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Analysis of Sociodemographic– and Sport-Factors as Correlates of Doping Tendency in Professional Handball Players

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Abstract

Factors associated with doping in sports are frequently studied, but sport specific, gender-stratified investigations are rare. This study aimed to evaluate sociodemographic and sport factors associated with doping tendency (DT) in professional handball players. The participants were handball professionals from Croatia and Bosnia and Herzegovina (n=173; 22.12±3.11 years of age, 64 females and 109 males) who were tested on sociodemographic variables (gender, age, education), sport factors (experience in sport, achievement at the junior and senior level), and doping factors (personal opinion on the problem of doping, doping knowledge, and personal DT). Logistic regressions with sociodemographic- and sport-factors as predictors were calculated for binarized outcome (positive DT vs. negative DT). A greater likelihood of having a positive DT was found for males than for females (OR=1.60, 95% CI: 1.16-2.12) and for those who achieved success at the junior level (OR=1.21, 95% CI: 1.02-1.95). Among females, positive DT increased with experience in handball (OR=1.31, 95% CI: 1.11-1.55). Male players who achieved better competitive/sport results at a younger age were more prone to doping (OR=1.50, 95% CI: 1.21-1.83). While a greater tendency toward doping in males might be expected due to sociocultural factors, the gender-specific associations indicated specific factors that must be noted in the development of anti-doping strategies in this sport.

Keywords: *performance enhancement, predictors, logistic regression, association, athletes*

Introduction

Doping in sports (doping) refers to the use of prohibited substances or methods by athletes to gain an unfair advantage in competitions. These substances can include performance-enhancing drugs, such as anabolic steroids, stimulants, hormones, and other illicit drugs. Doping also encompasses methods such as blood doping (increasing the blood's ability to carry oxygen) and gene doping (altering genetic material to enhance performance) (McLean, Naughton, Kerherve, & Salmon, 2023). Doping is currently considered one of the most important problems in sports for several important reasons. First, doping enhances athletic performance beyond natural abilities, giving dopers an unfair advantage over clean athletes. Second, many doping substances have serious health risks and side effects, and athletes jeopardize their well-being by using these substances. Third, doping goes against the spirit of fair play and violates the rules and regulations of most sports organizations. This is directly connected with (fourth) ethical concerns since doping raises questions related to cheating, honesty, and integrity in sports. Finally, it is clear that doping directly and indirectly damages the reputation of sports, leading to a loss of public trust and interest. Therefore, efforts to prevent doping in sports are crucial to maintain the integrity of sports (Özkan et al., 2020; Varfolomeeva, Kozyreva, & Beresneva, 2023).

The World Anti-Doping Agency (WADA) plays a crucial

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role in the global fight against doping in sports (Houlihan, Vidar Hanstad, Loland, & Waddington, 2019). Apart from the well-known duties of WADA (i.e., setting standards, forming a prohibited list of substances and methods, and anti-doping testing), one of the key duties of WADA is education and research (Deng, Guo, Wang, Huang, & Chen, 2022). Specifically, WADA promotes anti-doping education and prevention programs for athletes, coaches, and sports organizations to raise awareness about the dangers and consequences of doping. Additionally, WADA supports and funds scientific research to improve anti-doping methods, detection techniques, and understanding of doping trends in sports. Therefore, it is clear that WADA not only defines rules and regulations but also actively proclaims the necessity of an evidence-based approach in the global fight against doping in sports. One of the best-known and widely accepted practices is identifying factors associated with doping behavior in (certain) sports (Rodek, Idrizovic, Zenic, Perasovic, & Kondric, 2013; Sajber, Maric, Rodek, Sekulic, & Liposek, 2019). The idea is to control factors associated with a positive likelihood of doping and to identify factors associated with a negative tendency toward doping in athletes and supportive personnel (coaches, physicians, etc.) (Rodek et al., 2013)

A range of factors have been identified as correlates of doping behavior and doping tendency (DT) in sports. For example, Lazuras et al highlighted the role of attitudes, normative beliefs, situational temptation, and behavioral control in predicting doping intentions (Lazuras, Barkoukis, Rodafinos, & Tzorbatzoudis, 2010). Boardley et al. explored the role of moral disengagement, with the former identifying specific mechanisms such as moral justification and displacement of responsibility and the latter developing and validating measures of team-based efficacy beliefs and moral disengagement (Boardley, Grix, & Harkin, 2015). Morente-Sánchez et al. emphasized the need for educational programs to combat doping (Morente-Sánchez & Zabala, 2013), while Kirby et al. provided game-theoretic and qualitative analyses of the economic and psychological factors influencing doping decisions, respectively (Kirby, Moran, & Guerin, 2014).

However, most of the studies reported the correlates of DT in mixed samples of athletes involved in individual and team sports and/or did not perform gender-stratified analysis. In one of the rare studies where only athletes involved in team sports were observed, the authors found that male athletes, those with better junior-level results, and those who regularly consumed dietary supplements were more likely to dope (Sekulic et al., 2016). However, the abovementioned study clearly revealed sport-specific templates of DT and differences among sports (the authors observed four Olympic team sports) and highlighted the necessity of further sport-specific, and gender-specific analyses.

Doping is currently considered one of the most important problems in sports, and sport and scientific authorities intensively seek the most efficient solutions in the global fight against doping. Among other approaches, this includes systematic studies performed with the aim of elucidating the factors associated with DP in sports (Rodek, Sekulic, & Pasalic, 2009; Sajber et al., 2019; Versic, Uljevic, & Pelivan, 2022). However, studies investigating specific sports are rare, and we have found no study which examined factors associated with DT, specifically in handball (team-handball) athletes. Therefore, the aim of this study was to evaluate the sociodemographic and sport-related factors associated with DT in professional handball players. Initially, we hypothesized that different factors would be correlated with DT in female and male professional handball players.

Methods

Participants

The participants in this study were professional handball players from Croatia and Bosnia and Herzegovina (n=173; 22.12±3.11 years of age, 64 females and 109 males). At the time of testing, all participants were members of teams competing at the highest level of national competitions. Handball teams were invited to participate in the study after the study was approved by the Ethics Committee of the Faculty of Kinesiology, University of Split (protocol code 2181-205-02-05-14-004; 17 June 2014). Participants were informed that the study was anonymous, that there was no intention to connect responses to a specific person, that they could leave some questions or that the whole questionnaire unanswered.

Variables

Variables were collected by a previously validated questionnaire and consisted of sociodemographic factors, sport factors and doping-related factors (Rodek et al., 2013; Sajber et al., 2019).

Sociodemographic factors included queries on age (in years), gender (male – female), and education (elementary school, high school, university/college student, university/college degree). Sports factors included questions on experience in handball (in years), the highest competitive achievement at the junior level (local competitions, national competitions, national-level achievement-medal, national team member), and at the senior level (local competitions, national competitions, national-level achievement-medal, national team member).

Doping-related factors included questions on self-perceived knowledge about doping in sport (poor, average, good), personal opinion on the main problem of doping in sports (doping is mainly a health hazard, doping is mainly a problem of fair-play, doping is equaly health hazard and a fair-play issue, I don't think doping is a problem), and opinions on personal DT (I will never use doping, I don't know, I will use doping if it will help me with no health hazard, I will use doping). For the purpose of the later logistic regression calculations (please see Statistics for details), DT was categorized into "Negative DT" (first answer) and "Neutral and positive DT" (remaining answers).

Online internet platform was used for testing all the players. A link for the questionnaire was sent to all players, and participants directly connected to the online platform where they answered the questionnaire on the QSU. All players received the link at approximately the same time of day and were informed that the questionnaire would be closed within 24 hours. The used platform was preprogrammed to allow a single connection from one IP address to prevent multiple answers from same participant.

Statistics

Since the Kolmogorov–Smirnov test identified all variables except age and experience in sport as nonparametric, descriptive statistics included calculations of frequencies

and percentages (means and standard deviations for age). Differences between males and females were calculated with the Mann–Whitney test (for ordinal variables), Chi-square test (for nominal variables), and independent samples t-test (for parametric variables).

Spearman's rank order correlation was calculated to determine the associations between the study variables when appropriate. The associations between sociodemographic and sport factors as predictors of DT were determined by performing logistic regressions. Specifically, DT was dichotomized (please see previously for categorization) and observed as a criterion, with "Negative DT" coded as 1 and "Neutral and positive DT" coded as 2. Odds ratios (ORs) and 95% confidence intervals (CIs) were reported.

Results

Male and female players were of the same age (22.03±4.43 and 22.28±3.12 years for males and females, respectively, t test =0.38, p=0.69) and had similar experience in handball (8.17±4.32 and 7.71±3.15 years for males and females, respectively; t test =0.73, p=0.46).

Table 1 presents descriptive statistics for the study variables and differences between genders. Compared with their male peers, females were better educated (Mann–Whitney test =2.68, p=0.01) and self-declared poorer doping knowledge (Mann–Whitney test =2.38, p=0.01). Positive DT was more common in males than in females (Mann–Whitney test =2.41, p=0.01).

The correlations between the study variables are presented in Table 2. Apart from some logical correlations (i.e., age

Table 1. Descriptive statistics and differences between genders in study variables

	Total		Males		Females		Gender differences	
	F	%	F	%	F	%	Test value	p
Education MW								
Elementary school	0	0	0	0	0	0		
High school	119	68.8	38	80.1	34	53.1		
College/University student	39	22.5	15	14.1	24	37.5		
College/University level	11	6.4	5	4.7	6	9.4	2.68	0.01
Junior level achievement MW								
Local Competitions	0	0.0	0	0.0	0	0.0		
National Competitions	108	62.4	70	64.2	38	59.4		
National level achievement	61	35.3	35	32.1	26	40.6		
National team member	2	1.2	2	1.8	0	0.0	0.68	0.49
Senior level achievement MW								
Local Competitions	0	0.0	0	0.0	0	0.0		
National Competitions	30	17.3	23	21.1	7	10.9		
National level achievement	110	63.6	63	57.8	47	73.4		
National team member	33	19.1	23	21.1	10	15.6	0.47	0.63
Doping knowledge MW								
Poor	98	56.6	69	63.3	29	45.3		
Average	37	21.4	21	19.3	16	25.0		
Good	38	22.0	19	17.4	19	29.7	2.38	0.01
Main problem of doping Chi square								
Doping is health-hazard	105	60.7	58	53.2	47	73.4		
Doping is against fair-play	42	24.3	29	26.6	13	20.3		
Both, health-hazard and against fair-play	9	5.2	7	6.4	2	3.1		
Doping is not the problem	12	6.9	10	9.2	2	3.1	6.18	0.10
Doping tendency MW								
Positive	20	11.6	12	11.0	8	12.5		
Somewhat positive	25	14.5	23	21.1	2	3.1		
Neutral	25	14.5	24	22.0	13	20.3		
Negative	93	53.8	52	47.7	41	64.1	2.41	0.01

Legend: MW denotes variables where differences were established by Mann Whitney test; Chi square denotes variables where differences were established by Chi square test; for detailed explanation of variables please see Variables subsection

is significantly associated with experience in handball, while experience is associated with achievement), several significant correlations deserve attention. Among men, DT was associated with greater junior-level achievement (Spearman's R=0.49, p<0.01). Additionally, among females, DT was significantly associated with experience (Spearman's R=0.61, p<0.05) and age (Spearman's R=0.32, p<0.05).

The results of the logistic regressions calculated sepa-

Table 2. Spearman's rank order correlations between study variables (* denotes significant correlations)

	Age	Experience	Education level	Junior level achievement	Senior level achievement	Doping knowledge
TOTAL SAMPLE						
Age	-					
Experience	0.68*	-				
Education level	0.18*	0.06	-			
Junior level achievement	-0.10	-0.23*	-0.27*	-		
Senior level achievement	0.36*	0.35*	0.19*	0.24*	-	
Doping knowledge	-0.01	-0.05	0.06	0.12	0.04	-
Doping tendency	0.07	0.13	0.03	0.36*	0.02	-0.01
MALES						
Age	-					
Experience	0.70*	-				
Education level	0.03	0.11	-			
Junior level achievement	-0.01	-0.22*	-0.41*	-		
Senior level achievement	0.44*	0.43*	0.12	0.24*	-	
Doping knowledge	-0.18	-0.19*	-0.11	0.15	-0.05	-
Doping tendency	0.04	-0.05	0.00	0.49*	0.04	-0.02
FEMALES						
Age	-					
Experience	0.62*	-				
Education level	0.31*	0.08	-			
Junior level achievement	-0.27*	-0.24	-0.17	-		
Senior level achievement	0.10	0.13	0.26*	0.26*	-	
Doping knowledge	0.33*	0.27*	0.26*	0.03	0.20	-
Doping tendency	0.32*	0.61*	0.09	0.21	0.02	0.02

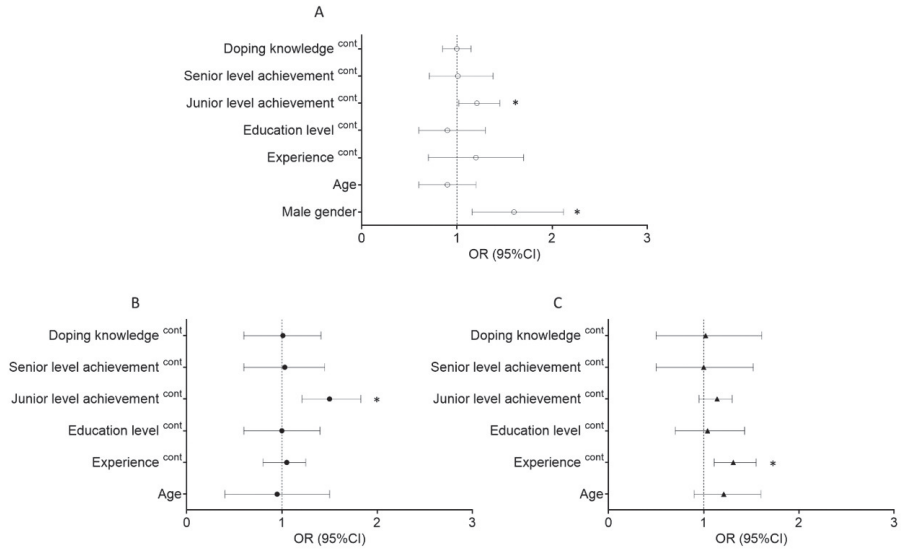

FIGURE 1. Results of logistic regression between study variables and doping tendency outcome in the total sample (A), in males (B), and in females (C); * denotes significant associations at p<0.05; cont denotes variables observed as continuous for the purpose of logistic regression calculation

rately for the total sample and gender stratified are presented in Figure 1. For the total sample, male gender was a factor associated with an increased risk for neutral/positive DTs (OR=1.60, 95% CI: 1.16-2.12). Additionally, higher likelihood for neutral/positive DT was found for players who were more successful at the junior level (OR=1.21, 95% CI: 1.02-1.95) (Figure 1A). For males, a greater likelihood of neutral/positive DT was found for players who achieved competitive success as juniors (OR=1.50, 95% CI: 1.21-1.83) (Figure 1B). Among females, those with more experience in handball were more prone to having neutral/positive DTs (OR=1.31, 95% CI: 1.11-1.55) (Figure 1C).

