University of Zagreb

FACULTY OF KINESIOLOGY

Antonela Sinković

CORRELATION BETWEEN KNOWLEDGE OF ANTIDOPING REGULATION AND THE DOPING ATTITUDES OF SPORT PARTICIPANTS

DOCTORAL THESIS

Zagreb, 2026

Sveučilište u Zagrebu

KINEZIOLOŠKI FAKULTET

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POVEZANOST POZNAVANJA ANTIDOPINŠKIH PROPISA SA STAVOVIMA O DOPINGU SUDIONIKA U ŠPORTU

DOKTORSKI RAD

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prof. dr. sc. Damir Sekulić

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SUPERVISOR INFORMATION

Damir Sekulić was born in 1970 in Split, Croatia. He is a Full Professor at the University of Split, Faculty of Kinesiology. After completing his undergraduate studies at the Faculty of Physical Education in Zagreb, he obtained his PhD in Kinesiology from the same institution in 2001.

His primary research interests include sport-specific measurement protocols and testing, substance use and misuse in sport and exercise, and factors associated with physical activity. He has published more than 200 scientific papers indexed in the Web of Science, with over 4,000 citations, and is the author of four university textbooks.

Professor Sekulić has delivered invited lectures at more than 30 international scientific conferences. He has also served as a guest professor at several international universities, including Reykjavik University (Iceland), Mid Sweden University in Östersund (Sweden), the University of Ljubljana (Slovenia), and the University of Novi Sad (Serbia), among others. He has supervised fifteen doctoral students in Croatia and abroad.

His scientific achievements have been recognized through numerous national and international awards and distinctions. In 2017, he received the National Award for Science of the Republic of Croatia. He has also received several Awards for Science and Arts from the University of Split (2019, 2021, and 2023), as well as a Special Award for Scientific Contribution from the University of Montenegro (2016). Furthermore, he was included among the world's top 2% of scientists according to the Stanford University/Elsevier rankings in 2023, 2024, and 2026, reflecting the international recognition and scientific impact of his research.

BIOGRAPHY

Antonela Sinković was born in 1992 in Croatia. She graduated from the Faculty of Law, University of Split, in 2015 and passed the Croatian Bar Examination in 2017. In 2019, she enrolled in the doctoral study program in Kinesiology at the Faculty of Kinesiology, University of Zagreb.

Since 2019, she has been employed as a legal advisor at the City of Zagreb, Office for Education, Sport and Youth, where her responsibilities include the interpretation and application of sports legislation, administrative procedures, and legal matters related to sport. Previously, she worked as a trainee lawyer and legal advisor.

Her scientific interests focus on anti-doping regulations, legal aspects of doping prevention, anti-doping education, and doping-related attitudes among athletes and athlete support personnel. She is the author and co-author of four scientific papers published in international journals, including *Sports*, *Sport Mont*, *Sustainability*, and *Kinesiologia Slovenica*. She has also participated in several scientific conferences in the field of kinesiology.

She received the Dean's Award for Academic Excellence from the Faculty of Law, University of Split, in 2014. In addition to her academic and professional career, she has an extensive background in competitive tennis, spanning 18 years. Her sporting achievements include four national championship titles, a bronze medal at the European University Championships, a gold medal at the National University Championships, and a career-high ranking of 80th on the ITF World Junior Rankings.

Most important publications:

1. **Sinković, A.**, Pivalica, D., Jukić, I., Pehar, M., & Sekulić, D. (2026). Measuring legal competence in anti-doping: Reliability and validity of the novel measurement tool among athlete support personnel. *Kinesiologia Slovenica, 32*(1), 87–106.
2. **Sinković, A.**, Pivalica, D., Jukić, I., Pehar, M., Pivalica, B., Čerkez Zovko, I., & Sekulić, D. (2026). The effect of educational intervention on legal anti-doping knowledge and doping tendency in elite athletes. *Sports, 14*(1), Article 35.
3. **Sinković, A.**, Pivalica, D., Pivalica, B., Jukić, I., & Sekulić, D. (2025). Evaluating an anti-doping education program for athlete support personnel: Knowledge gains without behavioral shift. *Sport Mont, 23*(3), 127–133.
4. Vuksanovic Stankovic, D., **Sinković, A.**, Sekulić, D., Jeličić, M., & Rodek, J. (2022). Knowledge of the legal issues of anti-doping regulations: Examining the gender-

specific validity of the novel measurement tool used for professional athletes. *Sustainability, 14*(19), Article 12883.

Scientific Conference Contributions:

1. Marić, D., Veršić, Š., & **Sinković, A.** (2021). Attitudes toward doping and knowledge about doping in competitive Croatian rowers. *9th International Scientific Conference on Kinesiology*.
2. **Sinković, A.**, Sinković, V., & Milanović, D. (2021). Correlation of economic, geographic, and demographic characteristics of countries winning medals at world and Olympic rowing championships. *9th International Scientific Conference on Kinesiology*.
3. **Sinković, A.**, Sinković, V., & Milanović, D. (2021). Correlation of global economic, geographic, and demographic factors with Grand Slam singles titles (1992–2019). *29th Summer School of Kinesiologists of the Republic of Croatia*.
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LIST OF ABBREVIATIONS:

- **WADA** – World Anti-Doping Agency
- **CROADA** – Croatian Agency for Combating Doping in Sport
- **HZTA** – Croatian Institute of Toxicology and Anti-Doping
- **HZJZ** – Croatian Institute of Public Health
- **IOC** – International Olympic Committee
- **ADAMS** – Anti-Doping Administration and Management System
- **Q-LADR** – Questionnaire of Legal Anti-Doping Regulations
- **Q-LADR-ASP** – Questionnaire of Legal Anti-Doping Regulations for Athlete Support Personnel
- **LADEP** – Legal Anti-Doping Education Program
- **LADK** – Legal Anti-Doping Knowledge
- **DT** – Doping Tendency
- **ASP** – Athlete Support Personnel
- **TPB** – Theory of Planned Behavior
- **SLT** – Social Learning Theory
- **SCT** – Social Cognitive Theory
- **SIT** – Social Identity Theory
- **SDT** – Self-Determination Theory
- **UCI** – Union Cycliste Internationale / International Cycling Union
- **FIFA** – Fédération Internationale de Football Association / International Federation of Association Football.

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Abstract

Objectives The main objectives of this doctoral dissertation were to (i) determine the association between knowledge of anti-doping rules and attitudes toward doping among elite athletes, coaches, and athlete support personnel involved in health care, (ii) develop a targeted educational program aimed at improving knowledge of anti-doping regulations, and (iii) examine the effects of the implemented educational program on changes in attitudes toward doping-

More specifically, **Study 1** aimed to (i) evaluate the reliability and gender-specific discriminative validity of an original questionnaire (Q-LADR) designed to assess knowledge of the legal aspects of anti-doping regulations, and (ii) examine gender-specific associations between the level of legal anti-doping knowledge and potential doping behavior among senior-level professional athletes from Croatia and Montenegro.

Study 2 aimed to evaluate the reliability and validity of a newly adapted questionnaire (Q-LADR-ASP) designed to assess knowledge of the legal aspects of anti-doping regulations among athlete support personnel, including coaches, medical professionals, and nutritionists from Croatia and Bosnia and Herzegovina.

Study 3 aimed to examine the effects of a structured educational program focused on the legal aspects of anti-doping regulations among elite athletes and to analyze the relationship between changes in legal anti-doping knowledge and doping tendency.

Study 4 aimed to evaluate the effectiveness of an educational program focused on the legal aspects of anti-doping regulations among coaches and athlete support personnel involved in athletes' health care. The study sought to determine whether the educational intervention increases knowledge of the anti-doping legal framework and whether this education influences changes in attitudes toward doping among athlete support personnel.

Study 1

The main purpose of Study 1 was to develop and validate a measurement instrument to assess professional athletes' knowledge of the legal aspects of anti-doping regulations and to examine the association between legal anti-doping knowledge and attitudes toward doping.

Methods – Study 1 The study included professional athletes from Croatia and Montenegro (N = 479; 179 women; mean age 21.3 ± 3.3 years) participating in Olympic team sports such as football, basketball, handball, and volleyball. All participants were over 18 years of age and actively competing at the senior level. The research employed a cross-sectional design to validate an instrument for assessing knowledge of the legal aspects of anti-doping regulations. Test–retest reliability indicated satisfactory stability of the instrument ($\kappa = 0.65$). The original Q-LADR questionnaire was used to assess knowledge of the legal aspects of anti-doping regulations. In addition, socio-demographic data, sport-related factors (performance level and experience), and doping-related factors (attitudes and potential doping behavior) were collected.

Results – Study 1: The first study demonstrated that the developed instrument is reliable and applicable for assessing knowledge of the legal aspects of anti-doping regulations. Lower levels of legal anti-doping knowledge were associated with more permissive attitudes toward doping. Differences in knowledge were also observed according to gender, sport experience, and competitive level.

Conclusion – Study 1 The findings of the first study confirmed that the questionnaire designed to assess knowledge of the legal aspects of anti-doping regulations represents a reliable and valid instrument for use with professional athletes. Observed gender-specific differences, as well as the association between lower levels of legal anti-doping knowledge and more permissive attitudes toward doping, highlight the importance of legally oriented education in sport. The findings suggest that the legal aspects of anti-doping regulations may play a significant role in understanding attitudes toward doping and provide a foundation for future research and educational interventions.

Study 2

The main purpose of Study 2 was to adapt and validate a measurement instrument to assess knowledge of the legal aspects of anti-doping regulations among athlete support personnel, and to examine its reliability and criterion validity in a broader professional context.

Methods – Study 2 The study included 211 athlete support personnel from Croatia and Bosnia and Herzegovina (71 women; mean age 41.1 ± 7.8 years), including coaches, medical professionals, and nutritionists. A subsample of 56 participants completed the questionnaire twice within a 7–10-day interval to assess test–retest reliability. The adapted Q-LADR-ASP questionnaire was developed from the original athlete-oriented tool and initially consisted of 20 items. In addition to legal anti-doping knowledge, socio-demographic, sport-related, and doping-related variables were collected. Factor analysis, t-tests, Spearman correlations, and logistic regression were used to evaluate the instrument's psychometric properties and criterion validity.

Results – Study 2 After excluding two items with insufficient reproducibility, the final 18-item version of the questionnaire demonstrated satisfactory reliability ($\kappa = 0.61$; absolute agreement 82%). Factor analysis identified two latent dimensions reflecting (i) rights and obligations under the anti-doping code and (ii) doping control procedures and legislation. Criterion validity was confirmed by significantly higher scores among medical professionals than among coaches and nutritionists, as well as by positive associations among legal anti-doping knowledge, sport level, and prior exposure to doping control procedures. No gender-specific differences were observed.

Conclusion – Study 2 The findings of the second study confirmed that Q-LADR-ASP is a reliable and valid instrument for assessing knowledge of the legal aspects of anti-doping regulations among athlete support personnel. The results highlight the importance of role-specific legal education in sport and suggest that the instrument may be useful for identifying knowledge gaps and informing the development of more targeted anti-doping educational strategies, particularly those aimed at reducing unintentional rule violations.

Study 3

The main purpose of Study 3 was to examine the effects of a structured educational intervention focused on the legal aspects of anti-doping regulations among elite athletes and to analyze the relationship between changes in legal anti-doping knowledge and doping tendency, with the aim of assessing the practical impact of legally oriented education on attitudes toward doping.

Methods – Study 3 A randomized controlled trial included 310 elite athletes (156 women; mean age 24.1 ± 4.2 years) competing at the national or international level (individual sports: N = 119; team sports: N = 191). Participants were randomly assigned to an experimental group (N = 140) and a control group (N = 170). A randomized pretest–posttest design was applied.

The following variables were assessed: socio-demographic and sport-related characteristics, knowledge of the legal aspects of anti-doping regulations (LADK), and doping tendency (DT). Repeated-measures ANOVA was conducted to examine changes over time and group differences. The analysis revealed a significant main effect of time and a significant time × group interaction. Logistic regression analysis was performed to evaluate the association between changes in legal anti-doping knowledge and doping tendency; however, no significant association was found.

Results – Study 3. The third study confirmed that the educational intervention significantly increased elite athletes' knowledge of the legal aspects of anti-doping regulations. However, no statistically significant association was found between increased knowledge and reduced doping tendency. These findings suggest that legal education alone is not sufficient to produce changes in attitudes toward doping.

Conclusion – Study 3 The third study demonstrated that a structured educational program significantly improves knowledge of the legal aspects of anti-doping regulations among elite athletes. Nevertheless, the results did not indicate a statistically significant association between increased knowledge and reduced doping tendency. The findings suggest that while the legal aspects of anti-doping regulations constitute an important component of education, they are not

sufficient on their own to change attitudes toward doping. Therefore, the development of long-term, multidimensional interventions that integrate legal, psychological, and value-based components is recommended.

Study 4

The main purpose of Study 4 was to evaluate the effectiveness of an educational program focused on the legal aspects of anti-doping regulations among coaches and athlete support personnel involved in athletes' health care, and to examine whether such education leads to changes in knowledge levels and attitudes toward doping within this population.

Methods – Study 4 The study included 183 athlete support personnel (64 women; mean age 45.11 ± 8.90 years), comprising 101 medical staff members and 82 coaches. All participants were actively working with athletes at the national or international level.

An intervention design with an experimental and a control group was applied (intervention group: N = 99; control group: N = 84). Changes in knowledge and attitudes toward doping were assessed following the educational program. The following data were collected: socio-demographic and sport-related factors, doping tendency (dichotomized as negative vs. neutral/positive), and knowledge of the legal aspects of anti-doping regulations assessed using a 10-item questionnaire adapted for the athlete support personnel population. The questionnaire included items related to rights and obligations, anti-doping procedures, and the legal responsibilities of athlete support personnel.

The Legal Anti-Doping Education Program (LADEP) consisted of 10 structured lessons delivered by experts in sport law, anti-doping, and coaching practice. Repeated-measures ANOVA was used to evaluate the effects of the educational intervention over time.

Results – Study 4 The results of the fourth study showed that the educational program led to a statistically significant increase in knowledge among coaches and medical staff; however, no significant changes were observed in their attitudes toward doping. These findings suggest that

education focused on the legal aspects of anti-doping regulations primarily affects participants' cognitive dimension, but does not necessarily influence the value-based component of their attitudes.

Conclusion – Study 4 The fourth study demonstrated that an educational program focused on the legal aspects of anti-doping regulations effectively improves knowledge among coaches and athlete support personnel. Nevertheless, despite significant progress in understanding the anti-doping legal framework, no significant change in attitudes toward doping was observed. These findings indicate that education based solely on legal information primarily influences cognitive outcomes, whereas changes in attitudes may require integrating psychological and ethical components into anti-doping education programs.

Keywords: anti-doping; legal aspects of anti-doping regulations; attitudes toward doping; elite athletes; athlete support personnel; coaches; anti-doping education; legal anti-doping knowledge; doping tendency, sports law.

Sažetak

Cilj Glavni ciljevi ovog doktorskog rada su (i)utvrditi povezanost između poznavanja antidoping pravila i stavova o dopingu kod vrhunskih sportaša, trenera i osoba koje brinu o zdravstvenoj skrb, (ii) razviti ciljani edukacijski program u pogledu unapređenja znanja o antidoping pravilima te (iii) ispitati efekte provedenog edukacijskog programa na promjene u stavovima o dopingu. Točnije, **Studija 1** imala je za cilj (i) procijeniti pouzdanost i spolno specifičnu diskriminativnu valjanost izvornog upitnika (Q-LADR) za procjenu poznavanja pravnih aspekata antidopinške regulative te (ii) ispitati spolno specifične povezanosti između razine poznavanja pravnih aspekata antidopinške regulative i potencijalnog doping ponašanja kod profesionalnih sportaša seniorske razine iz Hrvatske i Crne Gore. **Studija 2** imala je za cilj procijeniti pouzdanost i valjanost novog prilagođenog upitnika (Q-LADR-ASP) za procjenu znanja o pravnim aspektima antidopinške regulative kod članova pratećeg osoblja, uključujući trenere, zdravstvene djelatnike i nutricioniste iz Hrvatske te Bosne i Hercegovine.

Studija 3 imala je za cilj ispitati učinke strukturiranog edukacijskog programa usmjerenog na pravne aspekte antidopinške regulative kod vrhunskih sportaša te analizirati odnos između promjena u razini znanja i doping tendencije. **Studija 4** imala je za cilj evaluirati učinkovitost edukacijskog programa usmjerenog na pravne aspekte antidopinške regulative kod trenera i osoba koje sudjeluju u zdravstvenoj skrbi sportaša. Istraživanje je imalo za cilj utvrditi dovodi li edukacijska intervencija do povećanja razine znanja o antidopinškom pravnom okviru te utječe li takva edukacija na promjenu stavova o dopingu kod pratećeg osoblja.

Studija 1

Glavna svrha studije 1 bila je razviti i validirati mjerni instrument za procjenu poznavanja pravnih aspekata antidopinške regulative kod profesionalnih sportaša te utvrditi povezanost između razine znanja i stavova prema dopingu.

Metode studije 1 U istraživanju su sudjelovali profesionalni sportaši iz Hrvatske i Crne Gore (N = 479; 179 žena; prosječna dob 21,3 ± 3,3 godine), uključeni u ekipne olimpijske sportove poput nogometa, košarke, rukometa i odbojke. Sudionici su bili stariji od 18 godina i aktivno su se natjecali na seniorskoj razini. Istraživanje je imalo presječni (cross-sectional) dizajn s ciljem validacije instrumenta za procjenu poznavanja pravnih aspekata antidopinške regulative. Test–retest pouzdanost pokazala je zadovoljavajuću stabilnost instrumenta ($\kappa = 0,65$). Primijenjen je originalni upitnik Q-LADR, razvijen za procjenu znanja o pravnim aspektima antidopinške regulative. Uz to su prikupljeni sociodemografski podaci, sportski faktori (uspjeh, iskustvo) i doping faktori (stavovi i potencijalno doping ponašanje).

Rezultati studije 1 Rezultati prvog istraživanja pokazali su da je razvijeni instrument pouzdan i primjenjiv za procjenu poznavanja pravnih aspekata antidopinške regulative te da je slabije poznavanje povezano s permisivnijim stavovima prema dopingu . Također su uočene razlike u razini znanja ovisno o spolu, sportskom iskustvu i natjecateljskoj razini.

Zaključak studije 1 Rezultati prvog istraživanja potvrdili su da je razvijeni upitnik za procjenu poznavanja pravnih aspekata antidopinške regulative pouzdan i valjan instrument za primjenu kod profesionalnih sportaša. Uočene spolno specifične razlike te povezanost između slabijeg poznavanja pravnih aspekata antidopinške regulative i permisivnijih stavova prema dopingu ukazuju na važnost pravno usmjerene edukacije u sportu. Nalazi sugeriraju da pravni aspekti antidopinške regulative mogu imati važnu ulogu u razumijevanju stavova o dopingu te predstavljaju temelj za razvoj daljnjih istraživanja i edukacijskih intervencija.

Studija 2

Glavna svrha studije 2 bila je prilagoditi i validirati mjerni instrument za procjenu poznavanja pravnih aspekata antidopinške regulative kod članova pratećeg osoblja te ispitati njegovu pouzdanost i kriterijsku valjanost u širem profesionalnom kontekstu.

Metode studije 2 U istraživanju je sudjelovalo 211 članova pratećeg osoblja iz Hrvatske i Bosne i Hercegovine (71 žena; prosječna dob 41,1 ± 7,8 godina), uključujući trenere, zdravstvene djelatnike i nutricioniste. Poduzorak od 56 sudionika ispunio je upitnik dvaput u razmaku od 7 do 10 dana radi procjene test–retest pouzdanosti. Prilagođeni upitnik Q-LADR-ASP razvijen je iz izvornog instrumenta namijenjenog sportašima i u početnoj je verziji sadržavao 20 čestica. Uz pravno antidopinško znanje, prikupljeni su i podaci o sociodemografskim, sportskim i doping faktorima. Za procjenu psihometrijskih obilježja i kriterijske valjanosti instrumenta korištene su faktorska analiza, t-testovi, Spearmanove korelacije i logistička regresija.

Rezultati studije 2 Nakon isključenja dviju čestica s nedovoljnom reproduktivnošću, konačna verzija upitnika s 18 čestica pokazala je zadovoljavajuću pouzdanost ($\kappa = 0,61$; apsolutno slaganje 82%). Faktorska analiza izdvojila je dvije latentne dimenzije koje odražavaju (i) prava i obveze prema antidopinškom kodeksu te (ii) postupak dopinške kontrole i zakonodavni okvir. Kriterijska valjanost potvrđena je značajno višim rezultatima zdravstvenih djelatnika u odnosu na trenere i nutricioniste, kao i pozitivnom povezanošću pravnog antidopinškog znanja sa sportskom razinom i prethodnim iskustvom u dopinškoj kontroli. Nisu utvrđene spolno specifične razlike.

Zaključak studije 2 Rezultati drugog istraživanja potvrdili su da je Q-LADR-ASP pouzdan i valjan instrument za procjenu poznavanja pravnih aspekata antidopinške regulative kod članova pratećeg osoblja. Nalazi naglašavaju važnost pravno usmjerene i profesionalno prilagođene edukacije u sportu te sugeriraju da instrument može biti koristan u prepoznavanju nedostataka u znanju i usmjeravanju ciljanijih antidopinških edukacijskih strategija.

Studija 3

Glavna svrha studije 3 bila je ispitati učinke strukturirane edukacijske intervencije usmjerene na pravne aspekte antidopinške regulative kod vrhunskih sportaša te analizirati odnos između promjena u razini znanja i doping tendencije kako bi se procjenio stvarni utjecaj pravno usmjerene edukacije na stavove o dopingu.

Metode studije 3 U randomiziranom kontroliranom istraživanju sudjelovalo je 310 vrhunskih sportaša (156 žena; 24,1 ± 4,2 godine), koji su se natjecali na nacionalnoj ili međunarodnoj razini (individualni sportovi: N = 119 i ekipni sportovi: N = 191). Sudionici su nasumično raspoređeni (eksperimentalna skupina: N = 140 i kontrolna skupina: N = 170). Primijenjen je randomizirani pretest–posttest dizajn. Procjenjivane su sociodemografske i sportske varijable, pravni aspekti antidopinške regulative (LADK) i doping tendencija (DT).

Rezultati studije 3 Treće istraživanje potvrdilo je da edukacijska intervencija značajno povećava razinu znanja o pravnim aspektima antidopinške regulative kod vrhunskih sportaša, dok nije utvrđena statistički značajna povezanost između povećanja znanja i smanjenja doping tendencije. Ovi rezultati sugeriraju da pravna edukacija sama po sebi nije dovoljna za promjenu stavova o dopingu.

Zaključak studije 3 Treće istraživanje potvrdilo je da strukturirani edukacijski program značajno povećava razinu poznavanja pravnih aspekata antidopinške regulative kod vrhunskih sportaša. Ipak, rezultati nisu pokazali statistički značajnu povezanost između povećanja znanja i smanjenja doping tendencije. Nalazi ukazuju na to da pravni aspekti antidopinške regulative predstavljaju važan element edukacije, ali sami po sebi nisu dovoljni za promjenu stavova o dopingu. Stoga se preporučuje razvoj dugoročnih i multidimenzionalnih intervencija koje će uz pravni okvir uključivati i psihološke te vrijednosne komponente.

Studija 4

Glavna svrha studije 4 bila je evaluirati učinkovitost edukacijskog programa usmjerenog na pravne aspekte antidopinške regulative kod trenera i osoba koje sudjeluju u zdravstvenoj skrbi sportaša te ispitati dovodi li takva edukacija do promjena u razini znanja i stavovima o dopingu kod pratećeg osoblja.

Metode studije 4 U studiji je sudjelovalo 183 člana pratećeg osoblja (64 žene; prosječna dob 45,11 ± 8,90 godina), uključujući 101 člana medicinskog osoblja i 82 trenera. Sudionici su aktivno radili sa sportašima na nacionalnoj ili međunarodnoj razini.

U istraživanju je primijenjen intervencijski dizajn s eksperimentalnom i kontrolnom skupinom (intervencijska skupina: N = 99 i kontrolna skupina: N = 84). Procjenjivane su promjene u razini znanja i stavovima o dopingu nakon edukacijskog programa. Prikupljeni su sljedeći podaci: sociodemografski i sportski faktori, doping tendencija (binarizirana: negativna vs. neutralna/pozitivna), pravni aspekti antidopinške regulative (10-člani upitnik prilagođen ASP populaciji). Upitnik je sadržavao pitanja o pravima i obvezama, antidopinškim procedurama i pravnim odgovornostima pratećeg osoblja. Program LADEP sastojao se od 10 strukturiranih lekcija koje su vodili stručnjaci iz područja sportskog prava, antidopinga i trenerske prakse. Za procjenu učinka edukacije kroz vrijeme korištena je ANOVA.

Rezultati studije 4 U četvrtom istraživanju edukacijski program doveo je do statistički značajnog povećanja razine znanja kod trenera i zdravstvenog osoblja, ali nije utvrđena značajna promjena u njihovim stavovima o dopingu . Ovaj nalaz ukazuje da edukacija usmjerena na pravne aspekte antidopinške regulative djeluje na kognitivnu razinu, ali ne nužno i na vrijednosnu dimenziju stavova.

Zaključak studije 4 Četvrto istraživanje pokazalo je da edukacijski program usmjeren na pravne aspekte antidopinške regulative učinkovito povećava razinu znanja kod trenera i zdravstvenog osoblja. Međutim, unatoč statistički značajnom napretku u razumijevanju antidopinškog pravnog okvira, nije utvrđena značajna promjena u stavovima o dopingu. Ovi rezultati upućuju na zaključak da edukacija koja se temelji isključivo na pravnim informacijama djeluje prvenstveno na kognitivnu razinu te da promjena stavova zahtijeva integraciju psiholoških i etičkih sadržaja u antidopinške programe.

Ključne riječi: antidoping; pravni aspekti antidopinške regulative; stavovi o dopingu; vrhunski sportaši; treneri; zdravstveno osoblje; antidopinška edukacija; doping tendencija; sportsko pravo.

1 Introduction

Doping currently represents the greatest problem in modern sport and, unfortunately, is present at international sporting events worldwide (Baron, Martin, & Magd, 2007). There are several main reasons why doping can be considered an important problem in sport. First, it has been clearly and unequivocally confirmed that the consumption of doping substances and practices associated with their use (for example, the use of diuretics) directly damages the health of athletes (Vlad, Hancu, Popescu, & Lungu, 2018). In addition, doping undermines the fundamental values of sport because it is contrary to social, cultural, pedagogical, and educational values (Sekulić, 2011). International sports federations, led by the International Olympic Committee, have attempted to curb doping, but no significant progress has been made. It was expected that education and testing would reduce the use of prohibited substances, but this has not happened. On the contrary, it has turned out that doping is still one step ahead, and in the meantime, new and more sophisticated methods and substances have been discovered, which athletes use to enhance their performance.

1.1 Definition of doping

There is no common definition of doping that applies across all sports (Vieweg & Paul, 2002). For a substance or method to be treated as doping, it must meet at least two of the following three criteria: (i) enhance performance, (ii) pose a danger to the athlete's health, and (iii) violate the spirit of sport (Vlad et al., 2018). Historically, the first official definition of doping dates from 1963 and was issued by the Council of the European Committee. According to it, doping represents the use of xenobiotics in any form or by any means, or of physiological substances in abnormal form or by abnormal means, by a healthy person whose sole aim is to artificially and unfairly enhance his or her performance in competition (Vlad et al., 2018). Several other definitions of doping appeared subsequently. Beckmann's sports dictionary defines doping as the use of performance-enhancing substances that would place an athlete in a superior position than he or she would otherwise achieve

(Vlad et al., 2018). The definition of doping varies among international sports organizations, which transmit it to national sports organizations, which are obliged to incorporate it into their own systems and rules.

According to the definition of the International Olympic Committee (IOC), doping is the use, intake or administration to the human body of foreign substances or larger quantities of substances that the organism contains, with the aim of artificially stimulating or increasing an athlete's competitive abilities, which is contrary to sporting ethics and to the physical and mental integrity of the athlete (IOC 2012, Hughes, 2015).

In the year 2000, the International Olympic Committee adopted the World Anti-Doping Code, which became the standard for rules, regulations, and the definition of doping. The World Anti-Doping Code is the most important sub-statutory act, containing the rules and principles governing organizations that adopt, implement, or enforce anti-doping rules (Hughes, 2015).

It is precisely in the World Anti-Doping Code that doping is most thoroughly described. The Code states that doping represents a violation of one or more of a total of eleven rules described in the Code (WADA 2021).

1.2 History of doping

Doping dates back to ancient times and is as old as sport itself, that is, as old as sporting competition. The very name comes from the Dutch word "doop", meaning an opium drink, and the word doping is first specifically mentioned in an English dictionary in 1889, when it denoted the use of stimulants under the influence of which a person could work for longer (Müller, 2010). Interestingly, doping in sport was first mentioned in 1900 in equestrian sport, where it referred to the unlawful preparation of horses for racing. Because horse race results were being fixed to secure large betting winnings, the first doping control was carried out in 1910 at a horse race in Austria (Müller, 2010).

Historically, doping has been found in activities and pursuits outside competitive sport. Depending on the culture of a particular country, various plants were used to enhance sporting performance. It is known that in ancient Greece stimulant drinks were used, made from extracts of hallucinogenic mushrooms and plant sprouts. In contrast, in South America, cocaine from coca leaves, caffeine from coffee beans or guarana berries was (and still is) used as a stimulant for physically demanding activities. On the African continent, the plant Catha edulis, which contains norpseudoephedrine, was used to reduce fatigue and increase strength (Müller, 2010).

The 19th century was marked by the development of modern medicine, leading to a rise in the use of performance-enhancing drugs and substances. During this period, the focus was on stimulants, but also on the beginnings of scientific experimentation with the anabolic effects of hormones. The stimulant action of coffee, that is, of caffeine, has been known since the American Civil War, from which dates the saying that "a ration of coffee is what keeps an army going" (Yesalis & Bahrke, 2002). As early as 1879, six-day cycling races were being held, lasting 24 hours a day, that is, 144 hours in total (Yesalis & Bahrke, 2002). It is therefore not surprising that athletes at these long, exhausting competitions used stimulants without any attempt to conceal their use. Cyclists drank coffee fortified with caffeine during competition and, as the race progressed, added increasing doses of cocaine, as well as strychnine, which in small doses has a stimulant effect. Increasing experimentation with stimulants led to the first fatal case in 1896, when the British cyclist Arthur Linton died (Yesalis & Bahrke, 2002). The arrival of derivatives of testosterone, anabolic steroids (anabolics), soon followed; the year 1889 is considered most important for the use of these agents, when Charles Eduard Brown-Sequard, a prominent psychologist and neurologist, reported to the Biological Institute in Paris that over the course of three weeks he had injected himself with 10 injections containing the blood of testicular veins, semen and testicular juice of a dog or a guinea pig, after which he reported significant improvements in mental and physical energy (Yesalis & Bahrke, 2002).

In 1928, the International Amateur Athletic Federation became the first International Sports Organization to adopt a document prohibiting the use of stimulant substances (Bowers, 2012). The

year 1935 marks the beginning of the true era of doping, when testosterone in injectable form was introduced. The International Cycling Union (UCI) and the International Federation of Association Football (FIFA) were among the first organizations to introduce doping tests at their world championships in 1966. The following year, another tragedy occurred, in which the cyclist Tom Simpson died at the Tour de France, which prompted the establishment of the Medical Commission of the International Olympic Committee, which in 1968 introduced the first formal testing for doping at the Winter Olympic Games in Grenoble and the Summer Olympic Games in Mexico City (Bowers, 2012).

The period from the 1960s to the 1980s is considered the "golden age" of the use of anabolic steroids in sport. The use of anabolic steroids was tested for the first time at the Olympic Games in Montreal in 1976, and as a consequence, many athletes were disqualified and lost the medals they had won (Vlad et al., 2018). This outcome led the International Olympic Committee to decide that doping test results should be made public during competitions. After it became known that the remarkable success of the USSR national team in weightlifting was partly the result of testosterone use, Dr. John B. Zeigler began experimenting with Dianabol on weightlifters (Bowers, 2012). The year 1980 marked the beginning of a struggle between those searching for substances and agents that were not yet on the prohibited list and the sporting authorities trying to detect those substances. A major step forward in the fight against doping was made in 1989, with the introduction of out-of-competition anti-doping control (Vlad et al., 2018). In 1999, the International Olympic Committee concluded that effective action against doping required cooperation among sport participants, sporting and governmental authorities, which led to the establishment of the World Anti-Doping Agency, charged with harmonizing international anti-doping regulations (Bowers, 2012).

1.3 Anti-doping rule violations

Athletes or other persons are obliged to know what constitutes a violation of an anti-doping rule and to be familiar with the substances and methods listed on the publicly published Prohibited List (anti-doping rules).

Anti-doping rule violations include the following:

1. Presence of a prohibited substance or its metabolites or markers in an athlete's sample
2. Use or attempted use by an athlete of a prohibited substance or prohibited method.
3. Evading, refusing, or failing to submit to sample collection by an athlete
4. Whereabouts failures by an athlete
5. Tampering or attempted tampering with any part of the doping control by an athlete or other person
6. Possession of a prohibited substance or prohibited method by an athlete or athlete support personnel
7. Trafficking or attempted trafficking in any prohibited substance or prohibited method by an athlete or other person
8. Administration or attempted administration of a prohibited substance or prohibited method to an athlete in-competition, or administration or attempted administration of a substance or method that is prohibited out-of-competition, by an athlete or other person.
9. Complicity or attempted complicity by an athlete or other person
10. Prohibited association by an athlete or other person
11. Acts by an athlete or other person aimed at discouraging reporting to the authorities, or retaliation for such reporting

Given the importance of the above, each segment of anti-doping policy will be briefly presented below.

1. Presence of a prohibited substance or its metabolites or markers in an athlete's sample

An athlete is personally responsible for ensuring that no prohibited substance enters their body. Athletes are responsible for any prohibited substance, or its metabolites or markers, found in their samples. It is not necessary to prove an athlete's intent, fault, negligence, or knowing use in order to establish a violation of an anti-doping rule under this provision (anti-doping rules). Violation of this anti-doping rule occurs regardless of the athlete's fault. This is often referred to as the "strict liability" rule. The mere presence of a prohibited substance or its metabolites or markers in an athlete's sample is sufficient proof of a violation of this anti-doping rule (anti-doping rules).

2. Use or attempted use by an athlete of a prohibited substance or prohibited method

If a prohibited substance or prohibited method has been used, or if there has been an attempt to use a prohibited substance or method, that is sufficient for a violation of this anti-doping rule. The success or failure of the use, or of the attempted use, of the prohibited substance or method is not relevant. For an anti-doping rule violation to occur, it is sufficient that the prohibited substance or prohibited method was used or that there was an attempt to use it. For this rule — use or attempted use of prohibited agents — a violation may also be established by other reliable means, such as admissions by the athlete, witness statements, documentary evidence, conclusions drawn from longitudinal profiling, including data collected as part of the athlete's biological passport, or other analytical data (anti-doping rules).

3. Evading, refusing, or failing to submit to sample collection by an athlete

This provision encompasses evading sample collection, or refusing to provide a sample without a justifiable reason, or failing to submit to sample collection after being notified by a duly authorized person (anti-doping rules). For example, an anti-doping rule violation for "evading sample collection" exists if it is established that the athlete deliberately avoided the doping control officer to avoid notification or testing. A violation of the rule by "failing to submit to sample collection" may be based on the athlete's intentional or negligent conduct, whereas "evading" or "refusing" sample collection indicates intentional conduct by the athlete (anti-doping rules).

4. Whereabouts failures by an athlete

A violation consists of any combination of three (3) missed tests and/or filing failures of whereabouts information by an athlete who is in a registered testing pool, within a period of twelve (12) months, as defined in the International Standard for Results Management (anti-doping rules).

5. Tampering or attempted tampering with any part of doping control by an athlete or other person

Under the World Anti-Doping Code, tampering is defined as intentional conduct that obstructs, manipulates, or attempts to manipulate any part of the doping control process, including providing false information, intimidating witnesses, obstructing officials, or altering a sample.

Under national anti-doping regulations (which are aligned with the Code), this violation covers any intentional conduct by an athlete or other person that undermines the integrity of the doping control process, regardless of whether the test results have been altered.

6. Possession of a prohibited substance or prohibited method by an athlete or athlete support personnel

A violation consists of the possession by an athlete in-competition of any prohibited substance or prohibited method, or the possession by an athlete out-of-competition of any substance or method that is prohibited out-of-competition, unless the athlete establishes that the possession is consistent with an approved Therapeutic Use Exemption or is otherwise acceptable (anti-doping rules).

A violation also consists of the possession of any prohibited substance or any prohibited method by athlete support personnel in-competition, or the possession of any substance or method that is prohibited out-of-competition by athlete support personnel out-of-competition, in connection with an athlete, competition or training, unless the member of the athlete support personnel establishes that the possession is consistent with an approved Therapeutic Use Exemption or is otherwise acceptable (anti-doping rules).

An acceptable justification may include, for example, (a) an athlete or team physician carrying prohibited substances or prohibited methods for acute and emergency situations (e.g., an adrenaline auto-injector), or (b) an athlete possessing a prohibited substance or method for therapeutic purposes immediately before submitting an application for a Therapeutic Use Exemption or its approval (anti-doping rules).

7. Trafficking or attempted trafficking in any prohibited substance or prohibited method by an athlete or other person

An athlete or other person connected with an athlete must not have in their possession any prohibited and trafficked substances or methods, nor produce, process, import, export, supply, traffic in, or attempt to traffic in them (anti-doping rules).

8. Administration or attempted administration to an athlete in-competition of a prohibited substance or prohibited method, or administration or attempted

administration of a substance or method prohibited out-of-competition, by an athlete or other person

Any administration or attempted administration of a prohibited substance or method to an athlete or to another person from his or her support team, whether in-competition or out-of-competition, constitutes a violation of the eighth anti-doping rule (anti-doping rules).

9. Complicity or attempted complicity by an athlete or other person

Physical or psychological support is considered complicity in violating a rule, including assisting, encouraging, supporting, inciting, conspiring, concealing, or any other form of intentional complicity or attempted complicity (anti-doping rules).

10. Prohibited association by an athlete or other person

This provision concerns the association, in a professional or sport-related capacity, of an athlete or other person under the jurisdiction of an anti-doping organization with a person who is athlete support personnel and who:

- is under the jurisdiction of an anti-doping organization and is currently serving a period of ineligibility; or
- is not under the jurisdiction of an anti-doping organization and a period of ineligibility has not been imposed on that person in a results management process under the Code, but who has been convicted in criminal, disciplinary, or professional proceedings of conduct that would have constituted an anti-doping rule violation if Code-compliant rules had been applied to that person. The disqualification of such a person shall be in force for at least six (6) years from the date of the criminal, professional, or disciplinary decision, or for the duration of the criminal, disciplinary, or professional sanction; or

- serves as a representative or intermediary of an individual described in the previous two indents.

To establish a violation of this provision, the anti-doping organization must establish that the athlete or other person knew of the disqualifying status of the member of athlete support personnel (anti-doping rules).

Athletes and other persons must not cooperate with coaches, doctors, or other athlete support personnel who are serving a period of ineligibility for an anti-doping rule violation, or who have been convicted in criminal proceedings or professionally sanctioned in connection with doping. This also prohibits association with any other athlete acting as a coach or athlete support personnel during the period of ineligibility (anti-doping rules).

11. Acts by an athlete or other person aimed at discouraging reporting to the authorities or retaliating for such reporting

The purpose of this provision is to protect persons who report rule violations in good faith and not to protect persons who knowingly file false reports. The conduct envisaged includes situations in which another person is threatened or sought to be intimidated with the intention of dissuading that person from reporting in good faith information about a possible anti-doping rule violation. A violation of this provision also occurs when a person is retaliated against for providing, in good faith, evidence or information regarding a possible anti-doping rule violation (anti-doping rules).

1.4 WADA and CROADA

States, the International Olympic Committee, international sports federations, national sports federations, and various governmental and non-governmental bodies are actively involved in the fight against doping (Erceg & Fattorini, 2011). Because of mutual mistrust between international sports organizations and governments, the World Anti-Doping Agency (hereinafter: WADA) was

established as an independent international agency whose aim is to create sport free from doping. WADA was created on the initiative of the International Olympic Committee, which, particularly after the cycling competitions in the summer of 1999, decided to organize an international conference on doping (Houlihan, Vidar Hanstad, Loland, & Waddington, 2019). One of WADA's main functions is to support high-quality research to remain one step ahead of individuals and organizations that seek to unlawfully enhance sporting results.

Since the fight against doping involves all states, in the Republic of Croatia too, in accordance with the provisions of the Sport Act (Sport Act, 2006) and pursuant to a Government Regulation of 7 February 2007, the Croatian Anti-Doping Agency (hereinafter: CROADA) was established (Regulation on the Establishment of HADA, 2007). In October 2007, CROADA signed an agreement to accept the WADA Code and to use ADAMS (the database that facilitates WADA's implementation of the Code). CROADA operated through the following organizational units: the Education Department, the Doping Control Department, the Research and Development Department, the Information Section, and the International Cooperation Department (Erceg & Fattorini, 2011). CROADA carried out the following activities:

- ensuring the implementation of conventions, the World Anti-Doping Agency Code, and the rules of international sports federations and the International Olympic Committee;
- regulating, designating, organizing, and conducting doping control, both at sporting competitions and out-of-competition, except for those conducted by international sports federations at international competitions in the Republic of Croatia;
- monitoring the organization and conduct of doping control at international competitions held in the Republic of Croatia;
- monitoring and gathering information on the measures undertaken by governmental and non-governmental organizations in the fight against doping in sport;

- cooperating with governmental and non-governmental organizations with a view to combating doping in sport;
- providing recommendations and advice for measures to be undertaken by governmental and non-governmental organizations in the area of sport with a view to preventing doping in sport;
- monitoring and gathering information regarding statutory and other measures applied in other countries and international organizations in the fight against doping in sport;
- establishing international expert cooperation on doping issues, concluding testing agreements;
- organizing research, consultations, seminars, and round tables, and issuing publications on the issue of combating doping in sport;
- providing training and authorizing experts to conduct doping control;
- establishing the annual doping control plan that it implements;
- organizing educational and other anti-doping campaigns in sport;
- informing the public about the activities undertaken in the fight against doping (Bowers, 2012).

With amendments to the Sport Act in 2010, CROADA was abolished and incorporated into the newly established Croatian Institute of Toxicology and Anti-Doping (HZTA).

1.5 Substantive legal provisions on doping

Legal regulation is an important part of combating doping behavior. For this specific legal issue, as for all others, the basic legal source is the Constitution of the Republic of Croatia. In addition to the Constitution of the Republic of Croatia, which serves as the single general legal act of highest

authority in the Republic of Croatia, the issue of doping is regulated by statutory and substatutory acts. The Sport Act, as lex specialis, provides that athletes must not take prohibited substances (doping) or apply procedures that are prohibited under the rules of the Croatian Olympic Committee, the International Olympic Committee, and WADA, and that they are required to allow doping controls to be performed; coaches, doctors, and other persons must not give doping substances to an athlete. From the foregoing, it is clear that the Sport Act itself does not prescribe either criminal or misdemeanor liability for doping. With regard to coaches, doctors, and other persons in sport, the Criminal Code provides for criminal liability for anyone who produces, supplies, sells, or induces another to take substances prohibited in sport (the law). Since this is a delicta communia, the perpetrator can also be an athlete who induces another to take substances prohibited in sport. For this form of criminal offense, a prison sentence of up to three years is prescribed (the law). A more serious form of this offence is provided for where someone offers for sale, sells or mediates in the sale of substances prohibited in sport to a child or a person with severe mental disturbance, or does so in a school or in places that serve the education of children or sports activity, or where someone uses a child to commit this offence, or where it is committed by an official or responsible person (the law). In that case, a prison sentence from six months to five years is prescribed. The third form of the offense consists of organizing a network of dealers or intermediaries for the purpose of committing this offense, for which the legislator provides for a prison sentence of one to eight years (the law). If any of the above forms of the offense has caused the death of a person to whom substances prohibited in sport were sold, the legislator provides for a prison sentence from three to fifteen years; and if the perpetrator has voluntarily contributed to the discovery of the offense, the court may release him or her from punishment (the law). By regulating a criminal offense aimed at suppressing the production and trade of prohibited substances, the legislator has sought to provide criminal-law protection for athletes' health. However, once on the market, prohibited substances reach athletes who, unlike producers, distributors, dealers, and other persons, are not subject to criminal-law sanction for self-doping.

With the entry into force of the new Health Care Act on 1 January 2019, professional and scientific activity in the field of toxicology and anti-doping was prescribed as one of the activities of the Croatian Institute of Public Health (hereinafter: HZJZ). For the purpose of suppressing doping in the Republic of Croatia, HZJZ adopted the Anti-Doping Rules (anti-doping rules). The Anti-Doping Rules provide for the following sanctions for anti-doping rule violations:

- disqualification, meaning that the athlete's results at a particular competition or sporting event are declared invalid, with all consequences, including loss of the right to all medals, points, and prizes;
- ineligibility, meaning that an athlete or other person is, on account of an anti-doping rule violation, prohibited for a specified period of time from participating in any competition or other activities, and is denied funding;
- provisional suspension (mandatory and non-mandatory), meaning that an athlete or other person is provisionally prohibited from participating in any competitions or activities prior to a final decision at a hearing;
- financial consequences, meaning financial sanctions imposed for an anti-doping rule violation or to cover costs associated with such a violation;
- public reporting, meaning the publication or dissemination of information to the public or to persons to whom that information was not previously available, as well as sanctions for teams.

From all of the above, it is clear that liability for doping is provided for as a disciplinary sanction; some elements of an anti-doping rule violation, however, may also constitute the actus reus of certain criminal offenses under the Criminal Code, in respect of which criminal liability will be determined in criminal proceedings. Disciplinary sanctions also apply to sports teams in team sports: if it is established that more than two members of a team in a team sport have committed

an anti-doping rule violation, the body governing the sporting event imposes a disciplinary sanction on the team and individually on the athletes whose violation has been established (anti-doping rules).

In the fight against doping, differences between national legislations create a major problem, as is evident from the fact that doping is a criminal offense carrying criminal-law sanctions in only six European countries, while in other countries, doping constitutes a violation of anti-doping rules for which only sport-related sanctions are prescribed (Negro, Marzullo, Caso, Calanni, & D'Antona, 2018). The first step in the harmonization process was the adoption of the World Anti-Doping Code (hereinafter: the Code) in 2003 as the most important sub-statutory act, containing rules and principles to be followed by organizations responsible for adopting, implementing, or enforcing anti-doping rules (Hughes, 2015). The Code is a document that ensures consistency in anti-doping policies across all sports and countries. It is based on five international standards intended to achieve consistency among anti-doping organizations: testing and investigations; laboratories; therapeutic use exemptions; the prohibited list of substances and methods; and the protection of privacy and personal information (Negro et al., 2018). The Code represents the first level of the fight against doping; it is followed by standards which determine the list of prohibited medications, exemptions from prohibition, the manner of testing and sample collection, and laboratory analysis. The third level consists of the rules implemented by national anti-doping organizations and international sports federations. The Code, as the first level, ensures a uniform language and a consistent way of acting in implementing anti-doping rules in sport, and contains the definition of doping, the principles for proving doping, the list of prohibited medications and methods, sample analysis, results management, sanctions and appeals, confidentiality and the manner of reporting results, as well as possible limitations on the implementation of anti-doping (Hughes, 2015). Among other international legal acts on the suppression of doping, the European Convention against Doping in Sport, adopted by the Council of Europe in Strasbourg in 1989, and its Additional Protocol from Warsaw of 2002 are important (Pajčić & Petković, 2008). The Declaration on Doping in Sport followed, proclaimed at the World Conference on Doping in Sport

in Lausanne on 4 February 1999. The International Convention against Doping in Sport was adopted on 19 October 2005 at UNESCO's headquarters in Paris and entered into force on 1 February 2007 after being ratified by 30 countries, in accordance with Article 37 of the Convention. Following this, the Croatian Parliament, at its session held on 6 July 2007, adopted the Act on the Ratification of the International Convention against Doping in Sport (Act on the Ratification of the International Convention against Doping in Sport). All of the listed acts have the same goal: to promote clean sport, prevent and suppress doping, and establish measures restricting the availability and use of doping agents.

1.6 Comparison with European substantive provisions on doping

In creating uniform rules and principles governing doping at the European level, differing national legislations pose a significant challenge. As already noted, in six European countries, doping constitutes a criminal offense for which criminal-law sanctions are prescribed.

Austria

The Austrian Criminal Code regulates the criminal offense of fraud for any individual who has used a prohibited substance or method in sport. Penalties depend on the amount of the financial reward obtained as a result of the fraud and range from fines to imprisonment of up to ten years (Pajčić & Petković, 2008).

Germany

In Germany, doping is regulated by the Anti-Doping Act in Sport. Under that Act, it is prohibited to use doping substances; it is also prohibited to produce, trade in such substances, sell, give them as a gift, or in any other way place them on the market without trading in them, or to prescribe them (Korajlija, 2024). Furthermore, it is not permitted to procure, possess, or transport substances prohibited in sport in not-insignificant quantities into or through the area to which the Anti-Doping

Act in Sport applies, with the aim of doping people in sport. Where a person uses or makes available for use any of the substances or methods prohibited in sport with the intention of gaining an advantage in organized competition, that person shall be punished with imprisonment of up to three years or a fine. It is also prohibited to procure or possess a doping agent in order to use it on oneself without a medical indication and thereby gain an advantage in organized sporting competition. A person who acts contrary to this provision shall be punished by imprisonment of up to two years or a fine. A person who manufactures, or in any way sells, uses on another person, or procures, possesses or transports a substance and thereby endangers the health of a large number of people, exposes a person to death or serious harm to body or health, or for personal interest gains a financial benefit of large extent for himself/herself or another, shall be punished by imprisonment from one to ten years. The same penalty is prescribed if the perpetrator sells or supplies, or uses, a doping agent or method on a minor. If the perpetrator voluntarily contributes to the discovery of a criminal offense with which he/she is connected, or, in cases of more serious offenses, discloses information to help prevent a more serious offense before it is committed, the court may impose a more lenient sentence (Korajlija, 2024).

Italy

In Italy, criminal offenses related to doping were initially prescribed by the Act on Healthcare for Sporting Activity and the Fight against Doping, which set out three doping-related offenses; currently, the Criminal Code, which contains provisions on doping, is in force (Korajlija, 2024). According to the Italian Criminal Code, two criminal offenses relate to athletes and support personnel who procure, administer, consume, or encourage the use of prohibited substances or methods, with the aim of enhancing the athlete's competitive performance or altering the result of a doping test. Imprisonment from three months to three years and a fine from EUR 2,580.00 to EUR 51,645.00 are prescribed (Pajčić & Petković, 2008). For the said criminal offense, more severe penalties will be imposed if it is committed against a minor, or if the offense has been committed by a member or employee of the Italian Olympic Committee, or by a national sports

federation, club, association, or organization recognized by the Italian Olympic Committee (Korajlija, 2024). The third criminal offense is aimed at combating illegal suppliers who trade in substances prohibited in sport, for which imprisonment of 2 to 6 years and a fine of EUR 5,164.00 to EUR 77,468.00 are prescribed (Pajčić & Petković, 2008).

France

In its Sport Code (Code du sport), France criminalizes the use or consumption of prohibited substances without a justifiable medical reason, with a penalty of up to 1 year in prison or a fine of EUR 3,750.00 (Pajčić & Petković, 2008). Persons who prescribe (doctors), offer or sell prohibited substances to athletes without justifiable medical reason, as well as persons who produce, import or export substances prohibited in sport, are punishable by imprisonment of five years or a fine of EUR 75,000.00 (Pajčić & Petković, 2008). The same penalty is also prescribed for the falsification, destruction, or degradation of any element relating to doping control, the sample itself, or sample analysis. Where the perpetrator commits any of the above-mentioned offenses within an organized group, or commits it against a minor, or where the offense is committed by a person who has authority over one or more athletes, that person shall be punished by imprisonment of seven years and a fine of EUR 150,000.00 (Korajlija, 2024).

Spain

Spain also criminalizes doping and, under its Anti-Doping Act in Sport, prescribes sanctions including suspension, deprivation of liberty, the impossibility of obtaining a federation license for a period of two to four years, and, where appropriate, a fine (Pajčić & Petković, 2008). The Criminal Code provides that those who, without therapeutic reason, prescribe, give, distribute, supply, administer, offer or facilitate the taking of prohibited substances or irregular methods intended to enhance physical capacity or alter competition results — substances which, due to their content, repeated consumption or other concurrent circumstances, endanger life or health — shall

be punished by imprisonment from six months to two years, by a fine and by special prohibition from holding public office or service, profession or trade for two to five years (Korajlija, 2024).

In both the Croatian and the Spanish Criminal Codes, the focus is on individuals who enable the use of these substances, and there is also a clear orientation towards combating doping systems that may include organized networks (Korajlija, 2024). However, there are also differences between the Croatian and Spanish Criminal Codes regarding the elements of the offense. In Spanish law, attention is directed to persons who prescribe such substances, that is, who give them, distribute, supply athletes with such items, administer the substances, or offer or facilitate access to them by athletes, while in Croatian law attention is directed to the very production of substances and to placing them for sale, that is, putting them into circulation (Korajlija, 2024). Both legal systems prescribe criminal liability for a person who gives prohibited substances to an athlete. Both the Croatian and Spanish legal systems also prescribe imprisonment, but the Croatian system imposes heavier sentences depending on the gravity of the offense. In the Spanish system, imprisonment for doping ranges from six months to two years, while the Croatian legal system prescribes special prison terms for each offense under Article 191.a of the Criminal Code (the law). In Croatia, the Criminal Code prescribes imprisonment of 15 years if the death of the person to whom the substance was sold is caused (the law); in Spain, in addition to imprisonment, a fine and a prohibition on practicing the activity are also prescribed (Korajlija, 2024).

Serbia

Serbia also criminalizes doping; the Act on Preventing Doping in Sport of the Republic of Serbia prescribes disciplinary measures and imprisonment. For the violation of anti-doping rules, the breach of measures imposed for an anti-doping rule violation, and non-compliance with obligations laid down by the Act and the World Anti-Doping Code, the following disciplinary measures may be imposed: a) disqualification of sports results, b) provisional suspension, c) prohibition of participation in competitions, d) prohibition of working in the field of sport, and e)

other measures laid down by the World Anti-Doping Code (Act on Preventing Doping in Sport of the Republic of Serbia). The Act also provides for criminal liability for enabling the use of doping agents and for the unauthorized production and placing on the market of doping agents. Anyone who, for the purpose of doping in sport, without authorisation produces, processes, sells or offers for sale, or buys, holds or transports for the purpose of sale, or mediates in the sale or purchase of doping agents, or in any other way unlawfully places doping agents on the market, shall be punished by imprisonment from three to twelve years (Act on Preventing …). Furthermore, anyone who, without authorization, for the purpose of doping in sport produces, procures, possesses or makes available for use equipment, materials or substances which he/she knows are intended for the production or preparation of doping agents shall be punished by imprisonment from six months to five years (Act on Preventing …). The same prison sentence is prescribed for anyone who gives, prescribes, or issues a doping agent to an athlete for the purpose of doping in sport, or who applies a doping agent to an athlete, or who induces, assists, or otherwise enables an athlete to use a doping agent. If the criminal offense has been committed against a minor or against several persons, or has caused particularly serious consequences, the perpetrator shall be punished by imprisonment from two to ten years (Act on Preventing …).

Bosnia and Herzegovina

As regards Bosnia and Herzegovina, this country does not provide criminal sanctions for the doping of athletes; rather, similarly to the Republic of Croatia, it provides disciplinary measures for self-doping in accordance with the Code, while the Bosnian-Herzegovinian legislator does not prescribe sanctions for those who produce and trade in doping (Pajčić & Petković, 2008).ž

1.7 Procedural provisions on doping

1.7.1 Testing, investigation, and proof of doping

For the purpose of detecting anti-doping rule violators, testing and investigations are carried out in accordance with the International Standard for Testing and Investigations and certain protocols of the HZJZ. Testing as an evidentiary action is used solely for the purpose of establishing the presence or absence of prohibited substances in the athlete's body, while in the case of a violation of other anti-doping rules, an investigation is conducted (anti-doping rules). Testing is performed by HZJZ, more specifically, the Anti-Doping Service responsible for in-competition and out-of-competition testing of all athletes; it may require any athlete over whom it has testing jurisdiction (including any athletes serving a period of ineligibility) to provide a sample at any time and at any place (anti-doping rules). Testing shall not be conducted between 11:00 p.m. and 6:00 a.m., except in the event of a serious suspicion that an athlete is using doping. During that period, testing may also be conducted if the athlete has set a 60-minute window for testing or has otherwise consented to testing during that period (anti-doping rules). Although WADA is not the agency that performs testing, it reserves the right to do so in exceptional cases. Authority to conduct testing depends on the type of sporting event. For international competitions held in the Republic of Croatia, sample collection is initiated and directed by the international federation or other international organization governing the sporting event; for national sporting events held in Croatia, sample collection is initiated and directed by HZJZ (anti-doping rules). It may happen that an anti-doping organization that would otherwise have jurisdiction for testing but is not responsible for initiating and directing testing at the sporting event wishes to test an athlete at the venue during the sporting event (anti-doping rules). In that case, it must first contact HZJZ to obtain authorization to conduct and coordinate such testing. If the said organization receives a negative response from HZJZ, it may seek authorization from WADA. WADA shall not approve such testing without first notifying and consulting HZJZ. WADA's decision is final and not subject to appeal (anti-doping rules). HZJZ is required to draw up a testing plan and conduct testing in accordance with the International

Standard for Testing and Investigations. HZJZ designates the registered testing pool, composed of athletes who are required to submit whereabouts information on a quarterly basis and to update such information so that it is, at any moment, accurate and complete, and so that the athlete is available for testing at the locations indicated. Failure to do so amounts to an anti-doping rule violation (anti-doping rules). Through the ADAMS system, HZJZ makes available a list of athletes in its registered testing pool and coordinates with international federations to identify these athletes and collect their whereabouts information. Athletes will be notified before being included in the registered testing pool and after being removed from it (anti-doping rules).

Since testing is conducted at the request of HZJZ, HZJZ has assumed the role of the prosecuting party in the procedure for proving anti-doping rule violations and therefore bears the burden of proof (anti-doping rules). HZJZ thus appears as the competent investigative body that conducts testing and, in the event of atypical results, initiates disciplinary proceedings against the athlete. The standard of proof consists of the existence of certainty that an anti-doping rule violation has occurred (anti-doping rules). On the other hand, where the burden of proof rests on the athlete or other person allegedly in breach of an anti-doping rule, the standard of proof is the balance of probabilities (Primorac, Buhovac, & Miletić, 2021). Thus, to prove the use of doping, a level of probability higher than that required to initiate an investigation into criminal offenses must be established. Facts relevant to the doping decision may be established by any reliable means, including admissions, which means that an admission by the athlete that he/she has taken doping is sufficient evidence of a violation of an anti-doping rule (anti-doping rules). In addition, the same may be established on the basis of credible third-party testimony, reliable documentary evidence, and reliable laboratory data or conclusions drawn from a profile of a series of samples of the athlete's blood or urine, such as data from the athlete's biological passport (Primorac et al., 2021). This is significant because all the listed forms of evidence may also be legally valid in criminal proceedings; that is, the doping test is not the only evidence for establishing an anti-doping rule violation. The second rule of proof consists of the presumption that laboratories accredited and approved by WADA have conducted sample analysis and protective procedures in accordance

with the International Standard for Laboratories. This presumption may also be rebutted by an athlete or other person if it is established that there has been a departure from the International Standard for Laboratories (Primorac et al., 2021). If the athlete or other person proves the contrary, HZJZ bears the burden of establishing that the departure did not cause the adverse laboratory finding or the factual basis for the anti-doping rule violation. The next rule of proof consists of the principle that facts established by a decision of a court or competent disciplinary panel, which are not the subject of an appeal, constitute irrebuttable evidence against the athlete or other person to whom that decision relates, unless the athlete or other person proves that the decision violated principles of fairness (Primorac et al., 2021). The final rule consists in the right of the disciplinary panel, in proceedings to determine an anti-doping rule violation, to draw an inference adverse to the athlete or other person alleged to have committed the violation based on the refusal of the athlete or other person to appear at the hearing (in person or by telephone, as instructed by the disciplinary panel) and answer questions of the disciplinary panel or of HZJZ, which alleges the violation, after the request for a hearing has been served on the athlete or other person within a reasonable time (Primorac et al., 2021).

From the above, it can be concluded that the standard of proof for a disciplinary offense is a degree of probability higher than that required for criminal prosecution. This makes it more difficult to establish anti-doping rule violations, which has a negative impact on the effective fight against doping.

The proportion of positive findings in conventional anti-doping testing should not be equated with the prevalence of doping among athletes. A positive analytical finding reflects detection within the population of tested samples, whereas prevalence refers to the proportion of athletes estimated to have engaged in doping over a specified period. Moreover, the Athlete Biological Passport can provide longitudinal biological evidence and enable population-level estimates that differ from routine testing statistics. Using hematological markers from major international athletics events, Faiss et al. (2020) estimated blood-doping prevalence among endurance athletes at approximately

18% in 2011 and 15% in 2013. These figures were statistical prevalence estimates, not proportions of athletes formally found to have committed an anti-doping rule violation.

Indirect anonymous survey methods have yielded other estimates and illustrated the difficulties of measuring concealed doping behaviour. Using a randomized-response technique, Ulrich et al. (2018) estimated past-year doping prevalence at 43.6% among athletes at the 2011 World Championships in Athletics in Daegu and 57.1% at the 2011 Pan-Arab Games in Doha. However, Petróczi et al. (2022) subsequently re-examined data from these events using the Single Sample Count (SSC) approach and reported lower estimates of 21.2% and 10.6%, respectively. Such discrepancies do not establish a single definitive 'true' prevalence; rather, they underscore the sensitivity of prevalence estimates to survey design, participants' compliance with instructions, and methodological assumptions. Taken together, biological and anonymous survey approaches indicate why low rates of positive test findings alone cannot establish the actual extent of doping and why detection-oriented regulation should be complemented by preventive education (Ulrich et al., 2018; Petróczi et al., 2022).

1.7.2 Procedure for establishing and proving doping before sports bodies

Disciplinary proceedings against an athlete for an anti-doping rule violation are specifically regulated. The fundamental right which the athlete has in such proceedings is the right to a fair hearing. The athlete has this right before a provisional suspension is imposed or shortly thereafter (anti-doping rules). At any time, the athlete may waive the right to a hearing. If HZJZ sends notice to the athlete or other person that they have committed an anti-doping rule violation, and the athlete does not waive the right to a hearing, the matter is then referred to the HZJZ Disciplinary Panel (anti-doping rules). The Disciplinary Panel must ensure that proceedings (the hearing) are scheduled and concluded within a reasonable time, and that expedited proceedings are conducted where the hearing relates to a particular sporting event. After the proceedings, the first-instance decision on the anti-doping rule violation is rendered by the HZJZ Disciplinary Panel (anti-doping

rules). The decision is sent to the athlete, the national federation, and HZJZ; an appeal may be lodged against that decision before the HZJZ Appellate Panel. The final instance to which an appeal against a decision of the HZJZ Appellate Panel may be lodged is the Court of Arbitration for Sport (hereinafter: CAS). CAS has a constituted Anti-Doping Division, which has jurisdiction to decide doping-related issues at first instance or as the sole instance (Primorac et al., 2021). Proceedings before CAS in doping matters are conducted de novo, meaning that CAS is not bound by previous decisions at the national or international level (Primorac et al., 2021). All interested parties involved in the fight against doping (WADA, HZJZ, and other organizations), with the athlete's consent, may request a single hearing before CAS, which contributes to the efficiency of proceedings; it should be borne in mind, however, that CAS decisions are final and binding (Primorac et al., 2021). The deadline for filing an appeal with CAS is 21 days from the date the decision is received. An appeal to CAS may be filed by the athlete or other person to whom the decision under appeal relates; the other party in the case in which the decision was rendered; the competent international federation; HZJZ; the International Olympic Committee or the International Paralympic Committee, where the decision could relate to the Olympic Games or the Paralympic Games, including decisions affecting eligibility for participation in the Olympic Games or the Paralympic Games (Primorac et al., 2021). In the case of a provisional suspension, the only person who may appeal that decision is the athlete or other person on whom the provisional suspension has been imposed. One of the exceptional situations in which WADA may appeal directly to CAS is where HZJZ has not made a timely decision on whether the Anti-Doping Rules have been violated (Primorac et al., 2021). An appeal to CAS may also be lodged in proceedings concerning the determination of therapeutic use exemptions. The decision on a therapeutic use exemption is made by HZJZ, which notifies the athlete (Primorac et al., 2021). Such a therapeutic use exemption may apply only at the national level; an athlete competing at the international level must apply for a therapeutic use exemption from the international federation. If the international federation does not approve a therapeutic use exemption held by the athlete at the

national level, the athlete and HZJZ may refer the matter to WADA for review and may appeal to CAS (Primorac et al., 2021).

The procedure for establishing an athlete's doping presupposes disciplinary proceedings. However, this does not preclude judicial bodies from exercising their authority to conduct criminal proceedings where, through the disciplinary procedure, it is established that the violations involve elements of fraud, corruption, and the like (Primorac et al., 2021). This would be particularly necessary where a wider circle of persons is involved in the doping of an athlete, or where the athlete has intentionally engaged in doping with the aim of fraud. A decision rendered by CAS at first instance may be reviewed before the CAS Appeals Division. The only legal remedy against a decision of the CAS Appeals Division (unless excluded by clause or contract) is an action for annulment of the arbitral award before the Swiss Federal Supreme Court (Primorac et al., 2021). An action before this court may be filed where the arbitral tribunal has wrongly assumed jurisdiction or wrongly declined jurisdiction, where the arbitral tribunal has decided beyond the scope of the claims or has failed to decide on one of the claims, where there has been a breach of essential procedural rules, or where the award is contrary to public policy (Primorac et al., 2021). The Swiss Federal Supreme Court renders its decision on the basis of the facts established in the previous proceedings; there is no new hearing of the parties or presentation of new evidence.

1.8 Legal consequences of doping and sanctions where doping is established

Sanctions for doping established may be divided into sanctions imposed on individuals, sanctions imposed on teams, and sanctions imposed by HZJZ on other sports bodies.

An anti-doping rule violation in individual sports related to in-competition testing results in the disqualification of the result achieved at that competition, with all consequences, including forfeiture of all medals, points, and prizes (anti-doping rules).

As regards team sports, all prizes obtained by individual players will be disqualified. If, in sports that are not team sports but in which prizes are awarded to teams, one or more members commit an anti-doping rule violation, disqualification, or another disciplinary measure shall be imposed on the team in accordance with the applicable rules of the international federation (anti-doping rules).

1.8.1 Sanctions imposed on individuals

Individual athletes found to have violated anti-doping rules and to have used prohibited substances or methods are subject to: disqualification of the result at the sporting event at which the anti-doping rule was violated; allocation of costs imposed by CAS and money forfeited from the prize; redistribution of prize money forfeited to other athletes, where so defined by the rules of the relevant international federation; financial consequences; and a prohibition on participating in competitions for a specified period (anti-doping rules).

Disqualification of the result at the sporting event at which the anti-doping rule was violated

An anti-doping rule violation at a sporting event, or in connection with a sporting event, may, by decision of the body governing the event, lead to the disqualification of all of the athlete's individual results at that sporting event, with all consequences, including forfeiture of all medals, points, and prizes. If the athlete establishes that there was no fault or negligence on his/her part leading to the anti-doping rule violation, the athlete's individual results at other competitions will not be disqualified, unless they were affected by the athlete's anti-doping rule violation (anti-doping rules).

Ineligibility for the presence, use, or attempted use, or possession of a prohibited substance or prohibited method

The period of ineligibility shall be four (4) years, where:

- The anti-doping rule violation does not involve a specified substance or specified method, unless the athlete or other person establishes that the violation was not intentional.
- The anti-doping rule violation involves a specified substance or specified method, and HZJZ can establish that the violation was intentional.

The term "intentional" is used to identify athletes or other persons who act in a manner that they know constitutes an anti-doping rule violation, or who know that there is a significant risk that the conduct will constitute or result in an anti-doping rule violation, and who manifestly disregard that risk. An anti-doping rule violation based on an adverse analytical finding for a substance prohibited only in-competition shall not be regarded as "intentional" if the substance is not specified and the athlete can establish that the prohibited substance was used out-of-competition in a context unrelated to sport performance (anti-doping rules).

If the athlete can establish that the intake or use occurred out-of-competition and was unrelated to sport performance, the period of ineligibility shall be three (3) months (anti-doping rules).

Ineligibility for other anti-doping rule violations

In the case of an athlete's evading or refusing sample collection or failing to submit to sample collection, and in the case of tampering or attempted tampering with any part of doping control by an athlete or other person, the period of ineligibility shall be four (4) years, except:

- where, in the case of failing to submit to sample collection, the athlete can establish that the anti-doping rule violation was not intentional, the period of ineligibility shall be two (2) years;
- In all other cases, where the athlete or other person can establish exceptional circumstances justifying a reduction of the period of ineligibility, it shall be from two (2) to four (4) years, depending on the degree of fault of the athlete or other person.

- In the case of a protected person or recreational athlete, the period of ineligibility ranges from a maximum of two (2) years to a minimum of a reprimand without a period of ineligibility, depending on the degree of fault of the protected person or recreational athlete (anti-doping rules).

In the case of an athlete's whereabouts failures, the period of ineligibility shall be two (2) years and may, depending on the athlete's degree of fault, be reduced to a minimum of one (1) year. Where there is reasonable suspicion that the athlete is attempting to evade testing by repeatedly changing whereabouts information at the last moment or by similar conduct, the period of ineligibility may not be shorter than two (2) years (anti-doping rules).

In the case of trafficking or attempted trafficking in any prohibited substance or prohibited method by an athlete or other person, and in the case of administration or attempted administration to an athlete in-competition of a prohibited substance or method, or administration or attempted administration of a substance or method prohibited out-of-competition by an athlete or other person, the period of ineligibility shall be a minimum of four (4) years up to lifetime ineligibility, depending on the seriousness of the anti-doping rule violation (anti-doping rules).

In the case of complicity or attempted complicity by an athlete or other person, and in the case of acts by an athlete or other person aimed at discouraging reporting to the authorities or retaliating for such reporting, the period of ineligibility shall be a minimum of two (2) years up to lifetime ineligibility, depending on the seriousness of the anti-doping rule violation (anti-doping rules).

In the case of prohibited association by an athlete or other person, the period of ineligibility shall be two (2) years and may, depending on the degree of fault of the athlete or other person and other circumstances of the case, be reduced to a minimum of one (1) year (anti-doping rules).

Aggravating circumstances on the basis of which the period of ineligibility may be extended

If, in a particular case of an anti-doping rule violation, HZJZ establishes that aggravating circumstances exist that justify a longer period of ineligibility than the standard sanction, the period of ineligibility that would otherwise apply shall be further extended by up to two (2) years, depending on the seriousness of the violation and the type of aggravating circumstances, unless the athlete or other person establishes that he/she did not knowingly violate the anti-doping rule (anti-doping rules).

Elimination of the period of ineligibility where there is no fault or negligence

If, in a particular case, the athlete or other person establishes that he/she bears no fault or negligence, the otherwise applicable period of ineligibility shall be eliminated. This provision applies only to the imposition of sanctions, and not to the determination of whether an anti-doping rule violation has occurred (anti-doping rules).

Reduction of the period of ineligibility where there is no significant fault or negligence

If, in a particular case, the athlete or other person establishes that he/she bears no significant fault or negligence, then, subject to further reduction or elimination, the otherwise applicable period of ineligibility may be reduced based on the degree of fault of the athlete or other person, but the reduced period of ineligibility may not be less than half of the otherwise applicable period of ineligibility. If the otherwise applicable period of ineligibility is lifetime, the reduced period of ineligibility under this provision may not be less than eight (8) years (anti-doping rules).

Elimination, reduction, or shortening of the period of ineligibility, or other consequences not arising from fault

HZJZ is authorized, in a particular case, prior to a decision on appeal or the expiry of the deadline for appeal, to eliminate part of the consequences (other than disqualification and mandatory public reporting) where the athlete or other person has provided substantial assistance to an anti-doping organization, governmental investigative bodies, or professional disciplinary bodies (anti-doping rules).

The extent to which the period of ineligibility may be shortened is determined taking into account the seriousness of the anti-doping rule violation committed by the athlete or other person, and the importance of the substantial assistance provided by the athlete or other person in eliminating doping from sport. If the otherwise applicable period of ineligibility is lifetime, the period reduced under this provision shall be at least eight (8) years (anti-doping rules).

If the athlete or other person voluntarily and on their own initiative admits the anti-doping rule violation prior to receiving notice of a sample collection that could establish such a violation, and where this admission is the only reliable evidence of the violation at the time of admission, the period of ineligibility may be reduced, but to no less than half of the otherwise applicable period of ineligibility (anti-doping rules).

Where, after receiving a notice from HZJZ of a possible anti-doping rule violation for which a period of ineligibility of four (4) or more years is provided, the athlete or other person admits the violation and accepts the imposed period of ineligibility no later than within twenty (20) days from the date of receipt of the notice of the charge of an anti-doping rule violation, the period of ineligibility imposed on the athlete or other person by HZJZ may be reduced by one (1) year (anti-doping rules).

Multiple violations

For a second anti-doping rule violation by an athlete or other person, the period of ineligibility shall be the longer of:

- Six (6) months ineligibility, or
- a period of ineligibility within the range between:

1. the sum of the period of ineligibility imposed for the first anti-doping rule violation and the period of ineligibility that would otherwise apply to the second violation if it were treated as a first violation; and
2. twice the period of ineligibility that would otherwise apply to the second violation if it were treated as a first violation (anti-doping rules).

The period of ineligibility within this range shall be determined on the basis of all the circumstances and the degree of fault of the athlete or other person with regard to the second anti-doping rule violation (anti-doping rules).

For a third anti-doping rule violation, the period of ineligibility is always lifetime, unless the third violation meets the conditions for elimination or reduction of the period of ineligibility (anti-doping rules).

If HZJZ establishes that the athlete or other person committed an additional anti-doping rule violation prior to receiving notice, and that the additional violation occurred twelve (12) or more months before or after the first detected anti-doping rule violation, the period of ineligibility for the additional violation shall be calculated as if it were a separate first violation, and shall run consecutively, rather than concurrently, with the period of ineligibility imposed for the previously detected violation. In this connection, violations committed together are regarded as a single anti-doping rule violation (anti-doping rules).

If HZJZ establishes that a person has committed a second or third anti-doping rule violation during a period of ineligibility, the periods of ineligibility for the multiple anti-doping rule violations shall run consecutively, not concurrently (anti-doping rules).

Disqualification of results at competitions following sample collection or anti-doping rule violation

In addition to the automatic disqualification of the in-competition result, established on the basis of the positive sample, all other results obtained by the athlete in competitions from the date of collection of the sample that resulted in the positive finding (whether in-competition or out-of-competition), or from the date of another anti-doping rule violation, until the start of any provisional suspension or period of ineligibility, shall be disqualified, with all consequences, including forfeiture of medals, points and prizes, unless fairness requires otherwise (anti-doping rules).

Money forfeited from the prize.

Where HZJZ, by reason of an anti-doping rule violation, forfeits prize money, it shall take the necessary measures to allocate and redistribute that money to those athletes who would have won it had the disqualified athlete not competed (anti-doping rules).

Commencement of the period of ineligibility

If an athlete is already serving a period of ineligibility for an anti-doping rule violation, any subsequent period of ineligibility shall begin to run on the first day after the expiry of the existing period of ineligibility (anti-doping rules).

Where there have been substantial delays in the hearing process or other aspects of doping control which cannot be attributed to the athlete or other person, HZJZ or, where applicable, the HZJZ Disciplinary Panel may decide that the period of ineligibility shall begin earlier — that is, from the date of sample collection or from the date of the most recent other anti-doping rule violation (anti-doping rules).

If the athlete or other person abides by the provisional suspension, that period of provisional suspension shall be credited against the period of ineligibility ultimately imposed. If the athlete or other person does not abide by the provisional suspension, the elapsed period of provisional suspension shall not be credited against the period of ineligibility (anti-doping rules).

1.8.2 Status during a period of ineligibility or provisional suspension

No athlete or other person who has been imposed a period of ineligibility or provisional suspension may, during the period of ineligibility or provisional suspension, in any capacity participate in a competition or activity (other than authorised anti-doping educational or rehabilitation programmes) authorised or organised by any signatory, member organisation of a signatory, club or other organisation that is part of an organisation belonging to a member of a signatory, or in competitions authorised or organised by any professional league or organiser of any international or national sporting event, or in any elite or national sporting activity sponsored by a governmental agency (anti-doping rules).

An athlete or other person who has been imposed a period of ineligibility of more than four (4) years may, after completing the four (4) year period of ineligibility, as an athlete participate in local sporting events that are not organised by, or otherwise within the jurisdiction of, a Code signatory or a member of a Code signatory, but only if the local sporting event is not at a level that would otherwise qualify the athlete or other person directly or indirectly to compete (or to accumulate points to compete) at a national championship or international sporting event, and provided that this does not involve the athlete or other person working with protected persons in any capacity (anti-doping rules).

If an athlete or other person who has been imposed a period of ineligibility violates the prohibition on participation during the period of ineligibility, the results of such participation shall be disqualified, and a new period of ineligibility, equal in length to the original period of ineligibility, shall be imposed, to be added to the end of the original period of ineligibility. The new period of ineligibility, including a reprimand without imposition of a period of ineligibility, may be adjusted

to reflect the degree of fault of the athlete or other person and other circumstances of the case. Whether the athlete or other person has violated the prohibition on participation, and whether an adjustment to the period of ineligibility is appropriate, is determined by the anti-doping organization (anti-doping rules).

For each anti-doping rule violation for which mitigation of the sanction is not provided, HZJZ, the Government of the Republic of Croatia, the Croatian Olympic Committee, the Croatian Paralympic Committee, and national federations shall partially or fully withdraw the sport-related financial support or other sport-related benefits which such a person has obtained (anti-doping rules).

If, after the expiry of the period of ineligibility, the athlete decides to return to competition, the athlete must complete an HZJZ educational program designated by HZJZ (anti-doping rules).

1.8.3 Consequences for teams

If it is established that more than two (2) members of a team in a team sport committed an anti-doping rule violation during a sporting event, the body governing the sporting event shall impose an appropriate sanction on the team (e.g. loss of points, disqualification from the competition or sporting event, or another sanction), in addition to the sanctions imposed on the athletes who committed the anti-doping rule violation (anti-doping rules).

1.9 Factors Influencing Doping Behaviour

1.9.1 Psychological and contextual determinants of doping behaviour in sport

Doping behaviour represents a complex phenomenon that cannot be explained solely by athletes' desire to achieve better sporting results. Although gaining an unfair competitive advantage is one of the main motivations for using prohibited substances and methods, the decision to engage in doping results from the interaction of various psychological, social, situational, and sport-related factors. Previous research has demonstrated that such decisions may be influenced by personal attitudes towards doping, moral beliefs, motivation, risk perception, expectations regarding the effectiveness of prohibited substances, pressure from the sporting environment, and prevailing norms within a particular sport (Morente-Sánchez & Zabala, 2013; Ntoumanis et al., 2014; Blank et al., 2016). Therefore, understanding doping behaviour requires an examination of the reasons why athletes may consider using prohibited substances, as well as the psychological mechanisms underlying their decision-making processes.

The motivations for doping may vary depending on the physiological demands of a particular sport, the level of competition, and athletes' individual needs. In sports characterized by strength, power, and muscular development, the use of prohibited substances may be motivated by the desire to increase muscle strength, accelerate muscle growth, and improve anaerobic performance. In endurance sports, athletes may consider prohibited substances or methods to increase aerobic capacity, improve oxygen transport, and delay the onset of fatigue. In addition to directly enhancing physical performance, an important motivation may involve accelerating recovery following intensive training, reducing the consequences of physical stress, and increasing the ability to tolerate greater training loads. Morente-Sánchez and Zabala (2013) identified several motivations associated with doping, including sporting success, financial rewards, improved recovery, and the belief that other competitors also use prohibited substances.

The motivation to use certain prohibited substances is not necessarily limited to improving physical performance. In some circumstances, athletes may seek ways to reduce psychological pressure, regulate their emotional state, or manage competitive anxiety. However, intentional doping for performance enhancement should be distinguished from the use of psychoactive substances to cope with stress, relaxation, or injuries, as such use does not necessarily constitute an anti-doping rule violation. Psychological demands arising from the expectations of coaches, sporting organizations, sponsors, and the public may increase athletes' vulnerability to risky decisions. The period following an injury may be particularly challenging, as athletes may experience pressure to return to competition quickly while fearing the loss of their position within a team or their professional status (Morente-Sánchez & Zabala, 2013; Williams et al., 2024).

One of the most important psychological factors associated with doping behaviour is athletes' attitudes towards doping. Attitudes represent positive or negative evaluations of a particular behaviour and influence how individuals assess its potential benefits and consequences. Athletes who consider doping an acceptable means of improving performance, underestimate its health and ethical risks, or believe that prohibited substance use is common among competitors may demonstrate a greater susceptibility to doping. Conversely, athletes who perceive doping as unfair and unacceptable may be less likely to develop intentions to engage in such behaviour. In this context, attitudes are particularly relevant because they provide a psychological link between anti-doping knowledge, individual beliefs, and the decisions athletes make under specific competitive circumstances (Ntoumanis et al., 2014; Blank et al., 2016).

The relationship between attitudes, intentions, and behaviour can be explained through the Theory of Planned Behaviour (TPB), according to which behavioural intention is one of the immediate antecedents of behaviour and is shaped by attitudes towards the behaviour, subjective norms, and perceived behavioural control (Ajzen, 1991). Applied to doping, this means that an athlete who believes that prohibited substances may provide substantial benefits, perceives their use as acceptable within the sporting environment, and considers their use manageable without serious consequences may develop stronger intentions to engage in doping. Nevertheless, intentions do

not necessarily translate into actual behaviour, as the final decision may also depend on substance availability, immediate circumstances, social influences, and opportunities for behavioural control.

Empirical evidence supports the importance of attitudes in explaining doping-related outcomes. Blank et al. (2016), in their review of studies involving elite athletes, identified attitudes towards doping, situational temptation, and subjective norms as important predictors of doping intentions. Attitudes were associated with doping susceptibility ($r = 0.47$) and doping behaviour ($r = 0.30$). A more recent systematic review and meta-analysis by Ntoumanis et al. (2024) further demonstrated that favourable doping attitudes and pro-doping norms were associated with greater doping intentions and use. Additional risk factors included nutritional supplement use, body dissatisfaction, and psychological ill-being, whereas positive morality and self-efficacy were identified as protective factors. These findings suggest that doping prevention should not focus exclusively on increasing knowledge of prohibited substances and legal consequences, but should also address attitudes, moral values, and intentions to engage in doping.

Social factors also play an important role in the development of doping behaviour. Athletes do not make decisions in isolation but operate within a wider sporting environment that includes coaches, teammates, medical professionals, family members, and sporting organizations. When doping is implicitly tolerated or perceived as a common practice, athletes may gradually develop more permissive attitudes towards prohibited substance use. The perception that other athletes engage in doping may be particularly influential because it can contribute to the normalization of such behaviour and reduce personal feelings of responsibility. Conversely, sporting environments that promote fair competition, athlete health, and ethical values may provide protection against doping. Williams et al. (2024) emphasize that effective doping prevention requires addressing not only individual motivation but also social norms and organizational conditions within the sporting environment.

1.9.2 Doping Prevalence and Risk Factors Across Athlete Populations

When examining which athletes are more likely to engage in doping, it is important to distinguish between the actual prevalence of prohibited substance use, doping-related attitudes, doping susceptibility, and confirmed anti-doping rule violations. Estimating the true prevalence of doping is challenging because athletes may conceal their behaviour, while the number of positive doping tests does not necessarily reflect the actual frequency of prohibited substance use. In their review, de Hon et al. (2015) reported estimates of intentional doping ranging from 14% to 39% in specific groups of adult elite athletes, whereas doping control results indicated considerably lower figures. These estimates should not be generalized to all elite athletes, as prevalence varies according to the sport, population, and research methodology. In a more recent study involving 1,398 elite athletes from the United States, Davoren et al. (2024) found that approximately 6.5% to 9.2% of respondents reported using at least one prohibited substance or method during the preceding 12 months, depending on the calculation method.

Gender-related differences in doping behaviour have also received considerable research attention. Some studies suggest that male athletes demonstrate greater doping susceptibility than female athletes; however, findings are not entirely consistent and may vary according to the sport and the outcome being measured. Sekulic et al. (2016) investigated 457 national- and international-level athletes participating in football, basketball, handball, and volleyball. Their results indicated a higher likelihood of potential doping behaviour among male athletes, with significant gender differences observed in basketball and handball. Nevertheless, these findings concern doping likelihood rather than confirmed prohibited substance use. Gender should therefore be considered in relation to other factors, including sporting discipline, competitive demands, experience, social norms, and personal attitudes towards doping.

Competitive level may also influence athletes' vulnerability to doping, although this association is neither simple nor universal. Athletes competing at higher levels may experience greater

performance pressure, financial incentives, and expectations of sporting success, potentially increasing the perceived benefits of doping. However, these athletes may also be more frequently exposed to anti-doping testing, education, and medical supervision. Consequently, differences in doping behaviour cannot be explained by competitive achievement alone. Research suggests that associations between competitive level and doping susceptibility may differ depending on the country, sporting culture, and other contextual characteristics (de Hon et al., 2015; Sekulic et al., 2016).

Certain sporting disciplines may be more vulnerable to specific forms of doping risk because of their physiological and competitive demands. Strength- and power-based sports may create incentives to use substances that promote muscular development and strength, whereas endurance sports may create incentives to use substances or methods aimed at increasing oxygen transport and aerobic performance. In sports in which body mass is particularly important, additional risks may arise from attempts to manipulate weight. However, these differences represent potential patterns of vulnerability rather than conclusive evidence that doping is necessarily more prevalent in these disciplines. Sport-specific risk should therefore be assessed by considering physiological demands, the history of anti-doping rule violations, access to prohibited substances, and characteristics of the sporting environment. Doping remains a relevant research and prevention issue in both individual and team sports (de Hon et al., 2015; Davoren et al., 2024).

Collectively, it is clear that doping behaviour results from a complex interaction between athletes' individual characteristics, attitudes, motivations, moral beliefs, and broader social and situational factors.

1.10 Education on doping

By using doping in order to enhance sporting performance, athletes risk being banned from competition and are exposed to the risk of acute and chronic illnesses. Therefore, sports organizations conduct educational programs to prevent intentional and unintentional doping use (Hurst, King, Massey, Kavussanu, & Ring, 2023). WADA seeks to standardize anti-doping programs for 700 international and national sports organizations (Hurst et al., 2023). Accordingly, WADA requires organizations to develop and implement programs that raise awareness of anti-doping rules and regulations; provide accurate information on anti-doping procedures; foster personal values and principles; and build athletes' competence to follow anti-doping rules. Research has shown that athletes need educational strategies to help them make informed decisions about the properties of medicines used to enhance sporting performance (Mottram, Chester, Atkinson, & Goode, 2008). The aim of educational programs is to prevent athletes from violating anti-doping rules. First and foremost, athletes are warned that doping is against the rules and that any athlete found to have used doping may be banned from participating in competition. Educational programs on anti-doping rules are important for all athletes, regardless of whether they compete at the international or national level (Murofushi, Kawata, Kamimura, Hirosawa, & Shibata, 2018).

It is generally accepted that, to prevent doping, it is not enough to conduct doping testing; rather, athletes' attitudes towards doping must be changed (Sipavičiūtė, Šukys, & Dumčienė, 2020). The intention to take doping could thus be reduced by changing positive attitudes towards doping into negative ones, and by educating athletes on how to avoid taking doping (Lazuras, Barkoukis, Rodafinos, & Tzorbatzoudis, 2010). However, in addition to athletes, educational programs should also include coaches, friends, and family of athletes, particularly when it comes to the risks of using doping, since athletes in fact obtain most of their information from these sources (Nieper, 2005). To date, however, most preventive educational programs focused on the use of prohibited

substances have been ineffective; informing athletes about the possible health risks of doping has clearly not reduced the use of prohibited substances (Peters, Schulz, Oberhoffer, & Michna, 2009).

Anti-doping education is therefore not intended solely to increase athletes' knowledge of prohibited substances and regulations, but also to serve as a preventive measure aimed at shaping and changing their attitudes towards doping. By promoting negative attitudes towards doping and strengthening the values of clean sport, educational interventions seek to reduce athletes' intentions to use prohibited substances and, consequently, influence their actual behavior. In this way, changes in attitudes and behavioral intentions represent important mechanisms through which anti-doping education may contribute to doping prevention.

During the 2000s, anti-doping programs called ATLAS and ATHENA were conducted, focusing on young athletes (Elliot et al., 2004). These doping prevention programs concentrated on attitudes towards doping, knowledge about doping, and the intention to use doping. The ATLAS and ATHENA doping-prevention programs were effective in reducing the likelihood of using prohibited substances by reducing interest in doping and providing knowledge about it (Elliot et al., 2004). In addition to influencing the reduction of the intention to use prohibited substances in sport, these programs also had an effect on actual behavior and the use of doping (Elliot et al., 2004). It should be borne in mind, however, that these programs were developed in the 2000s and that their core ideas did not include the findings and developments of the past two decades.

More recent studies on knowledge about doping stemming from anti-doping education include the HERCULES program (Sagoe et al., 2016). The HERCULES educational program combines practical strength exercises with theoretical knowledge. The effectiveness of the intervention was tested on secondary school students (15–21 years). Participants were divided into three groups: a control group, a theory group, and a theory group with strength training. Before and after the intervention, participants completed a questionnaire which contained, among other things, questions about their self-assessed knowledge of anti-doping rules and their attitudes towards doping. The results show that the group that received both theoretical knowledge and strength

training has greater knowledge about the harmful effects of steroids on health than the control group. The combination of theoretical knowledge and strength training can therefore help prevent doping (Sagoe et al., 2016).

Anti-doping programs focused on health education include the ALPHA program (Murofushi et al., 2018), which found that athletes who have been educated about doping prevention at least once have higher knowledge of doping than those who have not. To improve knowledge about doping, athletes need to be repeatedly educated (Murofushi et al., 2018).

In Germany, a National Plan for the Prevention of Doping was introduced with two main objectives: structural change in the field of doping prevention and the development of educational measures to prevent doping among young athletes. The impact of the national plan changed the content of doping prevention but not the structure of anti-doping education in elite sports schools. Pupils at elite sports schools who were covered by the educational program under the national plan demonstrated significantly higher knowledge of doping than pupils in the control group (Wippert & Fließer, 2016).

Through doping-prevention educational programs, athletes acquire general knowledge about doping in sport; however, knowledge alone is difficult to apply in real-life situations (Hanson, 2013). To improve educational programs, regular evaluation is needed, since many anti-doping prevention programs are organized without any reporting on their theoretical background, effects, or outcomes (Hanson, 2013). In addition to evaluation, anti-doping education should focus on athletes' existing knowledge of doping, as this may change over the course of an athlete's life (Hanson, 2013).

In 2017, WADA established a working group that prepared recommendations for anti-doping educational programs based on moral and ethical values (Melzer, Elbe, & Brand, 2010). Studies have shown that educational programs should be based not only on moral and ethical values but also on athletes' cultural environment, sex, and age, since health-promotion-based programs have shown only a small effect (Melzer et al., 2010).

Finally, it can be said that education and the prevention of doping are studied relatively broadly and in various ways. However, educational programs mostly cover knowledge of the health effects of doping, rather than the moral and ethical aspects (Sipavičiūtė et al., 2020). Studies thus typically aim to determine by how much knowledge about doping has increased among participants in an educational program compared with a control group that did not participate (Sipavičiūtė et al., 2020). The number of studies focusing on fundamental, moral, and technical values, however, is significantly smaller, and I consider that more attention should be paid to this (Sipavičiūtė et al., 2020).

1.10.1 The role of coaches in anti-doping education

Coaches play an important role in athletes' lives and careers, as athletes regard them as authority figures in all aspects, including doping. Coaches are aware of their great responsibility to prevent athletes from using doping, but they may also encourage athletes to use prohibited substances (Laure, Thouvenin, & Lecerf, 2001). Research shows that elite athletes view coaches as educated and inspiring persons, and submit unquestioningly to their authority (Laure et al., 2001). The influence of coaches on athletes' doping-related behavior can be explained by maladaptive behavior, as coaches may encourage athletes to win at any cost (Vassilis Barkoukis, Lazuras, Tsorbatzoudis, & Rodafinos, 2011). Under the World Anti-Doping Code, coaches should advise and educate athletes on anti-doping rules and use their authority to encourage negative attitudes towards doping among athletes (World Anti-Doping Code, 2021). The Code stresses that coaches should also be sanctioned if they encourage an athlete to violate anti-doping rules. Coaches are one of the main sources of information about doping for athletes; anti-doping organizations should therefore create doping-prevention programs that target coaches (Laure et al., 2001).

1.10.2 Studies on the effects of anti-doping education

Horcajo and colleagues conducted a study that indicates that an external factor can influence athletes' attitudes towards doping. One group of athletes was sent information in favor of legalizing doping, and another against legalizing doping. The results showed that the group that received information in favor of legalizing doping had more positive attitudes towards doping than the other group, which had received information against legalizing doping. This shows that education affects athletes' attitudes towards and intentions to use doping; however, the study did not reveal how to change attitudes and intentions related to doping use (Horcajo, Santos, Guyer, & Moreno, 2019).

Barkoukis and colleagues identified the factors most likely to influence athletes' attitudes toward avoiding doping. These are: peer influence, coach influence, doping stigma, attitudes, and the culture of the environment. Most of the athletes tested had a negative attitude towards doping, with the main influencing factor being the surrounding culture. The conclusion is therefore that education on doping should cover not only athletes and coaches, but also the wider environment surrounding athletes (Vasileios Barkoukis et al., 2019).

Murofushi and colleagues conducted a study of 514 male and 629 female athletes to assess their knowledge of doping and identify directions for future doping education. The results show a low level of knowledge about doping among the participants; nevertheless, they are aware that anti-doping work is essential to protect the spirit of sport and that further cooperation is needed to control and suppress doping. The results showed that 2.54% of participants had undergone doping control. Regarding anti-doping education, 30.10% of participants had attended at least once, and 20.82% had attended more than once. The results did not show a significant difference in knowledge about doping between participants who had undergone doping testing and those who had not; however, a significant difference in knowledge was found between participants who had attended anti-doping education and those who had not. Participants who had attended anti-doping education recorded a significantly higher level of knowledge about doping compared with participants who had not. The results showed that education in Japan is being carried out, but that university athletes and athletes who do not compete at the highest level are often not included. Given this, it is suggested that anti-doping education be introduced at all universities where at least

one Japanese athlete is enrolled. Consideration should also be given to the timing of anti-doping education, since the prohibited list is updated each year on 1 January, and other changes and revisions are introduced; it is therefore necessary to obtain the latest rules and information (Murofushi et al., 2018).

Zhumabayeva and colleagues conducted a study to assess the level of knowledge and experience in anti-doping education among Kazakhstani athletes, as well as the impact of a prior anti-doping education program on them. The questionnaire contained items about sociodemographic characteristics, experience with anti-doping education, years spent in sport, and the highest level of competition at which the athletes had participated. Most participants (46.9%) obtained information about doping via the internet, and 17.3% of participants had never taken part in anti-doping education. 54.6% of participants had undergone anti-doping testing, and 82.7% had attended at least one anti-doping educational program. Significant differences were also identified in the level of awareness of doping among participants who had previous experience with anti-doping education. Among participants who had attended several anti-doping educational programs, a significantly higher level of knowledge was found in most questions (Zhumabayeva et al., 2022).

Recent approaches to anti-doping education distinguish the acquisition of factual knowledge from the development of competencies required for informed decision-making in situations involving doping-related risk. Petróczi and colleagues developed the concept of Doping Awareness Literacy (DAL), comprising functional literacy (knowing), interactive literacy (deciding), and critical literacy (leading). Building on this framework, the GRADE IT tool was designed to assess knowledge and decision-related competencies alongside trust in anti-doping organizations and the perceived legitimacy of anti-doping policies (Blank et al., 2022).

Petróczi and Boardley (2022) further emphasized that education for clean sport should address sporting integrity, individual agency, and the meanings athletes attach to clean performance, rather than relying solely on lists of prohibited substances or regulatory information. These perspectives

complement the deterrence-oriented rationale of the present dissertation: legal knowledge may help athletes understand anti-doping obligations and sanctions, whereas doping-related decisions may also depend on applied skills, social context, and trust in the regulatory system. DAL is used here as a complementary educational framework, not as the theoretical basis on which LADEP was originally designed.

1.11 Psychological factors and theories related to doping

Research on doping in sport is a complex, multidisciplinary field encompassing psychology, sociology, ethics, medicine, and other areas. Psychological factors associated with doping use in sport include various individual, social, and motivational aspects that influence athletes' decisions to use prohibited substances. These factors may be conscious or unconscious and are often related to the desire to achieve better results, gain an advantage over the competition, or cope with psychological pressures. In this regard, psychological theories play a key role in understanding the motives, decisions, and behavior of athletes in connection with the use of prohibited substances. Each theory offers specific insights into athletes' motivation, rationalization, and behavior and contributes to the development of preventive and intervention strategies.

1.11.1 General Deterrence Theory

Deterrence theory originates in classical criminology and assumes that individuals are less likely to engage in prohibited behavior when they consider the high probability of detection and believe that the consequences will be serious and fairly enforced (Johnson, 2019). In the context of anti-doping, this theory may suggest that athletes who understand how testing operates, what sanctions apply, and how strictly the rules are enforced become more cautious about using prohibited substances (Van Rooij, 2016; Verboon & van Dijke, 2012). Furthermore, a better understanding of procedural justice and athletes' rights can increase the perceived legitimacy of the anti-doping

system. There is indeed evidence that athletes' perceptions of legitimacy are closely linked to fair enforcement of anti-doping rules (Efverström, Ahmadi, Hoff, & Bäckström, 2016; Star & Kelly, 2021). To build trust in the anti-doping system, transparent and fair procedures are a key element (Vassilis Barkoukis et al., 2025). In addition, greater knowledge of legal regulations may reduce moral disengagement and encourage prosocial commitment to clean sport values. It is therefore still warranted to investigate whether knowledge of the legal regulations on doping influences attitudes and orientations toward doping.

1.11.2 Theory of Planned Behavior (TPB)

The Theory of Planned Behavior (TPB) is one of the most significant theories in social psychology. It seeks to explain how and why people make decisions about behavior, particularly when the behavior is intentional and under cognitive control (Ajzen, 1991). TPB assumes that behavior is the result of intention, and that intention depends on:

Attitude towards the behavior

— This refers to a personal opinion and evaluation of the behavior: whether it is positive, useful, desirable, or the opposite. If an athlete believes that doping will help him/her achieve better results, he/she is more likely to have a positive attitude towards doping (Lazuras, Barkoukis, & Tsorbatzoudis, 2015).

E.g.: "If I take doping, I will play better and have a better chance of success."

Subjective norms

— these refer to perceived social pressure: what the athlete thinks other people (coaches, parents, teammates, the public) approve of or expect. If the athlete perceives that his/her environment

approves of doping or does not condemn it, this can increase his/her intention to use doping (Vassilis Barkoukis, Lazuras, Tsorbatzoudis, & Rodafinos, 2013).

E.g.: "All top athletes do it, and the coach tacitly approves."

Perceived behavioral control

— This refers to the sense of control over the performance of the behavior: how much a person believes that he/she has the opportunity and ability to do something. In the case of doping, this can include the availability of substances, knowledge of ways to conceal use, or the belief that one will not be detected (Ajzen, 2002).

E.g.: "I can easily get hold of doping, and I know how to avoid testing."

Together, these three components lead to the intention to use doping and, when circumstances allow, to actual behavior (Lucidi, Grano, Leone, Lombardo, & Pesce, 2004).

Intention is the main predictor of actual behavior, and numerous studies confirm that athletes with positive attitudes towards doping, who perceive support from their environment and have access to substances, show a higher likelihood of using doping (Lucidi et al., 2004).

1.11.3 Social Learning Theory (SLT)

Social Learning Theory is a psychological theory that emphasizes the importance of models in the environment; that is, it explains how people learn by observing, imitating, and modeling the behavior of others. Its most important proponent is Albert Bandura. The key idea of SLT is that learning does not occur exclusively through direct experience and conditioning (as behaviorists claim), but also through observing others' behavior and its consequences (Bandura, 1977).

Unlike traditional behaviorist theories that emphasize the role of rewards and punishments in learning, social learning theory also includes cognitive processes such as attention, memory, and motivation (Bandura, 1986).

According to Bandura, learning through observation involves several key elements:

- Attention — the person must pay attention to the model's behavior.
- Retention of information — the observed behavior must be remembered.
- Motor reproduction — the person must be able to perform the observed behavior.
- Motivation — the person must have a reason for performing the behavior (e.g., expectation of reward).

In addition, Bandura emphasizes reciprocal determinism — the idea that behavior, personal factors (e.g., beliefs, expectations), and environment mutually influence one another (Bandura, 1986).

In the sports context, doctors and coaches play a key role as role models. If they adopt an anti-doping stance, athletes are more likely to do the same. This observation can also be linked to social norm theory, which suggests that changes in attitudes within a group can influence an individual's behavior within that group. If the attitudes of key team members change, this can establish a new social standard that affects all team members, including the athletes.

1.11.4 Social Cognitive Theory (SCT)

Social Cognitive Theory (SCT) describes how people learn and behave in social contexts, taking into account the interactions among personal factors, behavior, and the environment. The theory grew out of social learning theory and was further developed by Albert Bandura, who broadened the focus from the mere observation of behavior to cognitive processes such as thinking, beliefs, self-regulation, and expectations (Bandura, 1986).

Social cognitive theory emphasizes internal (cognitive) mechanisms — particularly how people process information and make decisions by observing others — while social learning theory emphasizes learning through modeling.

According to Bandura, the key elements of social cognitive theory are:

a) Reciprocal determinism — human behavior is the result of a dynamic mutual interaction between personal factors (e.g., thoughts, emotions, beliefs), behavior, and environment. This concept means that not only does the environment act on the person, but the person also influences the environment — it is a two-way interaction (Bandura, 1986).

b) Self-efficacy — one of the most important concepts within the theory. It denotes the individual's belief in his or her ability to organize and carry out the actions necessary to achieve a particular goal (Bandura, 1997). High self-efficacy is associated with greater perseverance, better coping with stress, and a higher probability of success.

c) Vicarious learning — learning that occurs by observing others and the consequences they experience. If a person sees that someone else is rewarded for a particular behavior, they are more likely to adopt that behavior themselves (Bandura, 2001).

d) Self-regulation — individuals can regulate their own behavior through goal-setting, self-monitoring, self-evaluation, and self-reward. They do not act solely under external influences but also on the basis of their own standards and motivations.

e) Expectations — people develop expectations about the outcomes of their behavior based on past experience and observation of others. These expectations can be outcome-related (what will happen) and efficacy-related (whether they can do it).

In the sport context, athletes who believe in their own abilities (high self-efficacy) show greater resilience to failure and better performance. Coaches' and other athletes' modeling of behavior also shapes norms and values within sports teams (Feltz, Short, & Sullivan, 2008).

Doping-related behavior can be explained through a socio-cognitive framework — if an athlete believes that doping is the only way to succeed and sees that others are not sanctioned, he/she may develop positive outcome expectations and reduce self-control (Boardley & Grix, 2014). Interventions focused on strengthening self-efficacy and on negative outcome expectations may be effective in prevention.

1.11.5 Social Identity Theory (SIT)

Social Identity Theory (SIT) was developed by Henri Tajfel and John Turner during the 1970s. The theory aimed to explain the psychological foundations of intergroup relations, prejudice, and discrimination. According to Social Identity Theory, an individual shapes his or her identity through belonging to various social groups (Turner, Brown, & Tajfel, 1979).

People place themselves and others into different groups (e.g., supporters of a particular club, nation, religion, or profession), which strongly influences self-concept, behavior, and interpersonal relations.

Basic ideas of the theory:

1. Social categorization — people unconsciously place themselves and others into "us" (in-group) and "them" (out-group), which often leads to stereotypes and prejudice (Turner et al., 1979).

2. Social identity — social identity is part of personal identity that derives from belonging to a particular group. People have a need to view their group in a positive light in order to maintain or enhance their self-esteem (Tajfel, 1982).

3. Social comparison — people strive for positive differentiation: they want to believe that their group is better than others. This leads to in-group favoritism and out-group derogation (Turner et al., 1979).

The central assumption of SIT is that individuals are motivated to achieve and maintain a positive social identity. This is most often achieved through:

- Increasing the status of one's own group
- Diminishing the value of other groups
- Changing groups if the group has a negative status

For example, an athlete who identifies with his/her club may feel greater self-confidence if the club wins, while losses may prompt psychological distancing from the group.

SIT is particularly important in sport because it is useful for understanding the behavior of fans, athletes, and teams:

- Fans often connect emotionally with their club, which then becomes part of their identity (Branscombe & Wann, 1991).
- Athletes who strongly identify with the team show greater engagement, collegiality, and motivation (Rees, Alexander, Haslam, Coffee, & Lavallee, 2015).
- Increased identification can also lead to conflict, violence, or hostility towards rivals, particularly when the group's status is threatened.

To maintain a positive social identity, various mechanisms are used:

- Social creativity — finding alternative ways of positive self-perception (e.g., "perhaps we are not the wealthiest club, but we have the most loyal supporters").
- Changing the comparison group — comparing with an even worse-off group.
- Individual mobility — leaving the group and joining another (Turner et al., 1979).

SIT has been criticized for:

- Assuming that people are primarily motivated by a positive identity, without taking into account personal goals and interests.
- An insufficient focus on internal group dynamics.
- Difficulty in predicting concrete behavior in all contexts.

Social Identity Theory can explain:

- Why do athletes justify unethical behavior for the benefit of their team?
- How team cohesion derives from strong group identification.
- Why do fans use "we" when speaking about the team, even though they are not direct participants (e.g., "we won!")?

In team sports, it is very important for the individual to identify with the team, as this can increase readiness to sacrifice and collective behavior, which contribute to success in sport (Rees et al., 2015).

Social Identity Theory offers a deep understanding of social processes, belonging, and group behavior, including in the sport domain. By recognizing the importance of group identity, coaches, sport psychologists, and managers can more effectively foster team cohesion, reduce intergroup conflicts, and improve athletes' motivation and loyalty.

1.11.6 Moral Disengagement Theory

Moral Disengagement Theory was developed by Albert Bandura to explain how individuals can commit immoral, harmful, or socially unacceptable acts without feeling guilt or moral discomfort (Bandura, Barbaranelli, Caprara, & Pastorelli, 1996). According to Bandura, people switch off their moral orientation when it serves their goals or interests.

Bandura argues that psychological mechanisms enable a disconnection between moral beliefs and immoral behavior, leading to so-called moral disengagement.

There are eight mechanisms of moral disengagement, which can be divided into three broader categories: reframing behavior, minimizing personal responsibility, and dehumanizing the victim (Bandura et al., 1996).

Reframing of behavior

1. Moral justification — immoral behavior is interpreted as morally acceptable because it serves a higher goal (e.g., "everyone does it", "it's for the good of the team") (Bandura, 1991).
2. Euphemistic labeling — using diminutives and harmless language to soften the perception of behavior (e.g., "performance assistance" instead of "doping") (Lucidi et al., 2008).
3. Advantageous comparison — comparing one's own behavior with worse behavior to make it appear less harmful (e.g., "at least I didn't cheat the way that other person did") (Bandura, 2002).

Displacement or diffusion of responsibility

1. Displacement of responsibility — blame is shifted onto an authority (e.g., coach, doctor, the system) (Boardley & Kavussanu, 2009).
2. Diffusion of responsibility — responsibility is shared among the group, which reduces personal guilt (e.g., "we all decided to do it") (Bandura, 1991).

Dehumanization and blaming the victim

1. Dehumanization of the victim — victims are perceived as less worthy or less than human, which enables immoral behavior without empathy (e.g., an opponent is seen as "the enemy") (Bandura, 2002).
2. Blaming the victim — the victim is portrayed as the cause of the negative behavior (e.g., "they deserved it") (Bandura, 2002).

Denial of consequences

1. Denial or minimization of consequences — the individual diminishes the actual harmful consequences of his/her behavior (e.g., "doping hasn't hurt anyone") (Lucidi et al., 2008).

In sport, moral disengagement is often used to explain athletes' immoral behavior, including cheating, violence, and doping. Existing research shows that athletes who use doping often use these mechanisms in order to justify their conduct and reduce the feeling of guilt (Boardley, Grix, & Dewar, 2014).

For example:

- "Everyone at the top level uses doping — it's not cheating, it's a necessity" (moral justification).
- "The coach said it was safe and legal" (displacement of responsibility).
- "Without it, I have no chance — everyone cheats" (diffusion of responsibility + moral justification).

1.11.7 Self-Determination Theory (SDT)

Self-Determination Theory (SDT) is a comprehensive framework for studying human motivation, particularly the quality of motivation rather than merely its quantity. It was developed by Edward L. Deci and Richard M. Ryan during the 1980s (Deci & Ryan, 1985). The core assumption of SDT is that people have an innate tendency towards growth, development, and integration into their environment, provided that certain psychological conditions are met (Ryan & Deci, 2000).

Self-Determination Theory emphasizes the importance of meeting three basic psychological needs, which are universal and crucial for optimal functioning, well-being, and motivation:

1. Autonomy — the need for the person to experience their behavior as self-chosen and self-directed, rather than as the result of external pressures or control.

2. Competence — the need for the person to feel effective in interaction with their environment and to successfully overcome challenges and tasks.
3. Relatedness — the need to establish close, secure, and supportive relationships with others (Ryan & Deci, 2000).

If these three needs are met, motivation becomes intrinsic and leads to positive outcomes. If they are not met, the person may develop amotivated behavior or low-quality extrinsic motivation.

SDT distinguishes a continuum of motivation, from amotivation to intrinsic motivation, through several levels of extrinsic motivation:

a) Amotivation — the individual lacks motivation because he/she does not see value in the activity, or feels that he/she has no control over the outcome.

b) Extrinsic motivation — occurs when behavior is prompted by external factors. SDT distinguishes four forms:

- External regulation — behavior for the sake of rewards or punishments.
- Introjected regulation — behavior due to internal pressure (guilt, shame).
- Identified regulation — the person recognizes the value of the activity, even if it is not necessarily enjoyable.
- Integrated regulation — behavior is in alignment with personal values and identity.

c) Intrinsic motivation — the most autonomous form of motivation: the person engages in an activity for the sake of inner satisfaction, interest, or challenge.

"People are most motivated and most effective when they act on their own volition, rather than because of external pressures" (Deci & Ryan, 1985).

In sport, SDT helps to explain why some athletes enjoy sport, while others feel pressured. Athletes whose psychological needs are met show greater perseverance, satisfaction, and mental health (Deci, Olafsen, & Ryan, 2017).

In the context of doping, research shows that athletes who are autonomously motivated think less about doping, while controlled forms of motivation may increase the inclination towards such behavior.

The application of SDT in sport and doping prevention is particularly important. Controlled motivation (e.g., fear of failure, pressure from the coach) is associated with a greater inclination towards doping, while autonomous motivation (e.g., personal development, love of sport) is associated with lower readiness to use doping (Ring & Kavussanu, 2018).

Meeting psychological needs through a supportive environment reduces the likelihood that athletes will turn to doping as a "necessary evil".

1.11.8 Achievement Goal Theory

Achievement Goal Theory is one of the most influential motivational theories in sport and physical activity. It focuses on how athletes define success and competence, that is, on the goals they wish to achieve during sporting activity (Harwood, Spray, & Keegan, 2008). This theory explains how individuals approach tasks,how they motivate themselves, and how they react to success or failure.

The main researchers associated with the development of AGT are John Nicholls, Carol Ames, and Carol Dweck.

AGT distinguishes two main types of orientation towards achievement goals:

1. Task orientation

- Success is defined by personal progress, learning, and effort.

- The focus is on internal motivation and self-improvement.
- Failure is not experienced as a threat but as an opportunity for learning.
- Athletes with this orientation are more resistant to stress and less inclined to engage in unethical behavior (Duda & Ntoumanis, 2003).

2. Ego orientation

- Success is defined by surpassing others and by winning.
- It is important to be better than others, even without effort.
- A high level of this orientation can lead to fear of failure, reduced perseverance, and, at times, cheating or doping to preserve one's self-image (Duda & Ntoumanis, 2003).

It is important to emphasize that both types of orientation can exist simultaneously, but one often predominates depending on individual and situational factors.

The theory also emphasizes the importance of the environment, particularly the role of coaches, parents, and peers in shaping motivation. Ames distinguishes:

- Task-oriented motivational climate — encouraging effort, cooperation, and personal progress.
- Ego-oriented motivational climate — emphasizing competition, comparison, and ranking (Ames, 1992).

Coaches who emphasize skill development, the learning process, and progress foster positive, sustainable motivation in athletes (Treasure et al., 2001).

Athletes with a task orientation:

- show greater intrinsic motivation,

- cope more easily with defeats,
- show greater satisfaction with sport and greater perseverance (Treasure et al., 2001).

By contrast, task orientation is also associated with moral behavior, fair play, and a lower risk of using prohibited substances (Kavussanu & Roberts, 2001).

Research shows that athletes with a high ego orientation, particularly when the environment is competitive, more often express acceptance of cheating and develop attitudes that justify doping (Lucidi et al., 2008).

AGT is often combined with Self-Determination Theory (SDT). For example:

- Task orientation is associated with autonomous motivation (intrinsic motivation and identified regulation),
- Ego orientation is more often associated with controlled motivation (e.g., external pressures, rewards).

Achievement Goal Theory provides an important framework for understanding motivation in sport. It recognizes that athletes differ in how they define success, and that these differences can be shaped by upbringing and the coaching approach. A task orientation promotes positive behavior, perseverance, and satisfaction, while an ego orientation, particularly in a competitive environment, can increase the risk of unethical behavior, including doping.

Understanding and applying the principles of AGT can help coaches, psychologists, and sports organizations to build a healthy sporting environment that not only leads to success but also fosters ethical values and long-term motivation.

1.11.9 Goal Orientation Theory

Goal Orientation Theory was developed by John G. Nicholls in 1984 within the framework of cognitive theories of motivation. It represents one of the most important theories for understanding

motivation in sport, education, and the workplace, and it emerged from the broader Achievement Goal Theory (Duda & Nicholls, 1992). According to Nicholls, people are motivated to feel competent, but they differ in how they define competence — and that is the source of the distinction between task and ego orientation.

Later authors, such as Duda and Nicholls, applied the theory to sport and developed the Task and Ego Orientation in Sport Questionnaire (TEOSQ) to assess athletes' dominant goal orientation (Duda & Nicholls, 1992).

The main question that the theory seeks to explain is:

How do individuals define success, and what goals guide their behavior?

According to this theory, there are two main types of goal orientation:

1. Task orientation:

- Success is defined by personal progress, learning, and effort.
- The individual compares him/herself with him/herself — progress is the indicator of competence.
- It favors intrinsic motivation, satisfaction, and perseverance.
- Behavior is not contingent on the outcome but on the process of attaining the goal (Duda & Nicholls, 1992).

E.g.: An athlete who tries to improve his/her technique regardless of whether he/she wins.

2. Ego orientation

- Success is defined as superiority over others — winning is what matters.

- The individual compares him/herself with others, and competence is measured by competitive comparison.
- It is often associated with external motivation, stress, and the risk of unethical behavior.
- Failure is experienced as a threat to self-esteem (Duda & Nicholls, 1992).

E.g.: An athlete who wants to win, even if he/she does not give his/her maximum, just to be better than others.

Goal orientation can have positive and negative consequences.

1. Positive consequences of task orientation:

- Greater intrinsic motivation
- Greater satisfaction with sport
- Perseverance, even when it is difficult
- Less fear of failure
- Lower probability of using doping (Kavussanu & Roberts, 2001)

2. Negative consequences of dominant ego orientation:

- Anxiety, particularly when victory is not assured
- Focus on outcome rather than development.
- Greater inclination towards cheating and unethical behavior
- Association with external regulation and risk of dropping out of sport (Treasure et al., 2001)

Research shows that athletes can have a high orientation in both task and ego, but behavior and attitudes often depend on which orientation predominates and on the environment.

In the sports context:

- Coaches should reward effort, progress, and cooperation, not only victories.
- Evaluation of athletes should be based on the process and not only on the result.
- Prevention of doping and unethical behavior is more effective when task orientation is developed.
- Educating athletes about different ways of defining success is key to a long-term sports career and mental health (Lucidi et al., 2008).

Goal Orientation Theory provides important insights into the way individuals approach achievement. In the sport context, understanding and guiding athletes' goal orientation is crucial for fostering positive motivation, ethical behavior, and long-term engagement in sport (Duda & Nicholls, 1992).

Coaches, parents, and sports organizations play a key role in shaping a motivational climate that fosters satisfaction and success while reducing the risks associated with pressure for results and unethical behavior.

1.11.10 Summary of psychological theories and their practical application

All the theories outlined above can be illustrated using the example of an athlete who turns to doping in the run-up to an important competition. According to General Deterrence Theory, the athlete's decision to take doping becomes more likely if he/she assesses that the probability of detection is low and that the sanctions are not sufficiently certain or deterrent. The Theory of Planned Behavior explains this decision by the athlete's belief that doping will help him/her — and therefore a positive attitude towards it — by the conviction that others tacitly approve, and by the

belief that doping is available and can be used without immediate consequences. Social Learning Theory and Social Cognitive Theory further point to the importance of models from the environment: observing other athletes who use doping without visible consequences can contribute to normalizing such behavior (e.g., the athlete saw a colleague taking doping and developed the conviction that it is acceptable to dope because the colleague suffered no consequences for taking doping). Social Identity Theory suggests that the athlete may also use doping to preserve his/her belonging to a group in which results and team loyalty are particularly emphasized (e.g., all athletes in the club use doping, so I have to as well). On the other hand, Moral Disengagement Theory shows how the athlete may justify such a decision by minimizing its moral problematic nature, for example, through the conviction that "everyone does it" or that without it one cannot remain competitive. According to Self-Determination Theory, the athlete is more likely to take doping if his/her behaviour is driven by external factors (fear of failure and the need for reward), while Achievement Goal Theory and Goal Orientation Theory indicate that the risk is particularly pronounced when the athlete defines success exclusively through victory, surpassing others, and preserving superiority. Doping, therefore, is not the consequence of a single isolated reason but the result of the interaction between motivational, social, cognitive, and moral processes.

Although various psychological theories provide explanations of doping behaviour, the primary theoretical framework of the present doctoral dissertation is General Deterrence Theory. This theory proposes that prohibited behaviour may be discouraged when individuals perceive a higher likelihood of detection and sufficiently serious and certain consequences of rule violations (Johnson, 2019; Van Rooij, 2016; Verboon & van Dijke, 2012). In the anti-doping context, improved knowledge of testing procedures, legal responsibilities, enforcement mechanisms and sanctions may inform athletes' perceptions of the risks and consequences of doping. However, legal knowledge and perceived deterrence are distinct constructs, and greater knowledge does not necessarily imply that deterrence perceptions will change.

On this basis, the dissertation examines whether improving legal anti-doping knowledge is associated with less favourable attitudes towards doping and lower doping tendency. General

Deterrence Theory provides the primary conceptual link between legal education and its anticipated preventive effects. The other psychological theories reviewed in this chapter, particularly the Theory of Planned Behaviour, offer complementary explanations of how attitudes, intentions and social influences relate to behaviour; they are not the main theoretical basis of the educational intervention.

2 Previous research

2.1 Knowledge on doping

The level of knowledge about doping and anti-doping rules is one of the basic preconditions for effective prevention of doping, particularly in a system based on strict liability, where the athlete is responsible for substances found in his/her body, irrespective of intent. Knowledge about doping does not refer only to general information about doping but includes an understanding of the legal aspects of the anti-doping regulatory framework — the definitions of doping, lists of prohibited substances and methods, the doping control procedure, therapeutic use exemptions (TUEs), sanctions, and the rights and duties of athletes and support personnel. Existing research shows that frequent causes of low knowledge about doping are the informal sources of information athletes rely on (colleagues, coaches, media, the internet) and a lack of understanding of the procedural aspects of the system.

Studies conducted on athletes often reveal a pattern in which respondents consider that they have information about doping, yet do not know the basic definitional and procedural elements of the anti-doping system. For example, among professional athletes in Uganda, 60% reported having information about doping, but as many as 80% did not know the definition of doping set out in the World Anti-Doping Code (Muwonge, Zavuga, & Kabenge, 2015). It can therefore be concluded that there is a discrepancy between the subjective sense of being informed and actual knowledge. As the most frequent sources of information about doping, athletes cite colleagues, coaches, and the media, which calls into question the reliability of the information obtained. Although most respondents consider that doping should not be permitted at any level, some report that prohibited substances were available to them via colleagues and coaches. Despite a negative attitude towards doping, some respondents nevertheless admitted using doping to enhance performance (Muwonge et al., 2015). Such findings suggest that attitudes and knowledge are not always aligned, and that

risk behavior can develop even when attitudes are declaratively negative, particularly when substances and methods are socially available.

Similar ambivalence has also been observed in a Korean sample of national-team athletes, where a significant proportion of adolescent and adult athletes report having information about prohibited substances, but a much smaller proportion actually recognize substances on the prohibited list (Kim & Kim, 2017). Interestingly, the key sources of information, particularly for adults, are formal anti-doping institutions, while coaches and medical staff are less often cited as primary sources. This finding can be interpreted as an advantage of a system with active institutional education, but it also points to a problem that is particularly relevant from a prevention perspective: athletes with greater knowledge sometimes show greater tolerance towards doping. This relationship may suggest that knowledge is not always a protective factor in itself, but that the effectiveness of education depends on whether it includes value-based and motivational components, and on how athletes interpret risks and the "rules of the game" in their sport.

Studies conducted on European athletes confirm a moderate level of knowledge about doping, with the greatest gaps observed in the area of the legal procedure of anti-doping testing. Among Polish athletes, a moderate level of knowledge has been recorded, with knowledge differing by sex and experience: male athletes show a higher level of knowledge than female athletes, younger athletes (18–24) have a higher proportion of correct answers, and the lowest level of knowledge appears among those with less than five years of competitive experience (Sas-Nowosielski & Świątkowska, 2007). The highest proportion of correct answers was recorded in the area of athletes' rights and responsibilities, while the worst results were achieved in the area of the legal procedure of anti-doping testing. From this, it can be concluded that athletes know what is normatively expected of them but do not fully understand the procedural side of the anti-doping system.

A low level of knowledge and a lack of formal education have also been confirmed in research on professional Turkish athletes, where a large proportion of respondents report not having taken part

in education on doping (Ozkan et al., 2020). Although most athletes claim to have information about doping, the results show that their knowledge is fundamentally low, and they cite doctors, coaches, pharmacists, and teammates as their main sources of information. This opens up an important legal and regulatory dimension: if athletes obtain most of their information from support personnel, then the level of knowledge and responsibility of those persons becomes decisive for the overall effectiveness of anti-doping policy. In that sense, education that targets only athletes may be insufficient, since the "information infrastructure" of sport in practice often relies on the expert team.

That anti-doping education makes a measurable contribution to knowledge is also confirmed by findings from Kazakhstan, where participation in education is associated with a higher level of knowledge, as are age, sport experience, and prior experience with doping control (Zhumabayeva et al., 2022). At the same time, the dominant sources of information remain the internet and coaches, while doctors are cited less frequently, underscoring the importance of structured, reliable, and continuous educational channels. An important practical conclusion can be drawn from this: formal education can increase knowledge, but in sport systems where the internet and informal sources dominate, it is necessary to strengthen institutional access to verified information, particularly in segments related to the legal aspects of anti-doping regulation.

Regional research on team-sport athletes at the high level emphasizes that knowledge about doping is often weak and that the risk of doping behavior is associated with a number of sport-related factors (Sekulic et al., 2016). Particular emphasis is placed on the need to introduce targeted education that, in addition to the health risks of doping, also focuses on the legal aspects of anti-doping regulation. Findings from research conducted in Oman confirm that negative attitudes towards doping may be associated with low knowledge, including a lack of information on what constitutes doping and a misunderstanding of the fact that an athlete may be sanctioned even for unintentional taking of a prohibited substance (Nasr, Al-Yaaribi, Al Hinai, & Al-Droushi, 2023). This finding is directly linked to the legal aspects of anti-doping regulation and further underlines the importance of conducting education, since the athlete is not aware of the legal consequences

of taking doping; under the principle of strict liability, however, he/she is responsible for the prohibited substances found in his/her body, irrespective of intent.

2.2 Athlete support personnel and doping behavior in athletes

Given that coaches and members of expert teams are often key sources of information for athletes, studies assessing their knowledge of doping are important. Iranian football coaches show a relatively good understanding of the definition of doping, but a low level of knowledge has been established in the area of knowledge of prohibited substances, especially the side effects of anabolic steroids (Barghi, Halabchi, Dvorak, & Hosseinnejad, 2015). It follows that knowledge can be limited to general concepts, while concrete understanding of substances and health risks remains limited. In Spanish football clubs, expert staff have demonstrated a low level of knowledge about WADA and the prohibited list, even though some staff have used or recommended supplements to athletes, which could ultimately lead to unintentional rule violations caused by a lack of knowledge. Precisely for this reason, future education should be directed at this group of respondents and focus on their role in preventing doping.

Furthermore, particular importance should be attached to understanding therapeutic use exemptions (TUEs), as data show that knowledge of this area is extremely poor, even among respondents who considered themselves well familiar with the prohibited list (Drapšin, Simić, & Karaba, 2019). This is particularly important because TUEs represent one of the most sensitive areas of anti-doping regulation, and errors, lack of knowledge, or procedural omissions in this area can lead to serious consequences for athletes, even when the use is therapeutically justified. Research on the football league in Malawi also shows that, for athletes, the main sources of information are colleagues, coaches, and team doctors, while coaches and sponsors obtain information at seminars and from doctors or friends, which once again underscores the importance of systematic and standardized education (Kaoche, 2019).

A particularly worrying finding concerns those who provide medical care to athletes, since, in practice, athletes often rely on them when making decisions about medications, therapies, and dietary supplements. Research on doctors of sports and physical medicine shows that, despite recognizing the risks of doping, knowledge of anti-doping regulations and their legal procedures may be very limited (Tabirta et al., 2024). Among doctors, divided opinions have been recorded: some doctors believe that doping is justified because it can speed up recovery and prolong the sports career, and some would legalize certain medical methods in order to enhance sporting performance.

Findings on physiotherapists show that for them, the main source of information is the media and that they generally have a negative attitude towards doping, although the level of knowledge about the prohibited list and procedural rules of testing has been shown to be insufficient (Javed, 2020). Research among doctors of sports medicine societies in the Balkans shows that even among experts, there are serious gaps in understanding of the role of WADA and athletes' rights during doping control (Nenad et al., 2007), and a significant proportion of doctors consider that they are not sufficiently educated and view education as a key prevention measure. In Serbia, a low level of knowledge about the prohibited list and the legal framework for the prevention of doping has also been recorded among general practitioners, with a pronounced need for additional education (Antić, 2017). A similar result was observed among pharmacists, who showed limited knowledge of doping agents, and a large proportion of respondents had not participated in education on doping (Gebre-Mariam Hailu, Yirsaw Gobezie, Tuha, Mulugeta, & Ahmed Mohammed, 2021). Finally, research on healthcare workers (doctors and pharmacists) shows that a small proportion attend lectures on doping, but there is very high interest in education, and an association is observed between participation in workshops and a better understanding of basic concepts of doping (Salih & Abd, 2021).

From all of the above, several specific conclusions can be drawn. Knowledge about doping covers a fairly broad area, and it has often been shown that respondents are familiar with general information about doping, while problematic areas relate to the legal aspects of anti-doping

regulation, such as the procedures of doping control, therapeutic use exemptions, athletes' rights, sanctions, and the principle of strict liability. Furthermore, coaches and support personnel are often cited as the primary sources of information, which increases the risk of misinterpretation and may lead to unintentional rule violations. Precisely for this reason, the data point to the need for systematic, continuous, and targeted education that will include all key participants in the sport system. In addition, in education — beyond the health risks of doping — special emphasis should be placed on the legal aspects of anti-doping regulation.

2.3 Research on Doping in Croatia

Research on doping behaviour conducted in Croatia provides important insights into the prevalence of prohibited substance use, athletes' attitudes towards doping, and psychological and social factors associated with doping intentions. Previous findings highlight the importance of distinguishing between actual prohibited substance use, doping tendency, and attitudes towards doping, as well as the need for educational and preventive interventions tailored to different athlete populations.

An early Croatian investigation of anti-doping knowledge among young athletes was presented by Rimac et al. (n.d.). The survey was conducted during national school sport competitions in May 2009 and included 697 pupils: 468 from the final grades of primary school and 229 from secondary school. Using questions drawn from the World Anti-Doping Agency (WADA) Anti-Doping Quiz, the researchers assessed knowledge of anti-doping rules and doping-related health issues. Approximately 91% of respondents correctly recognised athletes’ ultimate responsibility for substances entering their bodies, while 85% understood that coaches or physicians who facilitate prohibited substance use may be sanctioned. However, important knowledge gaps were identified: only 38% correctly rejected the claim that athletes with disabilities may use any medication they need, and 40% correctly rejected the claim that any suitably equipped medical laboratory may

conduct doping-control urine analyses. The authors reported no statistically significant differences in the number of correct answers by age or parents' education, although girls generally answered more questions correctly than boys. These findings illustrate that basic awareness of selected anti-doping rules can coexist with substantial misconceptions about medical exemptions and testing procedures (Rimac et al., n.d.).

Miskulin et al. (2021) investigated attitudes, beliefs, and practices related to performance-enhancing substance use among young Croatian amateur athletes. The study was conducted in Osijek between 2019 and 2020, with 306 fully completed questionnaires included in the final analysis. The results showed that 1.3% of participants reported current use, while 3.3% reported previous use of performance-enhancing substances. Current use was more frequent among young adults and athletes participating in individual sports. Athletes with one to five years of sporting experience demonstrated more permissive attitudes towards performance-enhancing substances. These findings highlighted the importance of developing preventive interventions targeting young athletes, with particular attention to their attitudes and beliefs concerning doping (Miskulin et al., 2021).

Sekulic et al. (2014) examined substance use, doping-related knowledge, and potential doping behaviour among 105 male rugby union players. The results indicated that 23% of participants reported potential doping behaviour, while approximately 52% used dietary supplements and 55% believed that doping was present in rugby. Potential doping behaviour was associated with several factors, including lower rugby experience, greater dietary supplement use, and perceptions of doping prevalence within the sport. These findings suggest that doping tendency is related not only to individual knowledge but also to broader patterns of substance use, sporting experience, and perceptions of the competitive environment. The authors emphasized the need for preventive interventions addressing these interconnected factors (Sekulic et al., 2014).

Further evidence concerning the social and value-related determinants of doping was provided by Zvan et al. (2017), who investigated associations between religiousness and potential doping

behaviour among 886 high-level team-sport athletes from Croatia and Slovenia. The study included athletes participating in volleyball, handball, football, and basketball and examined gender- and sport-specific differences. Higher religiousness was associated with lower doping tendency among certain groups of female athletes, particularly in volleyball, handball, and basketball. In contrast, religiousness did not demonstrate the same protective association among male athletes, for whom the perceived presence of doping in sport was more strongly related to doping tendency. These findings indicate that personal values, social perceptions, and sport-specific characteristics may contribute differently to doping-related decision-making across athlete populations (Zvan et al., 2017).

An important contribution to the understanding of psychosocial determinants of doping in Croatia was provided by Kuterovac et al. (2026), who examined the relationships between doping attitudes, motivation, self-esteem, achievement goal orientation, social norms, and doping intentions among 988 Croatian athletes. The results indicated that 7.6% of participants reported having used prohibited substances at least once during their sporting careers. Male athletes demonstrated more favourable doping-related attitudes and stronger behavioural intentions, while athletes participating in individual sports and those belonging to the lower competition-level group more frequently reported previous prohibited substance use. Importantly, attitudes towards doping demonstrated the strongest unique association with behavioural intention. These findings emphasize the importance of psychological factors in understanding doping-related decision-making and support the development of educational interventions aimed not only at increasing knowledge but also at shaping attitudes and reducing intentions to engage in doping.

Alongside scientific research, institutional anti-doping education programmes have been developed in Croatia. Erceg and Fattorini (2011) described the activities of the Croatian Anti-Doping Agency (CROADA), emphasizing the importance of educating athletes, coaches, healthcare professionals, and particularly young athletes. These activities included educational lectures, information materials, and educational initiatives organized at sporting events. Such

programmes underline the importance of introducing young athletes to anti-doping rules and the health risks associated with prohibited substance use at an early stage.

Overall, research conducted in Croatia and related studies involving Croatian athletes indicate that doping behaviour should be understood through the interaction of knowledge, attitudes, individual athlete characteristics, personal values, and the broader sporting environment. Findings concerning potential doping behaviour in rugby players, the relationship between religiousness and doping tendency in team-sport athletes, and the psychological predictors of doping intentions collectively suggest that legal knowledge alone cannot fully explain doping-related decision-making. These findings reinforce the importance of comprehensive anti-doping educational programmes that integrate legal knowledge with psychological, social, and ethical components relevant to behavioural intentions and doping prevention.

3 The research problem of the doctoral thesis

Despite a clearly defined anti-doping legal framework, existing research shows that athletes, coaches, and persons involved in healthcare often lack sufficient knowledge of the legal aspects of anti-doping regulation, particularly in the area of the principle of strict liability, the procedures of doping control, therapeutic use exemptions, and the legal consequences of rule violations.

At the same time, attitudes towards doping represent an important psychological factor associated with potential doping behavior, but the relationship between the level of legal knowledge and attitudes towards doping has not been sufficiently clarified. There is also a lack of systematic evaluations of the effectiveness of legally oriented educational programs and their influence on changing attitudes.

From the existing research, it is clear that: (a) the level of knowledge about doping among coaches is generally insufficient (research shows the same level of knowledge as among athletes); and (b) all previous research has dealt with the health-related issues of doping, while a great deal of room remains for research on the legal issues of doping in sport.

The basic problem of this doctoral thesis, therefore, arises from the need to determine whether there is an association between knowledge of the legal aspects of anti-doping regulation and attitudes towards doping, and whether legally oriented education can contribute to changing those attitudes among athletes, coaches, and healthcare professionals.

4 Aims of the study

Existing research has shown that the level of knowledge about doping among coaches and athletes is insufficient, and that research has mainly dealt with the health-related aspects of doping, while the legal aspects of doping, as far as I am aware, remain largely under-researched. Given the conclusions of previous research, the aim of this thesis is, first and foremost, to determine the level of knowledge about doping among athletes, coaches, and persons responsible for healthcare. In addition, previous research has identified a need for educational programs. This will therefore be one of the first studies to develop and apply an educational program aimed at improving specific knowledge of the legal issues surrounding doping in sport, and to determine any changes in attitudes and inclinations towards doping resulting from this increased knowledge. In addition to athletes, professional support personnel will also be included in the education, and the effects of the educational intervention will be monitored separately. The aim of this thesis is also to determine and to explain in detail the factors that regulate the relationship between knowledge of anti-doping regulations and the intention/inclination to use doping among athletes, coaches, and persons responsible for the healthcare of athletes.

Aim 1: to determine the relationship between knowledge of anti-doping rules and attitudes towards doping among elite athletes, coaches, and persons responsible for healthcare;

Aim 2: to develop a targeted educational program aimed at improving knowledge of anti-doping rules;

Aim 3: to investigate the effects of the implemented educational program on changes in attitudes towards doping.

5 Research hypotheses

On the basis of the previously defined aims, the following hypotheses have been developed:

Hypothesis 1: A higher level of knowledge of anti-doping rules will be statistically significantly associated with negative attitudes towards doping among:

1. elite athletes;
2. coaches;
3. persons responsible for healthcare.

Hypothesis 2: educational programs on anti-doping rules will statistically significantly reduce positive attitudes towards doping among:

1. elite athletes;
2. coaches;
3. persons responsible for healthcare.

6 Methods

6.1 Sample of participants

The four analyzed studies covered three groups of participants: athletes, coaches, and members of athlete support personnel. The first study involved competitive athletes from Croatia and Montenegro (N = 457), including 179 women, all aged 18 or older. Participants were involved in Olympic team sports — football, basketball, handball, and volleyball. The study was conducted on a sample of 24 sports teams (9 women's and 15 men's); to assess test–retest reliability, part of the sample (n = 87) was tested twice, with an interval of 5 to 7 days, while the rest of the sample was tested subsequently. The mean age of participants was 21.3 ± 3.3 years (Stankovic, Sinkovic, Sekulic, Jelicic, & Rodek, 2022).

Regarding sporting standard, all athletes competed in senior team sports, and their highest sporting achievement was recorded in three categories: local, national, and international level. The sample represented 24 teams (15 men's and nine women's teams), comprising 10 football, six basketball, four handball, and four volleyball teams. Thus, the study included athletes with different levels of competitive achievement; the source article does not specify the number of participants in each achievement category (Stankovic et al., 2022).

The second study involved 211 members of athlete support personnel from Croatia and Bosnia and Herzegovina, of whom 71 were women, with a mean age of 41.1 ± 7.8 years. The sample comprised coaches, medical personnel, and nutritionists who had been involved in sport for at least 3 years. The largest part of the sample consisted of coaches (n = 156), followed by medical professionals (n = 49), including doctors and physiotherapists, and nutritionists (n = 6). Participants were recruited via national sports federations; for the test–retest reliability assessment, a sub-sample of 56 participants completed the questionnaire twice, with an interval of 7 to 10 days. The study included participants who were actively engaged in sport as members of support

personnel; both countries were chosen for their language similarity and the need for a clear understanding of the questionnaire content (Sinkovic, Pivalica, Jukic, Pehar, & Sekulic, 2026).

The competitive level of the athletes supported by the participants was also recorded. Specifically, 12 support personnel (5.7%) worked at the youth national level, 30 (14.2%) at the youth international level, 61 (28.9%) at the senior national level, 73 (34.6%) at the senior international level, and 32 (15.2%) with national teams; this information was missing for three participants (1.4%). These categories refer to the highest level of sport in which the support personnel were involved, rather than to the personal competitive achievements of the support personnel themselves (Sinkovic et al., 2026).

The third study involved 310 elite athletes, of whom 156 were female, with a mean age of 24.1 ± 4.2 years. All participants were active senior athletes with competitive status at the national or international level. The sample included athletes from individual (n = 119; athletics, swimming, judo, sailing) and team sports (n = 191; football, basketball, handball, volleyball, water polo). Inclusion criteria were: age 18 or older, active senior status, at least 1 year of competitive experience at the national or higher level, and Croatian citizenship. Participants were stratified by sport type and then randomized to the experimental and control groups. The control group included 68 athletes from individual sports and 102 from team sports, while the experimental group included 51 athletes from individual sports and 89 from team sports (Sinkovic, Pivalica, Jukic, Pehar, Pivalica, et al., 2026).

The fourth study involved coaches and members of athlete support personnel (ASP), 183 participants in total, of whom 64 were women, with a mean age of 45.11 ± 8.90 years. The sample consisted of 101 medical personnel (doctors and physiotherapists) and 82 coaches who worked with senior-level athletes in elite sport. Inclusion criteria were: at least one year of work in sport in the role of ASP; work with athletes competing at least at the highest national level; meeting the formal qualifications prescribed by national sports federations; and Croatian citizenship.

Participants were randomized into an intervention group (n = 99) and a control group (n = 84) (Sinkovic, Pivalica, Pivalica, Jukic, & Sekulic, 2025).

The research protocols of all studies included in this dissertation were approved by the Ethics Committee of the Faculty of Kinesiology, University of Zagreb (approval no. 30/2025, dated 6 May 2025).

6.2 Variables and instruments

Three measurement instruments were used in the studies:

1) Questionnaire of Substance Use (QSU) (Zenić, Perić, Zubčević, Ostojić Z., Ostojić L., 2010)

QSU as a measurement instrument has repeatedly been demonstrated to be highly reliable and valid (Zenic, Peric, Zubcevic, Ostojic, & Ostojic, 2010). The reliability of the QSU questionnaire was checked using the test–retest method, by which it was established that 89–93% of respondents gave identical answers to the items, and it has been validated on different samples of respondents, including athletes from Croatia (Rodek, Sekulic, & Kondric, 2012).

In the QSU questionnaire, some items are answered on a nominal scale (e.g., the basic problem of doping), while others are answered on an ordinal scale (e.g., the organization of education on doping).

The sociodemographic variables do not separately list participant categories (athlete, coach, person responsible for healthcare) because the items in the QSU questionnaire are tailored to each group. The substance of the items is the same; only the wording differs depending on the group being tested. For example, in the QSU questionnaire for athletes, one item reads: "How many times have you been tested for doping during your sporting career to date?" while for coaches, the item reads: "How many times, as a coach, have you been in a situation in which your athletes were tested for

doping?" The questionnaire itself, therefore, does not include a variable grouping participants, but this information (athlete, coach, person responsible for healthcare) was entered into the final data matrix.

The QSU questionnaire measures the following variables:

Sociodemographic factors (these variables were used to describe the sample)

- Age (in years);
- Sex ("male", "female", "other");

In a study of athletes from Croatia and Montenegro, these variables were used to describe the sample and to analyze relationships with knowledge of the legal aspects of anti-doping rules and potential doping behavior (Stankovic et al., 2022).

Sport-related factors varied across the samples. In the study conducted on professional athletes from Croatia and Montenegro in team sports, sport factors included:

- Sport practiced by the participant (football, basketball, handball, volleyball)
- Age at entry into sport, from which sport experience was derived
- Highest level of sport achievement, categorized as local, national, and international level (Stankovic et al., 2022).

In the intervention study conducted on elite athletes in individual and team sports, sport-related factors included:

- type of sport (individual or team sport)
- years of active senior competition ("<5 years", "6–10 years", ">10 years")

- highest level of sport success ("appearance at national level", "medal at national level", "appearance/medal at European or world championships", "appearance/medal at the Olympic Games") (Sinkovic, Pivalica, Jukic, Pehar, Pivalica, et al., 2026).

In the study on members of athlete support personnel, sport-related factors related to professional experience and the level of work in sport were included:

- length of work in sport ("<5 years", "6–10 years", ">10 years")
- The highest level of sport success achieved in the role of a member of support personnel, ranging from national to Olympic level (Sinkovic et al., 2025).

Doping-related factors were similar in all studies, with adjustments to the target group. In the studies conducted on athletes, the following variables were used:

- Self-assessed knowledge of doping ("poor", "neither poor nor good", "good");
- Doping testing during the sport career to date ("never", "1–2 times", "3–5 times", ">5 times");
- Trust regarding doping ("in the coach", "in medical personnel", "in the nutritionist", "in a friend/colleague/teammate", "I trust no one");
- Main source of information about doping ("coach", "medical personnel", "nutritionist", "friends", "personal formal education (schooling)", "informal education (Internet)", "I have no knowledge of doping, so I cannot identify a source");
- The basic problem of doping ("harmful to health", "not in the spirit of fair play", "I do not consider doping to be a problem");
- Attitude regarding potential personal use of doping (4 response options on a scale: "out of the question", "I am not sure I can say categorically that I will never use doping", "possible,

but only if there were no health consequences", "it is possible that I would use doping in some situation");

- Organization of education on doping by the federation/club ("I do not remember anything like that being organized", "yes, rarely", "yes, often").

In studies of coaches and members of athlete support personnel, the items were adapted to their respective roles. For example, instead of asking about personal doping testing, participants answered how many times, as coaches or medical personnel, they had been in a situation in which their athletes were tested for doping.

Some items related to doping factors were measured on a nominal or ordinal scale, depending on the variable's nature. For example, the basic problem of doping and the source of information about doping are nominal variables, while the frequency of anti-doping education, the number of tests, and the level of self-assessed knowledge are ordinal variables.

2) Questionnaire on Knowledge of Anti-Doping Rules (Stanković, Sinković et al., 2022)

To assess knowledge of the legal regulation of doping, all four studies used the Q-LADR (Questionnaire of Legal Anti-Doping Regulations) in its original or adapted version. The instrument was developed to assess knowledge of the rights, obligations, and procedures set out in anti-doping rules.

The original questionnaire was developed in several phases. In the initial phase, a panel of six experts was assembled, which defined two basic content areas:

1. rights and obligations of athletes in the anti-doping system
2. legal procedures of anti-doping testing (Stankovic et al., 2022).

On this basis, an initial version of 20 items was constructed, with 10 items in each of the two areas. Participants responded on a three-point scale:

- true
- false
- I am not sure.

Each correct answer was scored 1, while incorrect and "I am not sure" answers were scored 0. In the initial version, the theoretical range of results was 0 to 20, with a higher result indicating better knowledge of the legal regulation of doping. After checking the metric characteristics, the number of items was reduced to 10, so that in the final version, the result ranges from 0 to 10.

The questionnaire's reliability was assessed using the test–retest method. In the validation study, a Cohen's kappa coefficient of 0.65 was observed, indicating satisfactory to substantial reliability, while the average percentage of identical responses between the two measurements was 84%. Factor analysis identified three latent dimensions, of which the first two were clearly interpretable and related to:

- procedural aspects of anti-doping testing
- rights and obligations of athletes within the framework of anti-doping rules.

The Questionnaire on Knowledge of Anti-Doping Rules (Q-LADR) assesses knowledge of the legal aspects of anti-doping rules. The variable is operationalized through 10 items covering the rights and obligations of participants in the anti-doping system, as well as procedural aspects of anti-doping testing and legal proceedings. The total score is the sum of correct answers; a higher score indicates a higher level of legal anti-doping literacy.

The final version of the Q-LADR questionnaire covers items relating to:

- The possibility of an unlimited number of tests for an athlete within one year
- the obligation to provide whereabouts information
- the possibility of refusing to provide a sample
- Prior notification of doping control
- The taking of urine and blood samples
- the storage and re-analysis of samples over a period of ten years
- The meaning of a discrepancy between the A and B samples
- the right to appeal
- public reporting of an anti-doping violation
- The effects of voluntary admission of a violation.

Adapted version for members of athlete support personnel (Q-LADR-ASP) (Sinkovic, Pivalica, Jukic, Pehar, & Sekulic, 2026)

In studies of coaches and members of athlete support personnel, an adapted version of the original instrument, called Q-LADR-ASP, was used (Sinkovic, Pivalica, Jukic, Pehar, & Sekulic, 2026). Since the original questionnaire was developed for athletes, its content was reviewed and adapted by two physicians associated with national anti-doping organizations to ensure that the items were appropriate for coaches, doctors, physiotherapists, and nutritionists.

In the second study, an extended, adapted version of Q-LADR-ASP was used, developed to provide a more detailed assessment of knowledge of the legal aspects of anti-doping regulation among members of athlete support personnel from Croatia and Bosnia and Herzegovina. The initial version contained 20 items; after checking the metric characteristics, two items were

excluded due to insufficient stability. The remaining version showed satisfactory reliability (κ = 0.61; absolute agreement 82%), while factor analysis identified two basic dimensions:

- rights and obligations under anti-doping rules
- doping control procedure and legislative framework.

In the second study, a shortened 10-item version of the instrument, adapted to the ASP population, was used; the same scoring principles and response method as in the original version were retained.

In this way, conceptual comparability of the instrument was maintained across all studies, while the wording and content were simultaneously adapted to the specifics of each target group.

All questionnaires were used in the local Croatian-language version, and in the more recent studies, the survey was administered through the digital platform SurveyMonkey. In the second study, data were also collected digitally, with participants completing the questionnaire on their own electronic devices; part of the sample completed it twice, with an interval of 7 to 10 days, in order to assess test–retest reliability.

6.3 Educational program as an intervention instrument

In two of the studies, in addition to questionnaire-based measurement instruments, a structured educational program called LADEP (Legal Anti-Doping Education Program) was also used (Sinkovic, Pivalica, Jukic, Pehar, Pivalica, et al., 2026; Sinkovic et al., 2025). This program was the intervention instrument by which efforts were made to improve participants' knowledge of the legal aspects of anti-doping rules.

The theoretical rationale of the Legal Anti-Doping Education Program (LADEP) is primarily informed by General Deterrence Theory, which emphasizes the preventive role of the perceived likelihood of detection and the certainty and severity of sanctions in discouraging prohibited behaviour (Johnson, 2019; Nagin, 2013; Strelan & Boeckmann, 2006). In accordance with this

theoretical framework, the educational programme addressed athletes' and athlete support personnel's rights and obligations, anti-doping testing and control procedures, and the legal and sporting consequences of anti-doping rule violations. The programme was designed to provide participants with information relevant to understanding how anti-doping rules are enforced and what consequences may follow from their violation.

Although the primary objective of LADEP was to improve legal anti-doping knowledge, the intervention was also expected to have a potential preventive effect on doping-related attitudes and tendencies. The proposed mechanism was that greater understanding of testing procedures, the possibility of detecting violations, and applicable sanctions could contribute to more informed perceptions of the risks and consequences associated with doping. According to General Deterrence Theory, such perceptions may discourage prohibited behaviour and potentially reduce the perceived attractiveness of doping (Nagin, 2013; Strelan & Boeckmann, 2006). Thus, the expected change in doping-related attitudes was not assumed to result automatically from the acquisition of legal information, but potentially through changes in participants' subjective assessment of detection risk and consequences. However, these deterrence-related perceptions were not directly measured in the present studies. Therefore, the proposed mechanism represents the theoretical basis for expecting an attitudinal effect of the intervention rather than an empirically confirmed causal pathway.

The program consisted of 10 structured lessons, focused on two basic areas:

1. rights and obligations under anti-doping regulations
2. legal procedures of anti-doping testing.

The education was delivered by certified anti-doping officers, sports law specialists, and experienced sports coaches. Lessons were organized through interactive discussions, analysis of real cases, and the application of legal content to specific sport situations. In the work with elite

athletes, particular emphasis was placed on experiential learning and active participant involvement in discussions of realistic doping-control and legal-procedure scenarios.

6.4 Statistical analyses

Data processing in the analyzed studies was conducted using descriptive and inferential statistical procedures, in accordance with the goals of each study and the nature of the variables observed. In all four studies, basic descriptive indicators were calculated first. For numerical variables — variables with an approximately normal distribution — arithmetic means and standard deviations are presented; for categorical and ordinal variables, frequencies and percentages are presented. The normality of distribution was checked by the Kolmogorov–Smirnov test (Sinkovic, Pivalica, Jukic, Pehar, Pivalica, et al., 2026; Sinkovic, Pivalica, Jukic, Pehar, & Sekulic, 2026; Sinkovic et al., 2025; Stankovic et al., 2022).

In the study that developed and validated the Q-LADR measurement instrument, the statistical analysis focused primarily on its metric characteristics. The instrument's reliability was assessed using the test–retest method; Cohen's kappa coefficient and the percentage of identical responses between the two measurements were calculated. To check the factor validity of the Q-LADR, factor analysis with varimax rotation and the Guttman–Kaiser extraction criterion was performed. Sex differences in the Q-LADR were calculated by means of an independent-samples t-test, while one-way analysis of variance was used to determine differences between sports in the Q-LADR. Associations between variables were examined using the Spearman correlation coefficient, and to investigate the relationship between a set of predictors, including the Q-LADR score, and the criterion variable of potential doping behavior, multinomial logistic regression was applied. In that study, correlation analyses were conducted separately for men and women (Stankovic et al., 2022).

In the second study, which focused on the adaptation and validation of the Q-LADR-ASP questionnaire among members of athlete support personnel, the metric properties of the questionnaire's knowledge of anti-doping rules section were first established. Reliability was assessed primarily using the test–retest method and the percentage of identical responses between

the two measurements, and Cohen's kappa coefficient was calculated. After checking the distributional normality, descriptive indicators are presented as arithmetic means and standard deviations for age and the total score on the Q-LADR-ASP questionnaire, and as frequencies and percentages for the other variables. To examine factor validity, factor analysis with varimax rotation and the Guttman–Kaiser criterion was performed; on this basis, two latent dimensions of the questionnaire were identified. Criterion validity was further assessed using an independent-samples t-test, which examined differences in the level of legal anti-doping knowledge between men and women and between medical personnel and other members of athlete support personnel. Associations between the total Q-LADR-ASP score and the other variables were examined by means of the Spearman correlation coefficient. Furthermore, to examine the relationship between a set of predictors, including the Q-LADR-ASP score, and the binarised criterion variable of the likelihood of suggesting doping to an athlete, logistic regression was applied. The statistical analysis in this study showed that the instrument has satisfactory reliability and validity for use among members of athlete support personnel (Sinkovic, Pivalica, Jukic, Pehar, & Sekulic, 2026).

In the study analyzing the effect of the educational intervention on elite athletes, the distribution was first checked for normality. After distribution normality was assessed, arithmetic means and standard deviations were calculated for age and the Q-LADR score, while for the remaining variables, descriptive indicators are presented as frequencies and percentages. The chi-square (χ^2) test was used to determine differences in categorical and ordinal variables between the control and experimental groups. To assess the effects of the educational intervention on legal anti-doping knowledge, a multifactorial repeated-measures analysis of variance was applied. The model included the main factors: group (experimental vs. control), measurement time (pretest and posttest), and type of sport (individual vs. team), as well as their interaction effects: group × time, group × type of sport, time × type of sport, and the three-way interaction group × time × type of sport. Effect size was expressed by partial eta-squared (η^2); in the case of statistically significant interactions, Bonferroni post hoc comparisons were performed. To examine the relationship between legal anti-doping knowledge as a predictor and the binarised doping inclination as the

criterion, univariate logistic regression was applied; results are presented as odds ratios and 95% confidence intervals, separately for the experimental and control groups and for the pretest and posttest measurements (Sinkovic, Pivalica, Jukic, Pehar, Pivalica, et al., 2026).

In the study examining the effects of the educational intervention on coaches and members of athlete support personnel, the statistical analysis was adapted to the experimental design with repeated measures. After checking for normality, descriptive statistics are presented as arithmetic means and standard deviations for continuous variables and as frequencies and percentages for categorical variables. Differences between groups in non-parametric variables were analyzed by the chi-square test. The effect of the intervention on knowledge of the legal aspects of anti-doping was examined using a two-way repeated-measures analysis of variance, with the within-subject factor being measurement (pre- and post-intervention) and the between-subject factor being group (intervention and control). The interaction effect of measurement and group was also analyzed; where necessary, Scheffé post hoc tests were used. In this study, analyses were conducted separately for medical personnel and coaches. To assess any changes in doping inclination, the chi-square test was also used; in some analyses, it was not possible to calculate the test due to zero frequencies in certain categories (Sinkovic et al., 2025).

In all studies, statistical analyses were performed using Statistica software, version 14.0 (TIBCO Software Inc., Palo Alto, CA, USA; license number: JPZ009K288211FAACD-Q). The level of statistical significance was set at $p < 0.05$.

7 Original research studies

This dissertation is written in the form of the "Scandinavian model" and consists of four published studies, each of which addresses the research questions posed.

1. Stankovic, D. V., Sinkovic, A., Sekulic, D., Jelicic, M., & Rodek, J. (2022). Knowledge of the legal issues of anti-doping regulations: Examining the gender-specific validity of the novel measurement tool used for professional athletes. *Sustainability, 14*(19), 12883. https://doi.org/10.3390/su141912883

2. Sinkovic, A., Pivalica, D., Jukic, I., Pehar, M., & Sekulic, D. (2026). Measuring legal competence in anti-doping: Reliability and validity of the novel measurement tool among athlete support personnel. *Kinesiologia Slovenica, 32*(1), 87–106. https://doi.org/10.52165/kinsi.32.1.87-106

3. Sinkovic, A., Pivalica, D., Pivalica, B., Jukic, I., & Sekulic, D. (2025). Evaluating an anti-doping education program for athlete support personnel: Knowledge gains without behavioral shift. *Sport Mont, 23*(3), 127–133. https://doi.org/10.26773/smj.251018

4. Sinkovic, A., Pivalica, D., Jukic, I., Pehar, M., Pivalica, B., Cerkez Zovko, I., & Sekulic, D. (2026). The effect of educational intervention on legal anti-doping knowledge and doping tendency in elite athletes. *Sports, 14*(1), 35. https://doi.org/10.3390/sports14010035

7.1 Stankovic, D. V., Sinkovic, A., Sekulic, D., Jelicic, M., & Rodek, J. (2022). Knowledge of the legal issues of anti-doping regulations: Examining the gender-specific validity of the novel measurement tool used for professional athletes. *Sustainability, 14*(19), 12883. https://doi.org/10.3390/su141912883

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Knowledge of the Legal Issues of Anti-Doping Regulations: Examining the Gender-Specific Validity of the Novel Measurement Tool Used for Professional Athletes

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Abstract: In the present study, we aim to assess the reliability and gender-specific validity of an original questionnaire (Q-LADR) in evaluating the knowledge of legal anti-doping regulations and to examine the gender-specific associations between Q-LADR and potential doping behavior (PDB) in senior-level professional athletes. The participants were team-sport players from Croatia and Montenegro (n = 479, 179 females, 21.3 ± 3.3 years of age). Apart from Q-LADR, they were tested in sociodemographic, sport, and doping factors. The results show the proper test–retest reliability of the Q-LADR (Cohen's kappa = 0.65; average percentage of the equally responded questions: 84%). Men achieved higher scores for the Q-LADR than women (t-test = 9.55, $p < 0.001$). The Q-LADR score was correlated with age in men, and with number of doping tests and sport success in men and women. Lower Q-LADR scores were correlated with neutral (in women) and positive doping attitudes (in men and women). The results confirm the importance of testing knowledge on the legal issues of anti-doping regulations for athletes, with the possible applicability of findings in the global fight against doping in sport. In order to provide equal opportunities for all to be involved in professional sport, special attention should be paid to vulnerable groups (i.e., women, younger athletes, and those who have not achieved sport success).

Keywords: questionnaire; validity; legislative; sport law; integrity

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1. Introduction

Doping, namely, the use of a substance or technique to illegally improve athletic performance, is one the most critical problems in modern sport. Apart from being a serious health-threatening behavior associated with numerous detrimental health-related problems (i.e., hypertension, diabetes, blood clotting, insomnia, and anxiety), doping is considered an unfair way of improving an athletes' capacities and, therefore, contradicts the main essence of fair play in sport [1,2]. Not surprisingly, there is a growing body of research examining (i) methods for the detection of doping in athlete specimens, (ii) the negative health consequences of doping, and (iii) factors associated with doping behavior in athletes [3–6]. From the perspective of sustainability of sport as a global phenomenon that should be accessible and affordable around the world, all three specified research topics deserve attention. However, it is clear that the information obtained for (i) methods of detection and (ii) health consequences should be considered as "universal", and the findings of the studies dealing with these issues are globally generalizable regardless of the country/region/sport of origin. Meanwhile, the knowledge concerning factors of influence on doping behavior is known to be sport- and community (socioculturally)-specific, and there is a growing body of evidence that this issue should be observed as being gender-specific [7–9].

The rationale for adopting a gender-specific approach in studying the association of specific factors with doping behavior is based on the following reasons. First, in order to achieve sport performance results, female and male athletes are differentially oriented toward doping, simply because of physiological and psychological gender differences [10]. Studies have mostly—but not always—found that female athletes have a lower tendency of doping than their male peers within the same sport [3,7,8,11]. This was supported by a recent French study providing evidence of female athletes being less prone to doping than their male peers, with a significantly lower usage of hormones (i.e., anabolic agents). However, females were more prone to using glucocorticoids, beta-2 agonists, and diuretics [10]. Finally, a gender-specific approach is directly confirmed in the previous studies when authors confirmed that males and females often differed in factors they individually considered as being important barriers against their personal doping behavior (e.g., factors of hesitation (FHs)).

For example, a study on college-level athletes identified the differential influence of various FHs in men and women, with familial education level being the important FH against doping behavior in women, and religiousness (religiosity) being the important FH in men [12]. Even when a specific issue was investigated (i.e., health hazard of doping behavior), the genders differed in the ranking of specific consequences that should be observed as an FH against doping. For example, a study conducted on young athletes involved in different sports evidenced health hazards related to doping usage as highly important FHs in both males and females, but within this group of FHs, females ranked possible body malformations (e.g., hirsutism and development of male pattern baldness) as the most important negative consequence of doping usage, while males ranked immune function problems as being the most important FH [9]. Finally, although the authors of the previously mentioned studies highlighted the possible influence of gender-specific popularity of a certain type of sport on the differentiation in FHs between males and females (i.e., some sports are considered as being typically "male sports", while some are considered as "female sports"), and while sports themselves frequently differ in tendency toward a specific type of doping), it seems that sport type should not be observed as an important covariate based on the previous findings regarding the FHs in male and female athletes. Namely, more recent studies examining specific sport and/or group of sports supported these previous results and identified clear gender-specific FHs for athletes involved in the same sport [3,8,13].

Despite the global interest regarding doping in sport, there is an evident lack of knowledge about the legal issues (i.e., law regulations and legal regulations) and their eventual influence on doping behavior in athletes [14–16]. This is particularly interesting given that legal regulations are recognized as one of the most important mechanisms in the global fight against doping and is generally defined in the Law on Sports in most of the countries that are members of the International Olympic Committee [17–19]. However, there is and evident lack of: (i) specific measurement tools examining knowledge about the legal regulations of the anti-doping policy, and (ii) knowledge of the eventual association between this type of knowledge and the doping behavior of athletes. This is particularly important if we know that the global anti-doping authority, the World Anti-Doping Agency (WADA), adopted the World Anti-Doping Code (WADC) and established it as the most important by-law that contains the rules and principles to be followed by organizations responsible for the adoption, implementation, or imposition of anti-doping rules [20].

The obligation of every athlete, coach, medical professional, and other team members is to know and respect the valid anti-doping policies and rules adopted in accordance with the WADC. However, previous research has shown there is a low level of knowledge of athletes about doping and the need to educate them about it [20,21]. In particular, in studies that directly examined athletes' knowledge about doping problems, the highest percentage of correct answers related to questions concerning the athlete's rights and responsibilities, while the lowest percentage of correct answers related to questions about anti-doping rules and procedures [21,22]. One of the reasons for the low level of knowledge of athletes about

the legal regulations of doping is their general trust in coaches and other team members as a source of acquiring information about doping [23–25]. As a result, athletes evidently do not pay attention to acquiring proper information about anti-doping regulations, which directly puts them in danger of violating anti-doping rules.

Therefore, in improving the overall situation of that matter, it would be important to clearly identify the possible association between knowledge of the legal issues related to doping in sports and doping behavior in athletes. As a first step, it is crucial to develop a reliable and valid measurement tool aimed at assessing the level of knowledge on anti-doping legal regulations in sport. This study aims to (i) evaluate the reliability and gender-specific discriminative validity of an original questionnaire (Q-LADR), in evaluating the knowledge of legal anti-doping regulations (LADR knowledge) and (ii) to examine the gender-specific associations between LADR knowledge and potential doping behavior in senior-level professional athletes from Croatia and Montenegro. We hypothesize that greater LADR knowledge is associated with a lower tendency toward doping behavior in athletes, irrespective of gender.

2. Methods

2.1. Participants and Study Design

Participants in this study were competitive athletes from Croatia and Montenegro (n = 457; 179 females). All participants were older than 18 years of age and involved in Olympic team sports (football/soccer, basketball, handball, and volleyball). This sample was intentionally selected for the following reasons. First, since one of the study aims was to assess the reliability and validity of the newly developed questionnaire in evaluating LADR knowledge, it was important to observe athletes who were involved in similar sports. Otherwise, the high variability of the responses could artificially increase the test–retest reliability throughout, leading to higher numerical values of the test–retest correlation. Second, despite some technical and grammatical differences, the same language is spoken in both countries, which was one of the most important prerequisites for the effective application of the measurement tool. Third, we had to overview the "real" LADR knowledge, and for this reason, the study should be conducted within a relatively short time frame (to avoid consultations and discussion on the tested issues in sport society). Team sports are the most popular sports in the study countries, which allowed us to obtain an appropriate sample of participants in a relatively short period of time. This study was conducted in direct cooperation with the national sport authorities (i.e., committees and federations) in both countries. At the very beginning, sport authorities were contacted and they provided positive feedback about the investigation. Accordingly, the suggestion was sent by them to sport teams and athletes to participate in being contacted by the authors of the study. The authors directly contacted several teams from their region and arranged the testing. Testing comprised, altogether, 24 sports teams (9 female and 15 male teams), including 10 football/soccer, 6 basketball, 4 handball, and 4 volleyball teams.

For the purpose of the evaluation of the test–retest reliability, the subsample of participants (n = 87) was tested twice in a time frame of 5–7 days, depending on the possibility of gathering athletes for testing. The results were used for the evaluation of the questionnaire's reliability (please see later sections for the statistical analyses used), which was conducted immediately after retesting. The remaining sample (n = 370) was tested in the 2nd period (7–14 days after retesting the 87 participants, who were observed throughout the testing and retesting phases). In the remaining analysis, the data of all tested athletes were used.

2.2. Variables and Testing

The variables observed in this study were sociodemographic factors, sport factors, doping factors, and LADR knowledge. All variables were collected by testing participants through a specifically designed digital platform located on a server belonging to the university of the corresponding author. The participants completed the digital form of the applied questionnaires using their smartphones (the investigator provided smartphones for

those who eventually did not have one). Testing was anonymous, and all participants were informed that they could refuse to participate, and/or could leave some questions or the entire questionnaire unanswered. However, in order to allow the tracking of the responses, the participants who were tested using the test and retest procedure used the self-selected code for identification purposes. The response rate was higher than 98%, and the results of the participants who responded to all the questions were used for the analyses conducted in this study (see proceeding sections for further exclusion criteria)

The sociodemographic variables included age (in years) and gender (male–female–not applicable). In this study, we observed results for only those participants who defined their gender as male or female; therefore, one participant was not included in further analyses (based on responding with "none"). Sport factors included participating sport (football–basketball–handball–volleyball), age of initiation in sport (later used to determine "experience in sport" by subtracting the participant's age), and the highest sport achievement (local–national–international levels). Doping factors included variables asking participants about their personal opinion on doping presence in their sport (not present–doping is rare–doping is common–doping is regular in my sport), opinion about penalties for offenders of anti-doping regulations (I do not think they should be punished–financial penalty–first-time milder punishment and then exclusion from sport/competition for a couple of seasons–exclusion from sport for a couple of seasons–lifelong exclusion from sport), number of anti-doping tests in which the athlete was involved (none–one–two to three–more than three), and potential doping behavior (I will not consider doping–I do not know/not sure–I will consider doping if there are no side effects–I will consider doping). Later, the results for potential doping behavior were categorized as "negative attitude toward doping behavior" (first response), "neutral attitude" (second response), and "positive attitude" (last two responses). All sociodemographic, sport, and doping variables were tested by previously designed and validated questionnaires, and the details of the psychometric properties are available elsewhere [26].

The Q-LADR was developed through several phases. In the first phase, a panel of six experts was gathered and consulted in order to obtain a clear idea of the topics they considered important to be included in the measurement tool we intended to develop. The panel included two experts in legal issues in sport, two sport coaches with substantial experience in anti-doping protocols, and two professional athletes who were personally involved in anti-doping procedures. After the preliminary consultations, the panel agreed that the intended measurement tool should include questions on: (i) the athletes' obligations and rights with regard to anti-doping rules, and (ii) legal procedures for anti-doping testing. In the subsequent phase, the authors of the study proposed 20 questions on targeted topics (10 questions for each topic). The experts involved in the panel were asked to rank the questions in each topic from the most to the least suitable, considering (i) comprehensibility of the question, (ii) importance of the question for overall anti-doping regulations, and (iii) applicability of the question to both genders (i.e., some legal issues are exclusively characteristic for males/females while we intended to develop questionnaire that will be equally applicable to both male and female athletes). This procedure allowed us to construct a questionnaire in which the content was validated to ensure it was appropriate (e.g., have proper content validity).

The initial/longer version of Q-LADR consisted of 20 "statements", and the participants had to indicate whether the statement was correct or not. The response of "not sure" was also provided. Each correct response was scored as "1", and "0" otherwise, and the result was expressed as the sum of scores for each participant. After checking the reliability and factor validity of the questionnaire (please see proceeding sections for details of the analyses and results), the total number of questions was reduced to 10. Consequently, the final results ranged from "0" (e.g., if participant did not correctly respond to any of the questions) to "10" (all correct answers).

2.3. Statistics

In the first phase, we checked the reliability and validity of the Q-LADR. For the purpose of evaluating the reliability, Cohen's kappa coefficient (kappa) and the percentage of equally responded queries were calculated. These analyses were conducted on the results of those participants who were tested through a test–retest procedure. Kappa values were interpreted as slight = 0.00–0.20, fair = 0.21–0.40, moderate = 0.41–0.60, substantial = 0.61–0.80, and almost perfect = 0.81–1.00, and p0 $\geq$ 80% was considered as acceptable. A percentage of equally responded queries of >80% was considered as acceptable.

Using the Q-LADR results of the total sample, the factor analysis using varimax rotation and Gutman Kaiser criterion of extraction was applied to check the factorial validity of the Q-LADR. This analysis identified the latent dimensions of the questionnaire and the questions related to each latent dimension. Consequently, it allowed us to reduce the number of questions for each latent dimension. After reducing the number of questions and calculating the final result of the Q-LADR for each participant, the distribution normality was checked using the Kolmogorov–Smirnov test.

The differences between genders in the Q-LADR were calculated according to the *t*-test for independent samples. One-way analysis of variance was used to evidence the differences among sports in the Q-LADR.

After checking the normality of the distributions, Spearman's rank order correlation was calculated to establish the associations between variables. Finally, multinomial logistic regression analysis was conducted to evidence the association between all variables, including Q-LADR, and criterion, namely, categorized scores of athletes' potential doping behavior (negative–neutral–positive attitudes; please see Variables subsection for details). The correlation analyses were gender-stratified.

Statistica version 13.5 (Tibco Inc., Palo Alto, CA, USA) was used for all analyses, and a *p*-level of 95% was applied.

3. Results

The kappa coefficient of 0.65 indicated the Q-LADR as substantially reliable. The average percentage of the equally responded queries of 84% additionally confirmed the satisfactory consistency of the measurement across the test and retest procedure. However, it appears that the consistency of the responses differed across different questions/statements. More precisely, a relatively lower consistency was observed for questions/statements No6, No13, and No16 (70–75%), while the greatest consistency was observed for statements No14 and No20 (>96% of the equally responded queries).

Factor analysis with consecutive varimax rotation evidenced three independent latent dimensions, with the first two being easily interpretable. The first latent dimension (F1) was mostly saturated with high correlations of questions/statements about the anti-doping testing protocol (No10, No12; No17, No18, and No19), where athletes were asked about procedural details and the specifics of anti-doping testing legislatives. The questions/statements concerning the athletes' rights and obligations considering WADC were mostly correlated with second significant latent dimension (F2). Namely, the highest correlations with F2 were identified for questions No2, No5, No6, No9, and No20. The third latent dimension (F3) correlated with several questions, but the structure was not clear and therefore not interpreted. From the factor analysis results, it is evident that certain questions/statements are not strongly correlated with any of the extracted factors. For example, question No1 was equally correlated with F1 and F2, and this is also evident for some other queries (i.e., No4). As a result, the set of questions finally included in the Q-LADR consisted of 10 questions; 5 items that were highly correlated with F1 (No10, No12; No17, No18, and No19) and 5 that had the highest correlations with F2 (No2, No5, No6, No9, and No20) (Table 1).

Table 1. Factor analysis results for original (longer) version of the Q-LADR.

	F1	F2	F3
The list of prohibited substances is published by WADA (World Anti-Doping Agency) at least once a year. [P]	0.41	0.32	0.11
Within one year, an athlete can be tested an unlimited number of times. [A]	0.31	0.69	0.23
The burden of proving a violation of anti-doping rules rests with the athlete. [A]	0.37	0.22	0.11
An athlete who is in the group designated for testing can fail to submit their location data 3 times in a period of 12 months without sanction. [A]	0.41	0.32	0.06
The athlete who is in the group designated for testing is obliged to send information about the location for each day in the period for the next 3 months. [A]	0.20	0.71	0.03
An athlete can refuse to provide a sample to the organization responsible for testing if he believes that the organization that will test him has political or other prejudices about him (for example, organizations from countries that have political conflicts with the athlete's country). [A]	–0.03	0.61	0.27
The athlete must request a therapeutic exemption if he is forced to take a drug that is on the List of Prohibited Substances. [A]	0.12	0.12	0.24
A therapeutic exemption can be requested retroactively, but before the testing is conducted. [A]	0.09	0.18	0.12
The doping control officer must inform the athlete several hours before he will come to test him. [P]	0.04	0.78	0.15
The doping control officer can take a urine and blood sample from the athlete. [P]	0.79	0.23	0.15
When giving a urine sample, the athlete chooses the container to collect the sample himself. [P]	0.15	0.31	0.09
Samples can be stored and reanalyzed over a period of 10 years. [P]	0.71	0.21	0.22
During the period of ineligibility, the athlete is still subject to testing. [P]	0.12	0.01	0.34
If the A sample is positive, the athlete has the right to request the B sample's analysis. [A]	0.37	0.08	0.03
A temporary suspension is mandatory if the A sample is positive. [P]	0.67	0.10	0.50
The athlete may be present during the opening and analysis of the B sample. [A]	0.58	0.02	0.44
If the analysis of sample B does not confirm the analysis of sample A, the test will be considered negative. [P]	0.70	0.05	0.34
An appeal can be filed against a decision on a violation of anti-doping rules. [P]	0.73	–0.12	0.16
If an athlete is found guilty of violating anti-doping rules, the fact will be made public. [P]	0.78	0.22	0.04
An athlete who voluntarily admits to having violated an anti-doping rule before receiving notification of the violation may have his or her suspension period shortened. [A]	0.45	0.73	–0.15
Explained Variance	4.57	3.06	1.51
Proportion Total	0.23	0.15	0.08

Legend: [A] specify the questions initially considered to be related to athletes' obligations/rights in anti-doping testing, [P] specify the questions initially considered to be related to anti-doping protocol, F—factor structure (correlations with variables).

The *t*-test for independent samples identified significant differences in Q-LADR between genders (Figure 1A), with higher test scores for males (*t*-test = 9.55, $p < 0.001$). Differences among sports in Q-LADR (Figure 1B) were not significant (F-test = 0.72, $p = 0.73$).

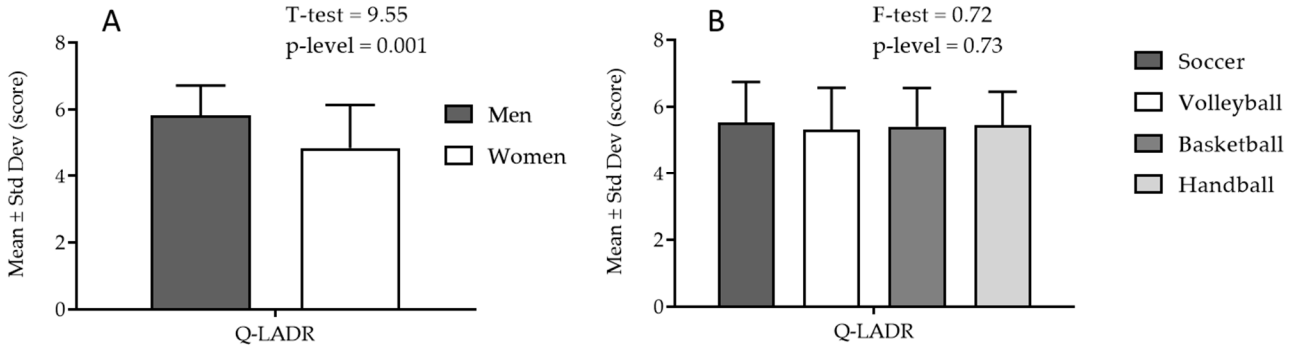


Figure 1. Differences in Q-LADR between genders (**A**) and among sports (**B**).

The correlations among the study variables are presented in Table 2. Apart from logical correlations (i.e., correlations between athletes' age and sport experience, sport success, and age), some interesting associations noting the specific correlations between study variables and Q-LADR scores were presented. For men, the older athletes and those who achieved

greater sport success had higher Q-LADR scores. Furthermore, better sport success was correlated with personal opinions about the necessity for more rigid penalties for doping offenders in both men and women. Moreover, Q-LADR was correlated with the number of doping tests in both men and women, with better Q-LADR scores for those athletes who frequently participated in doping tests. For women, sport success and experience were significantly positively correlated with Q-LADR.

Table 2. Correlations between study variables (* denotes significance of $p < 0.005$).

	Age	Sport Experience	Sport Achievement	Doping Testing	Doping Presence	Doping Penalties
MEN (n = 278)						
Sport experience	0.55 *					
Sport achievement	0.51 *	0.32 *				
Doping testing	0.19 *	0.08	0.08			
Doping presence	0.16 *	0.14 *	0.05	0.21 *		
Doping penalties	0.24 *	−0.11	0.42 *	−0.15 *	−0.11	
Q-LADR	0.38 *	0.16 *	0.38 *	0.41 *	0.35 *	−0.11
WOMEN (n = 179)						
Sport experience	0.61 *					
Sport achievement	0.25 *	0.23 *				
Doping testing	0.29 *	0.10	0.16 *			
Doping presence	−0.07	−0.24 *	−0.08	−0.05		
Doping penalties	0.06	0.05	0.50 *	−0.02	0.05	
Q-LADR	0.11	0.21 *	0.61 *	0.49 *	0.11	0.05

Among men, a higher likelihood for neutral (OR = 1.62, 95%CI: 1.21–2.03) and positive attitudes toward PDB (OR = 1.71, 95%CI: 1.11–2.22) was observed in the athletes who perceived their sport as being contaminated by doping. Additionally, men with positive PDBs were less likely to achieve high competitive results in sport (OR = 0.56, 95%CI: 0.35–1.90). Finally, a greater likelihood for positive PDB was evidenced in those who achieved lower scores for the Q-LADR (OR = 0.75, 95%CI: 0.5–0.96) (Figure 2).

The women who tended toward rigid penalties for doping offenders were less prone to neutral (OR = 0.81, 95%CI: 0.70–0.92) and positive (OR = 0.90, 95%CI: 0.80–0.98) PDBs. Better competitive results are correlated with a lower possibility for positive PDB (OR = 79, 95%CI: 0.60–0.92). In women, lower Q-LADR scores were correlated with neutral (OR = 0.88, 95%CI: 0.75–0.99) and positive (OR = 0.79, 95%CI: 0.60–0.92) PDBs (Figure 3).

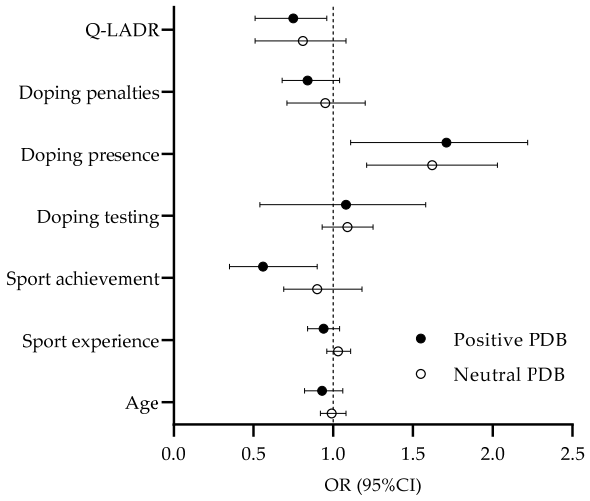


Figure 2. Multinomial logistic regression results for the criterion of potential doping behavior (PDB) in men, with negative PDB as reference value.

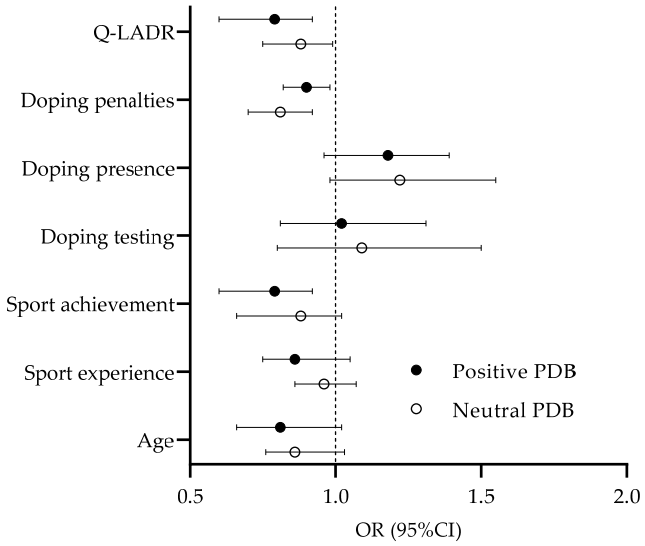


Figure 3. Multinomial logistic regression results for the criterion of potential doping behavior (PDB) in women, with negative PDB as reference value.

4. Discussion

This study aimed to assess the applicability of the newly develop questionnaire, Q-LADR, in evaluating the knowledge on legal issues of the anti-doping policy (LADR knowledge) in professional-team-sport athletes, and to investigate its gender-specific validity with regard to potential doping behavior. Apart from evidencing the sufficient reliability of the newly designed measurement tool, the results reveal several important observations. First, Q-LADR differentiated male and female athletes involved in team sports, with men demonstrating better knowledge. Second, Q-LADR was observed to be correlated with age in men, and the number of doping tests and sport success in men and women. Finally, Q-LADR was correlated with doping attitudes, with a generally lower likelihood for doping behavior in athletes who achieved higher Q-LADR scores. Therefore, our initial study hypothesis was confirmed.

4.1. Gender Differences in Q-LADR

One of the main ideas of this study was that doping problems and factors associated with doping problems in sport should be observed using a gender-specific approach. The differences in Q-LADR between men and women, where men achieved higher scores for Q-LADR, supported the use of such an approach. As the authors of this study, we are long-time professionals in sport studies and suggest that the a background of higher scores in men than women should be found in several practical reasons.

First, doping is more prevalent in male competitive sports, which is evident by simply observing the annual WADA reports [27]. Meanwhile, even in noncompetitive sports (i.e., recreational sport), doping is more prevalent in males than in females [28,29]. Altogether, this raises the interest in doping among men more than women, independently of whether they are involved in a competitive sport system or not. This altogether results in men being relatively better informed about doping than women.

Second, men are more involved in sport and persist in competitive sport for a longer period of time than women [30]. Indeed, gender is an indefinite position of inequality in sport [31]. Although this issue is partially related to the fact that sport is organized around the "discourses of hegemonic masculinity" [32], we cannot deny that there are also some "objective" reasons for the generally longer sport involvement of men in comparison to women. These "objective" reasons are as much biological (e.g., menstrual cycle is a significant burden for sport participation) as "ecological" (e.g., motherhood represents a much greater obligation than fatherhood) [33–35]. However, irrespective of the background, the average age of male athletes is regularly greater than the average age of female athletes

involved in the same sports, which altogether leads to the greater chance that "male society" in sport would be properly informed in any sports issues (including doping) than their female peers.

As a certain support system to the previous discussion, a short overview of the previous studies is important. In brief, studies have already examined gender differences in the knowledge of doping with interesting results. For example, in a study conducted on junior swimmers (<18 years of age), the authors evidenced an equal level of knowledge concerning doping issues in boys and girls [21]. Furthermore, a study conducted with team-sports players did not report differences between genders concerning doping knowledge [13]. However, in both studies, there was no difference in age between the male and female participants. Meanwhile, a study on senior tennis players where male players were older than the females evidenced a better knowledge of doping issues in males [20], clearly emphasizing the importance of experience in sport as a factor of influence on various doping-related factors. This issue was additionally discussed in the forthcoming text.

4.2. Correlates of Q-LADR

The knowledge of LADR was correlated with age, which actually additionally supports our previous discussion about the probable background of differences in Q-LADR between genders. It was clear that the overall time in which one was involved in sport reflected the opportunity to be informed about some specific sport issue. Studies, to date, have already confirmed the correlation between knowledge of doping with age in a gender-stratified study of tennis professionals, but also in a non-gender-stratified swimming study [20,21]. Therefore, we may say that our results are generally supportive of the previous findings and even previously offered explanations. In brief, older athletes have simply had more chances to familiarize themselves with the issue of interest (here being the legal regulations on doping), either from personal experience (i.e., more anti-doping testing) and/or by direct formal/non-formal learning.

That this correlation between Q-LADR and age was not established in women in our study (note that in a previously discussed study on tennis, the correlations between doping knowledge and age were established both for men and women) can be explained by the differences in the studied samples and sports characteristics [20]. In short, team sports are more "gender separated" than in tennis. In tennis, men's and women's tournaments are frequently organized simultaneously, while even training camps are organized for men and women at the same time [36]. At the same time, this is not the case for team sports, where men and women train and compete separately (with the exemption of the Olympics). This reduces the overall chance for information exchange between male and female colleagues, resulting in a significant association between age and Q-LADR, only in male-team-sports athletes.

Although we could not find a study where the problem of "exchange of information on doping" and its influence on the knowledge of doping was directly examined, the studies conducted so far indirectly support our previous discussion. Namely, investigations that focused on sources of information on doping problems in athletes regularly evidenced colleagues (peers) and coaches as the most important sources of knowledge on doping issues. This was repeatedly confirmed in various sports and athletes of a different competitive status [24,37–39]. Therefore, it was reasonable to conclude that the similar "mechanism" of influence exists, even for knowledge of LADR.

The correlation of Q-LADR with (i) the number of doping tests and (ii) sport achievements was significant for both men and women. These two associations were actually "confounding" (the chances for being tested for doping increased with sport success) and have already been presented in other studies [13], and we discussed this accordingly. As evident, most of the questions included in the final version of the Q-LADR went beyond "common knowledge" and directly incorporated information about strict legal regulations that have to be specifically learned. We may witness that in both of the countries we observed in this study, the information related to Q-LADR was rarely, if ever, systemati-

cally taught throughout the sport systems (by sport authorities, clubs, federations, etc.). Therefore, the "only" opportunity for athletes to increase their knowledge of these issues was to participate in anti-doping tests and directly acquire the knowledge in the real world. For example, if an athlete participated in anti-doping tests, they undoubtedly learned that "WADA officials must legitimize themselves before testing" and/or that "the doping control officer does not have to inform the athlete several hours before he will come to test him". Altogether, this explained the established correlations, but at the same time highlighted the vulnerability of younger athletes (both men and women) in violating anti-doping rules and regulations.

4.3. Q-LADR as a Factor Associated with Potential Doping Behavior

As noted in the Introduction, investigations have frequently examined the correlations of doping behavior/doping attitudes, but the knowledge on doping issues as a correlate of doping behavior has hardly been investigated [11,24,25]. There are several probable reasons for such a lack of studies on this problem. First, the world governing body for anti-doping in sport, WADA, as developed an accessible and applicable questionnaire ("Play true quiz"), which is freely available on the WADA website; this "measurement tool" was, however, evidently developed with the main intention of "educating" and not "testing", since the correct answers are indefinitely predictable and intuitive [40]. Therefore, the results obtained do not represent the examinee's knowledge, but rather the level of their intuition. Second, when investigators intend to develop an objective testing tool, they should respect specific sport/geographic/cultural issues and construct the questions accordingly. Therefore, if there is an intention to apply it in some other environment, the questionnaires should in most cases be adapted. Finally, the doping questionnaires developed to date, mostly focus on the health issues of doping (or at least comprised a significant proportion of questions related to health issues), and globally, there is a lack of precise information on the problem examined in the Q-LADR.

Despite some differences in the statistical significance, Q-LADR was correlated to the doping attitudes of both men and women, with less negative attitudes toward doping in athletes who achieved lower Q-LADR scores (have poorer knowledge of anti-doping legal regulations). This finding confirms the questionnaire's validity and supports our initial study hypothesis. However, for a more objective overview of the (predictive) validity of the questionnaire, additional correlations of doping attitudes (criterion) should be taken into account and discussed in parallel. A relatively consistent finding of wider knowledge of the legal regulations of doping among athletes with a negative tendency toward doping is not as straightforward as it may appear at first. Specifically, we must pay attention to our finding that greater sports achievements are also correlated with a lower tendency for doping, which is a known issue [13]. Therefore, it is possible that a certain degree of the correlation between Q-LADR and doping attitudes could be explained by confounding effects (e.g., intercorrelation between sport success and Q-LADR).

One can therefore argue that the Q-LADR score is a consequence of sport success (i.e., experience in sport and number of anti-doping tests an athlete was involved in) simply by confounding the statistical effect [41]. If this was the case, the Q-LADR itself would not represent a great significance with regard to doping-prevention efforts. However, it is important to note that neither the experience in sport or the number of doping tests were significantly related to doping attitudes in the multinomial logistic results. Therefore, the correlation of the Q-LADR and doping attitudes should be observed independently of the experience the athletes obtained throughout their time involved in sport and the number of anti-doping tests. From the perspective of anti-doping-prevention efforts, this is the most important finding. Putting the results together, we may conclude that those athletes who achieve better sport success and those who have higher Q-LADR scores are less prone to doping. However, sport success cannot be achieved overnight, and due to all the inevitable determinants (i.e., one's talent, conditions, coaching, finances, and sport luck) is only achievable for a small proportion of athletes. Meanwhile, a sufficient

level of knowledge of the legal issues of doping is attainable for all athletes and depends mostly (only?!) on: (i) an awareness of the necessity and (ii) the proper organization of the education.

4.4. Limitations and Strengths of the Study

The main limitation of this study was its cross-sectional nature. Therefore, we were unable to discuss the causality between the variables. However, this study primarily intended to explore the eventual importance of the legal issues of anti-doping regulations in sport and provide a base for future, more profound investigations of the problem. Second, we only observed athletes involved in team sports in two countries. Although we did this intentionally (please see Introduction and Methods Sections for details), there is no doubt that the presented findings are consequently generalizable only to similar samples. Moreover, the sample of variables did not include some variables that would certainly allow for a more comprehensive overview and more detailed discussion (i.e., familial variables, socioeconomic status, and educational level). However, we relied on the honesty of the participants, with testing conducted in small groups, and we tried to avoid any variables that could compromise the anonymity of the tested athletes.

This was one of the first studies to directly examine the knowledge of the legal issues of anti-doping regulations in sport while developing an original measurement tool for such a purpose. In addition, the fact that we investigated professional athletes involved in the most popular types of sport in southeastern Europe (e.g., team sports) was another important strength of the investigation. Finally, the analyses of the factors related to doping behavior were known to be relevant in developing targeted preventive campaigns against doping in sport; therefore, we hope that our study contributes to the body of knowledge on this important topic.

5. Conclusions

Our results confirm that female athletes are placed at a substantially higher risk of violating anti-doping rules because of being inadequately informed about anti-doping legal regulations they have to obey as competitive athletes. From the position of sport and legal authorities, this is irresponsible (at least), but we would rather call it discriminatory.

The study confirmed the reliability and applicability of the Q-LADR in senior-level professional-team-sports players from Croatia and Montenegro. However, it must be mentioned that the developed measurement tool was specifically designed for our countries, and it is possible that some questions will not be absolutely applicable to other countries. Therefore, in applying the Q-LADR in other countries, special attention should be placed on checking the proposed questions here and eventual modifications according to the current national laws.

Athletes who achieved better results in the Q-LADR were less prone to doping and it seems that the knowledge of anti-doping regulations could be effectively used in anti-doping efforts. Namely, we may theorize that the improvement of knowledge on legal issues about anti-doping would decrease the positive tendencies toward doping behavior among athletes. However, for a more elaborate conclusion, further intervention studies aimed at the improvement of knowledge regarding the legal issues of anti-doping regulations are needed.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data will be provided to all interested parties upon reasonable request.

Conflicts of Interest: The authors declare no conflict of interest.

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MEASURING LEGAL COMPETENCE IN ANTI-DOPING: RELIABILITY AND VALIDITY OF THE NOVEL MEASUREMENT TOOL AMONG ATHLETE SUPPORT PERSONNEL

MERJENJE PRAVNE KOMPETENTNOSTI NA PODROČJU ANTIDOPINGA: ZANESLJIVOST IN VELJAVNOST NOVEGA MERILNEGA ORODJA MED SPREMLJEVALNIM OSEBJEM ŠPORTNIKOV

ABSTRACT

Doping remains one of the most important problems in sports, but legal issues related to anti-doping are relatively understudied in this context, especially among athlete support personnel (ASP). This study aimed to evaluate the reliability and validity of a newly designed questionnaire aimed at evaluating antidoping legal knowledge among ASP. The participants included 211 ASP (coaches, medical professionals, nutritionists; 41.7±7. years of age, 71 females) from Croatia and Bosnia and Herzegovina, who were tested on a newly designed questionnaire on knowledge of legal anti-doping regulations for ASP (Q-LADR-ASP). Additionally, data on sociodemographic characteristics, sport-related factors, and doping-related factors were collected. In the first phase, a subsample of 56 participants was tested and retested on the Q-LADR-ASP in the time frame of 7-10 days to evaluate the reliability of the tool. Among the 20 original questionnaire items, 18 had appropriate test-retest reliability (Cohen's kappa > 0.61, absolute agreement > 80%). Factor analysis identified two distinct latent structures reflecting (i) rights and obligation under the anti-doping code and (ii) doping control process and legislation. The validity of the Q-LADR-ASP was confirmed by significant differences between medical staff and coaches/nutritionists (with higher scores in medical staff) and a significant correlation between the Q-LADR-ASP and sport-officiating level (Spearman's $R = 0.21$, $p < 0.05$) and between the Q-LADR-ASP and the number of doping tests of athletes officiated (Spearman's $R = 0.55$, $p < 0.05$). Considering its proper reliability and validity, Q-LADR-ASP can contribute to more effective anti-doping education, primarily by reducing unintentional rule violations. Further intervention studies are warranted.

Key words: performance enhancement, knowledge, sport law, anti-doping code

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IZVLEČEK

Doping ostaja eden najpomembnejših problemov v športu, vendar so pravna vprašanja, povezana z antidopingom, razmeroma slabo raziskana, zlasti med spremljevalnim osebjem športnikov (ASP). Namen te študije je bil oceniti zanesljivost in veljavnost vprašalnika za ocenjevanje pravnega znanja o antidopingu med ASP. V raziskavo je bilo vključenih 211 članov ASP (trenerji, zdravstveni delavci, nutricionisti; starost 41,7 ± 7 let, 71 žensk) iz Hrvaške ter Bosne in Hercegovine, ki so izpolnili na novo zasnovan vprašalnik o poznavanju pravnih antidopinških predpisov za ASP (Q-LADR-ASP). Poleg tega so bili zbrani podatki o sociodemografskih značilnostih, dejavnikih, povezanih s športom, in dejavnikih, povezanih z dopingom. V prvi fazi je bil podvzorec 56 udeležencev testiran in ponovno testiran z vprašalnikom Q-LADR-ASP v časovnem obdobju 7–10 dni, da bi ocenili zanesljivost orodja. Od prvotnih 20 postavk vprašalnika jih je 18 izkazalo ustrezno test-retest zanesljivost (Cohenov kappa > 0,61, absolutno ujemanje > 80 %). Faktorska analiza je identificirala dve ločeni latentni strukturi, ki odražata (i) pravice in obveznosti po antidopinškem kodeksu ter (ii) postopek dopinške kontrole in zakonodajo. Veljavnost vprašalnika Q-LADR-ASP je bila potrjena s statistično značilnimi razlikami med zdravstvenim osebjem in trenerji/nutricionisti (6,71 ± 1,79 in 4,21 ± 1,2 za zdravstveno osebje oziroma trenerje/nutricioniste; t-test = 8,71, $p < 0,01$) ter s statistično značilno korelacijo med Q-LADR-ASP in ravnjo sojenja v športu (Spearmanov $R = 0,21$, $p < 0,05$) ter med Q-LADR-ASP in številom dopinških testov športnikov, pri katerih so sodelovali (Spearmanov $R = 0,55$, $p < 0,05$). Glede na ustrezno zanesljivost in veljavnost lahko Q-LADR-ASP prispeva k učinkovitejšemu antidopinškemu izobraževanju, predvsem z zmanjševanjem nenamernih kršitev pravil. Potrebne so nadaljnje intervencijske študije.

Ključne besede: izboljšanje zmogljivosti, znanje, športno pravo, antidopinški kodeks

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INTRODUCTION

Athletes face constant pressure to succeed, often resulting in risky decisions that compromise fairness and ethics, including the use of illegal performance enhancers (doping) (Tahiraj et al., 2024). As a result, the use of doping continues to threaten the integrity of athletic competition and remains one of the most important and controversial challenges in modern sports despite the efforts of sporting organizations such as the World Anti-Doping Agency (WADA) (Kajtna et al., 2023; Liposek & Sekulic, 2024). While much of the discourse around doping focuses on health risks and individual responsibility, there is no doubt that the legal and regulatory dimensions are equally important (Blank et al., 2021; Stankovic, Sinkovic, Sekulic et al., 2022). These aspects involve complex questions of accountability, procedural fairness, and the harmonization of rules across international jurisdictions. Therefore, understanding the legal issues of antidoping efforts is essential for ensuring that sanctions are not only effective but also fair (Haas & Healey, 2016).

Importantly, anti-doping regulations often intersect with national and international legal frameworks, raising questions about due processes, athletes' rights, and procedural justice (Di Giandomenico, 2023). The issue is even more complicated given the unclear responsibilities among support personnel and the varying national legislation (Ruwuya et al., 2025). The existing preventive initiatives primarily target athletes, but much less is known about how well athlete support personel (i.e. coaches, physicians involved in sport) understand the legal obligations and risks associated with anti-doping violations. Preliminary observations and anecdotal reports suggest that this group may not always be adequately informed, but empirical data on this matter remain limited (Stankovic et al., 2022). This gap in knowledge represents a significant blind spot in anti-doping policy and education, warranting focused research and assessment.

Assessing awareness of legal frameworks presents a specific and highly complex challenge. In the realm of anti-doping policy, legal knowledge extends beyond familiarity with banned substances to include concepts such as strict liability, due processes, procedural fairness, and the roles of various institutions (Stankovic et al., 2022). Unlike attitudes or beliefs, legal knowledge of antidoping should be measured in comparison with established standards and regulations. However, there is currently no universally accepted tool or methodology for objectively assessing this kind of knowledge among sport officials. For athlete support personnel (ASP) understanding the legal aspects of anti-doping is critical, as they are known to

have enormous influence on athletes; therefore, their approach could be directly transferred to athletes' behavior and actions (Barnes et al., 2022; Sekulic et al., 2016).

A measurement tool focused specifically on legal aspects of anti-doping policy was recently developed and tested among athletes, offering a structured and objective approach to evaluating their knowledge in this area (Stankovic et al., 2022). The findings from that study highlighted both knowledge gaps and the potential for targeted legal education in sport. Building on that foundation, the present study aims to adapt and refine the tool developed and validated for athletes for use among ASP, including coaches, physicians, and other support personnel. The primary objective was to evaluate the reliability and validity of this adapted instrument in a new professional context. By doing so, the study seeks to contribute to a more comprehensive understanding of legal knowledge in anti-doping and support the development of more effective education and compliance strategies across all levels of sport governance. Initially, we (first) hypothesized that an adapted measurement tool aimed at evaluating the antidoping legal knowledge of ASP would be of appropriate reliability. Second, we hypothesized that the measurement tool would have sufficient criterion validity.

METHODS

Participants and study design

The participants were ASP from Croatia and Bosnia and Herzegovina (n = 211; 71 females; 41.1±7.8 years of age). These two countries were intentionally selected for the study because of the similarity of the spoken language, while proper understanding of the questions asked (please see later for details) was crucial for the evaluation of the metrics of the applied measurement tool. All the participants had been involved in sports as ASP for more than three years. The majority of them were coaches (head coaches, assistant coaches, and fitness coaches, n = 156, 32 females, 45.1±9.1 years of age), followed by medical professionals (medical doctors and physiotherapists, n = 49, 25 females, 35.8±4.8 years of age), and nutritionists (n = 6, 4 women, 25.9±2.3 years of age).

The participants were invited by the governing national sport federations. In the first phase, the sport federations from Croatia, Bosnia and Herzegovina were invited to participate, and those who responded positively were asked for contacts of representatives for each sport. In the second phase, representatives were contacted directly and asked to make connections with ASP.

In the third phase, ASP were contacted directly and asked to join the study. From the 278 ASP who were contacted throughout the 3rd phase (please see previously), the results of the 211 participants are presented in this study. However, for the purpose of evaluating the test-retest reliability of the measurement tool, the subsample consisting of 56 participants (20 females) responded to the questionnaire twice throughout the test-retest procedure, within the time frame of 7-10 days. The study was approved by the Ethics Committee of University of Zagreb, Faculty of Kinesiology (30/2025, 6th May 2025). The timeline of the research with phases is presented in Figure 1.

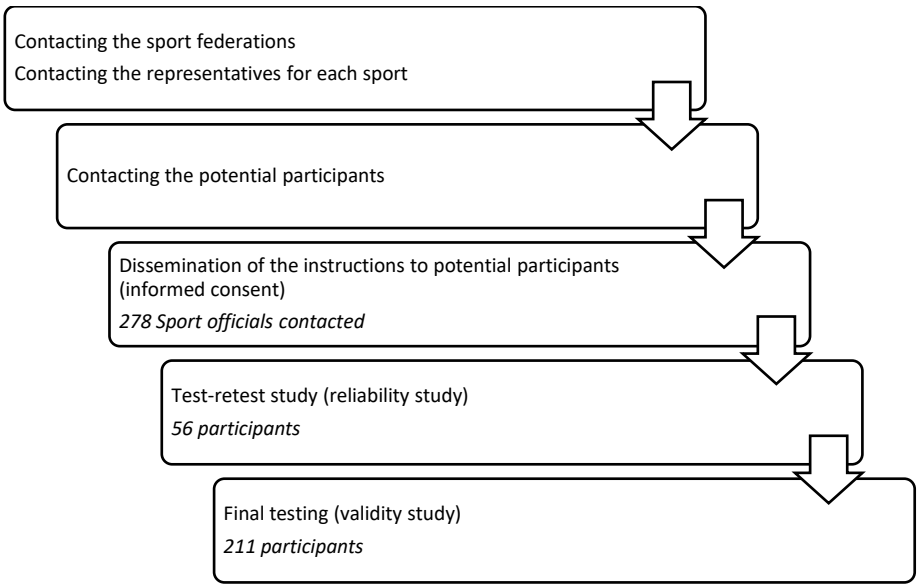


Figure 1. Study design and timeline.

Variables

The variables in this study included sociodemographic factors, sport factors, doping-related factors, and variables derived through a newly developed questionnaire on knowledge of legal anti-doping regulations for ASP (Q-LADR-ASP).

Data were collected through a custom-designed digital platform. The participants completed the digital version of the questionnaire via their own devices (i.e., cell phones, tablets, and/or computers). Participation was anonymous, and all individuals were informed of their right to decline participation or skip individual questions or the entire survey. To enable tracking for the test–retest reliability analysis, participants in that subgroup used a self-selected identification code. The overall response rate exceeded 95%.

The sociodemographic variables used in this study were gender (male–female–other), age (in years), and educational level (elementary school–high school–college/university degree). The

main factors observed were type of ASP in sport (coach – medical professional (medical doctor, physiotherapist) – nutritionist – other), highest level of sport being involved (youth national level – youth international level - senior national level – senior international level – national team), and time of involvement in sport as ASP (< 2 years; 3–5 years; 6-10 years; > 10 years).

Doping factors included variables asking participants about their personal opinion on the presence of doping in sport (not present—doping is rare—doping is common—doping is regular), opinion about penalties for offenders of anti-doping regulations (I do not think they should be punished—financial penalty—first time milder punishment and then exclusion from sport/competition for a couple of seasons—exclusion from sport for a couple of seasons—lifelong exclusion from sport), number of anti-doping tests the athletes had under their support (none—one—two-to-three—more than three), and likelihood of suggesting doping to athletes (No—I do not know/not sure—I consider suggesting doping if there are no side effects—I consider). Later, for the purpose of calculating logistic regression (please see later on Statistics), the likelihood of suggesting doping to athletes was observed as a criterion and categorized as "negative attitude toward doping behavior" (first response) – numerated as "0", vs. "neutral/positive attitude" (remaining responses) – numerated as "1".

The Q-LADR-ASP was designed and developed throughout several phases on the basis of a previously validated questionnaire aimed at evaluating similar knowledge in athletes (Stankovic et al., 2022). The original athlete-centered measurement tool was developed by six experts (two professional athletes, two sport coaches, and two experts in sport law), meaning that medical professionals were not involved in the development of the original questionnaire. Therefore, to reevaluate the questionnaire, in this study, we consulted two additional medical doctors, who were officials of the National Anti-doping agencies of Croatia and Bosnia and Herzegovina. They personally re-evaluated the original questionnaire and suggested certain changes that were implemented. Mainly, some questions from the original questionnaire were specifically athlete-centered, and amendments were necessary due to the specificity of testing ASP. As a result, the first version of the Q-LADR-ASP included 20 questions roughly divided into 10 questions targeting (i) obligations and rights with regard to anti-doping rules and (ii) legal procedures for anti-doping testing. Each question was in closed end-statement form, and participants had to answer whether the statement was "true" or "false" (i.e., the burden of proving a violation of anti-doping rules rests with the athlete—TRUE). The response "not sure" was also provided. The correct participants' responses were given one point; otherwise, they were given zero points. The final version of the Q-LADR-ASP was reduced to 10 items (please

see Results for details), with a theoretical scale from 0-10 (see Results for specific questions, please).

Statistics

After the analysis of the normality of distributions, which was performed via the Kolmogorov–Smirnov test, the descriptive statistics included calculations of counts (frequencies) and percentages for variables that did not meet the normality assumption. Means and standard deviations were calculated for normally distributed variables (age and Q-LADR-ASP).

To evaluate the reliability of the Q-LADR-ASP, we applied Cohen's kappa coefficient and calculated the percentage of identical responses across a test–retest procedure conducted with a subsample of 56 participants (please see previously for details on the participants involved in the reliability study). Kappa values were interpreted via standard benchmarks (slight: 0.00–0.20; fair: 0.21–0.40; moderate: 0.41–0.60; substantial: 0.61–0.80; almost perfect: 0.81–1.00), and a response consistency of ≥80% was considered acceptable.

To identify the factorial validity of the questionnaire items, we conducted factor analysis via varimax rotation and the Guttman–Kaiser criterion. This analysis was performed on a total sample of tested ASP (n = 211), helped identify underlying dimensions within the legal knowledge domain and allowed for refinement and reduction of questionnaire items for each factor. Following item reduction (please see Results for details), the final Q-LADR-ASP scores were computed for each participant.

To explore criterion validity, we applied the following statistical procedures. First, independent samples t-tests were conducted to examine differences (a) between genders and (b) between medical professionals (medical doctors and physiotherapists) and other ASP (coaches and nutritionists) in the Q-LADR-ASP. Next, associations between variables were assessed via Spearman's rank–order correlation. Finally, logistic regression was used to examine the relationships between the study variables, including Q-LADR-ASP, and categorized attitudes toward doping (negative vs. neutral/positive), as described in the Variables subsection.

Statistica version 13.5 (Tibco Inc, Palo Alto, CA, USA) was used for all calculations and p-level of 0.05 was applied.

RESULTS

The characteristics of the sample of participants are presented in Table 1. A significant proportion of observed ASP were involved in sports at the highest level (i.e., ASP of national teams and/or senior teams/athletes at the international level). With respect to the study aim, it should be noted that some of the participants did not have any experience with doping control proccess during their ASP careers. Additionally, all medical professionals and nutritionists declared strictly negative opinions about the likelihood of suggesting doping to athletes, whereas some coaches declared a neutral/positive doping tendency.

Table 1. Characteristics of the study sample and descriptive statistics for the study variables.

	Medical professionals (n = 49)		**Coaches (n = 156)**		**Nutritionists (n = 6)**	
	F	**%**	**F**	**%**	**F**	**%**
Educational level						
Elementary school	0	0.00	1	0.64	0	0.00
High school	0	0.00	41	26.28	0	0.00
College/University degree	49	100.00	114	73.08	6	100.00
Missing	0	0.00	0	0.00	0	0.00
Experience in sport as ASP						
< 2 years	3	6.12	31	19.87	1	16.67
3-5 years	10	20.41	56	35.90	3	50.00
6-10 years	29	59.18	22	14.10	2	33.33
> 10 years	5	10.20	42	26.92	0	0.00
Missing	2	4.08	5	3.21	0	0.00
ASP sport-level						
Youth national level	2	4.08	10	6.41	0	0.00
Youth international level	5	10.20	24	15.38	1	16.67
Senior national level	21	42.86	39	25.00	1	16.67
Senior international level	10	20.41	61	39.10	2	33.33
National team	10	20.41	20	12.82	2	33.33
Missing	1	2.04	2	1.28	0	0.00
Participation in anti-doping testing (doping control processs) as ASP						
None	5	10.20	45	28.85	3	50.00
Once	21	42.86	56	35.90	3	50.00
2-3 times	10	20.41	39	25.00	0	0.00
> 3 times	11	22.45	11	7.05	0	0.00
Missing	2	4.08	5	3.21	0	0.00

Doping presence in sport where involved as ASP						
Not present	13	26.53	10	6.41	1	16.67
Doping is rare	22	44.90	86	55.13	2	33.33
Doping is common	11	22.45	44	28.21	2	33.33
Doping is regular	0	0.00	11	7.05	0	0.00
Missing	3	6.12	5	3.21	1	16.67
Self opinion on penalties for anti-doping rule violations						
No penalty	0	0.00	4	2.56	0	0.00
Financial penalty	4	8.16	35	22.44	1	16.67
First time milder punishment	30	61.22	78	50.00	2	33.33
Lifelong ban of sport participation	10	20.41	33	21.15	2	33.33
Missing	5	10.20	6	3.85	1	16.67
Likelihood of suggesting doping to athletes						
No	49	100.00	119	76.28	6	100.00
Do not know (not sure)	0	0.00	23	14.74	0	0.00
I'd consider if there will be no health hazard	0	0.00	10	6.41	0	0.00
I'd consider	0	0.00	0	0.00	0	0.00
Missing	0	0.00	4	2.56	0	0.00

The kappa coefficient of 0.56 indicated that the Q-LADR-ASP demonstrated moderate reliability. When the reliability was assessed by the percentage of equally responded answers, the average value of 75% confirmed insufficient consistency across the test–retest procedures. While most of the items showed relatively good stability, the low percentage of absolute agreement was evident for two questions, namely, “The athlete must request a therapeutic use exemption if he is forced to take a drug that is on the List of Prohibited Substances” (34% of the equal responses) and “If the analysis of sample B does not confirm the analysis of sample A, the test will be considered negative” (37% of the identical responses). When these two items were excluded from the questionnaire and reliability coefficients were recalculated, the kappa coefficient increased to 0.61, with 82% of the respondents being equal, confirming the substantial reliability of the 18-item questionnaire.

Factor analysis with varimax rotation retained two significant independent latent dimensions (Table 2). The first dimension (F1) reflected knowledge of athletes’ rights and obligations under the World Anti-Doping Code (WADC), with the highest correlations found for items Q2, Q3, Q4, Q5 and Q18. The second dimension (F2) was defined primarily by strong loadings of items related to doping control process procedures and legislative details (Q1, Q5; Q8, Q9, and Q16). On the basis of these results, the final version of the Q-LADR-ASP included 10 items: the five

most strongly associated with F1 (Q2, Q3, Q4, Q5 and Q18) and the five most strongly associated with F2 (Q1, Q5; Q8, