalence of tramadol use in certain sports, notably cycling. WADA still lists tramadol on its monitoring programme, whereas other sport associations have already banned it in-competition [41].

Studies conducted with US college athletes repeatedly demonstrated an elevated use and misuse of opioid prescription drugs compared with non-athlete students, whereas no significant difference in consumption rates of illicit opioids was shown [42, 43]. In a study on career and post-career opioid use of former NFL football players, over half of the participants reported using prescription opioids during their career and 70% of those stated at least temporary misuse. Seven percent of the former players described prolonged misuse after the end of their careers, constituting an elevated prevalence rate compared with the general population [44].

Alcohol

Alcohol is the most frequently consumed recreational substance in the world in almost all adult subgroups. Regular alcohol consumption is one of the main global risk factors for disease [45]. An association between alcohol abuse and other psychiatric comorbidities has been demonstrated [46]. No performance-enhancing effects have been de-

scribed for alcohol. Knowledge of alcohol use among competitive athletes often derives from surveys of college students enrolled in sport programmes. Several studies demonstrated higher consumption and binge drinking rates among college athletes than in the general population [47, 48]. However, transferability of findings to other athlete groups is presumably reduced. Alcohol consumption seems to be significantly higher outside the competition season and during training periods. Athletes named mostly social and recreational reasons for drinking, with higher consumption rates in team sports than individual and endurance sports [49]. In other surveys, elite athletes described use of alcohol as a mechanism for coping with pressure to perform, anxiety and depressive symptoms [50]. Studies with athletes from contact sports showed reduced awareness of the potential hazards of alcohol drinking, raising the question of whether there is sufficient psychoeducation in this field [31, 51]. Studies on the alcohol use of retired elite athletes showed higher overall consumption rates compared with control groups, but could not demonstrate an increase in prevalence of alcohol dependency [12, 52].

Stimulants

Stimulants are a heterogeneous group of substances increasing activity of the central nervous system and body. Most of them have sympathomimetic effects and are associated with elevated dopamine release. Stimulants are used worldwide as prescription medicines for treatment of various medical disorders, as well as both legally or illicitly without prescription for performance enhancement or sought-after psychoactive effects. The overarching term comprises prescription drugs (methylphenidate, modafinil, etc.) and illicit substances (cocaine, “speed”, etc.) [53]. The main medical purpose is the treatment of impulse controls disorders (attention deficit hyperactivity disorder, ADHD), with further therapeutic off-label use [54]. There is significant abuse potential of use outside therapeutic indications. The use of stimulants for performance enhancement became widespread among both endurance and team sport athletes in the mid-20th century [55]. The current prohibited list published by the WADA comprises 69 different stimulants, all effectively detectable with present drug testing [15]. Use of recreational stimulant drugs such as cocaine or 3,4-methylenedioxymethamphetamine (MDMA, ecstasy) among elite athletes is rare according to doping tests results, with limited data on self-reported use available. There has been anecdotal evidence from US sports league athletes describing common cocaine consumption and lax doping controls. Recent years saw a significant increase of so-called therapeutic use exemptions (TUEs) for stimulants in athletes with diagnosed ADHD [56]. Prevalence of ADHD among elite athletes has not been investigated conclusively, but it is expected that rates are not less than in the general population [57]. Although stimulant medication is a well-established (if not always uncontroversial) treatment option for ADHD in the general population, the use of prescription stimulants is highly disputed in professional sports due to its potential/alleged performance enhancing effects.

Further substance use

There is little knowledge on the prevalence of further psychoactive substance use among elite athletes. Gamma-hydroxybutyric acid (GHB) has been popular in bodybuilding for allegedly anabolic effects. It is used in a recreational setting for euphoriant effects. GHB is medically approved for the treatment of narcolepsy, with positive effects on restorative night sleep making it potentially attractive for high-performance athletes [58]. Several works describe the use of anxiolytics and hypnotics by elite athletes dealing with anxiety, sleep disorders and pressure to perform [59, 60]. Benzodiazepines hold a high dependence potential when used autonomously or over longer periods. Ecstasy (MDMA), “speed” (amphetamine) and ketamine are popular club drugs, but their prevalence among elite athletes has not been specifically investigated so far.

Discussion

According to self-report surveys, recreational substance use among elite athletes seems to be more prevalent than official urine test figures suggest. Some of the described causes and patterns of consumption indicate harmful and hazardous substance use. However, based on available research, assertions on the prevalence of substance use disorders among elite athletes are limited. Large-sample, longitudinal control studies retrieving not only quantity and frequency of substance use, but also capturing diagnostic criteria of substance use disorders are therefore needed. So far, study participants were often US college athletes. Future research should therefore include adolescent and adult elite athletes from various international sporting organisations, to account for differing living, training and competition conditions, as those presumably influence substance use patterns. Assessment of consumption rates should preferably combine self-report declaration and verification via urine testing, as a false consensus effect was described in previous studies: Athletes partially underreported own substance use, but overestimated consumption rates of peer athletes [61]. Knowledge on prevalence and patterns of substance use among athletes provides the basis for future prevention, screening and therapeutic interventions for associated psychiatric disorders. Studies demonstrated in some athletes a reduced risk evaluation for substance use, illustrating the need for prevention measures [33, 62]. Treatment of substance use disorders in athletes may be challenging, as their daily routine is defined by training, competition and underlying stress factors difficult to assess. The development of specific treatment concepts is required to meet the needs of elite athletes, especially as strong reluctance to seek professional psychiatric support have been described [63]. We hope that in the future more athletes struggling with substance use disorders can benefit from disorder-specific treatment.

Implications for sports medicine

Mental and physical health cannot be separated. Over past decades, studies investigating mental health disorders in elite athletes demonstrated relevant prevalence rates in this population. Symptoms may be related to sport and interfere with performance. Recreational substance use in elite athletes was overshadowed by doping and attracted little scientific attention in the past, but is now researched more

intensively. Our review adds to the knowledge of earlier works by including recent studies [7, 64]. In our opinion, sports medicine as a cross-sectional subject should integrate knowledge on prevalence rates and treatment options of common mental disorders among elite athletes. The International Olympic Committee (IOC) and various sports association recently launched programmes raising awareness of mental health disorders in professional sports (such as the IOC, "Heads up" and "State of mind" campaign) [2]. According to the findings of our review, recreational substance use is common among elite athletes and may lead to hazardous patterns of use and substance use disorders. Management of mental disorders in professional sports must involve both treatment of individual athletes affected and optimisation of conditions in which athletes live, train and compete.

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