Discussion

Evidently, males are more prone to doping than females are. This is generally not a novel finding, but to the best of our knowledge, this is the first study in which this topic has been specifically addressed for handball sport (Sekulic et al., 2016). In general, the issue of why males are more prone to doping than females is complex and multifaceted, and several factors contribute to this disparity and can generally be categorized as (i) sociocultural influences, (ii) psychological factors, or (iii) physiological characteristics.

Sociocultural expectations and influences are known to be important determinants of any human behavior (Reynolds, Haycraft, & Plateau, 2022). In regard to sports, men are more pressured than women are to perform at high levels and to display physical capacities. There is no doubt that the region where the sample was drawn from (i.e., southeastern Europe) follows the same template. Consequently, such societal pressure can drive males to look for any kind of performance enhancement, including doping, simply to meet these expectations. This is additionally aggravated by the fact that men typically participate in competitive sports at higher rates than women (Gilic, Ostojic, Corluka, Volaric, & Sekulic, 2020; Sekulic et al., 2021). This puts men at increased risk of exposure to competitive environments and can result in a greater tendency toward doping. Finally, there is no doubt that doping as a phenomenon is not as stigmatized in men as it is in women. Consequently, male athletes (including the handball players studied here) probably experience greater peer pressure to use doping than their female peers involved in the same sport.

In regard to the psychological factors that can influence the likelihood of doping in males, the most important factor is likely gender differences in risk-taking behavior. Indeed, studies have repeatedly confirmed that men are generally more prone to risk-taking behavior than women are (Byrnes, Miller, & Schafer, 1999). This is confirmed in various circumstances, and sport-related behaviors are no exception (Woodman et al., 2013). Doping usage is known to be connected to various risks (i.e., health hazards and the danger of being caught and proclaimed as cheater). As a result, the decision to use doping can be seen as a form of risk-taking, being naturally more associated with males than with females. The previously described mechanism is typically amplified by typical male characteristics, aggression and competitiveness. In brief, higher levels of aggression and competitiveness among men may contribute to a greater likelihood of using doping to achieve superior performance.

In addition to sociocultural and psychological factors, some physiological differences between males and females deserve attention. Testosterone levels are positively correlated with greater muscle mass and strength, both of which are typical for males. The desire to enhance these traits, even by doping, might be stronger in men. Finally, metabolic differences between genders also contribute to a greater likelihood of doping among males. It seems that certain doping substances are more likely to be effective in males, while usage is related to "fewer risks" in males than in females. Specifically, one of the widely known side effects of anabolic-steroid usage is masculinization (Sjöqvist, Garle, & Rane, 2008). Naturally, this side effect presents bigger problem in females than in males, resulting in certain barriers to doping among female handball players.

More experienced female players were more prone to doping. Again, this finding can be supported by several factors. While some of these factors are relatively biased by certain sociocultural characteristics of the region where the sample was drawn from, others are probably more generalizable globally. Additionally, although we found a correlation between experience in handball and DT solely in females, there is a certain possibility that the following discussion is transferable to males as well.

As athletes age, they naturally experience a decline in physical performance due to factors such as reduced muscle mass, slower recovery times, and decreased stamina (Gries & Trappe, 2022). Doping can be seen as a way to counteract these age-related declines, being more accepted in older and more experienced players than in younger ones. Additionally, athletes who are involved in sports for a longer time are more vulnerable in terms of being injured, while recovery from intensive training and exhaustive competitions is slower (Bourogiannis, Hatzimanouil, Semanltianou, Georgiadis, & Sykaras, 2023; Hatzimanouil, Skandalis, Terzidis, Papasoulis, & Mavromatis, 2022). Doping drugs were originally developed as medicinal treatments for the treatment of injuries and illness. Therefore, if athletes experience such "benefits" from drugs (and this is more likely to occur in more experienced players), they will be more prone to doping as well. While specific mechanisms are characteristic for both males and females, the gender-specific association is understandable because of the previously discussed factors of a higher risk for doping in males (please see the previous discussion for more details).

Experienced athletes generally feel more pressure to maintain their competitive and performance levels. They try to stay competitive, and it is hard to accept that their achievement cannot be at the same level as when they are younger. Taken together, these factors can lead them to consider doping as a solution that can help them. While some of them are professionals and sport assure them financial income, as retirement approaches, they might resort to doping as a last chance to achieve their career goals and secure finances. In explaining differences between males and females with regard to these explanations, it must be highlighted that female players earn less in sports than males do (Mogaji, Badejo, Charles, & Millisits, 2021). Consequently, they might be more interested in prolonging their careers to earn additional money, resulting in a specified correlation solely among them and not among their male colleagues.

This is not the first study in which competitive achievement at a younger age was found to be correlated with DT in athletes. This correlation was also highlighted in a previous study on team sport athletes (Sekulic et al., 2016). However, this is one of the first studies in which such an association was

found for athletes involved in one specific sport, meaning that eventual sport-type bias cannot be identified as a factor of influence. Additionally, this is found only in male players, which clearly highlights gender-specific correlation.

High competitive/sport achievement at a junior age is naturally associated with high career expectations (Whitehead, Andrée, & Lee, 2004). In other words, if players achieve success at a young age, they consequently expect to be successful even at the senior level. However, this rarely occurs since competition at a younger age is limited to a very narrow age span (one or two years). At the senior level, rivals vary from 10-15 years, making competition much more challenging. As a result, the frustration of those who were successful at the junior level but not successful at the senior level is understandable. These athletes often face immense pressure to perform better than they are objectively able. This pressure can lead to the temptation to use doping to meet those expectations.

The social factor of external expectations could also contribute to a greater likelihood of doping in players, particularly those who achieved high success in the early phases of their career (Petróczi & Aidman, 2008). High expectations from coaches, sponsors, fans, and even families can increase the pressure on athletes to perform well. This external pressure can make doping a viable option for meeting these expectations, especially if success at the senior level is not achieved. This is logically connected with fear of failure, or the fear of not living up to one's own or others' expectations. This can drive athletes to seek any means necessary to succeed, including doping.

Finally, one typical sport factor and its potential influence on this correlation is particularly interesting. The volume and intensity of training load at the senior level are much greater than those at the junior level (Murray, 2017). This is particularly evident in handball due to its contact nature. Namely, at the very beginning of their senior-level career, young athletes must compete against much stronger rivals, who are not only better conditioned but also familiar with higher demands of the senior-level sport. Over the first few years of their senior-level career, most young players suffer injuries and/or at least experience dramatic psychophysiological exhaustion. As a result, they are challenged to seek any kind of help, including doping.

Limitations and strengths

The most important limitation of this study is that DT was self-reported by players. Therefore, there is a certain possibility for social desirability bias. However, we believe that the strict anonymity of the survey decreased this possibility. On the other hand, the fact that we studied a relatively large number of players competing at the highest competitive level, in a region where handball is a highly popular sport and both male and female teams are among the most successful in the world, is an important strength of the study.

Conclusion

The results revealed gender-specific correlates of DT in handball players. Therefore, our initial study hypothesis can be accepted. The established associations indicated specific factors that must be noted in the development of anti-doping strategies in this sport.

Since experience in sports is a risk factor for DT in females, special attention should be given to female players who are involved in handball for a longer time. Most likely, the anticipated end of one's career and pressure to maintain one's competitive and performance level are the most important factors contributing to this association.

Success at younger ages was shown to be a risk factor for positive DT in male players. Overall, some career-specific factors (i.e., high expectations) and sport-specific factors (i.e., exponential increase in training and competition demands at the senior level) should be studied in the future as circumstantial and contextual factors of identified associations.

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Conflict of interest
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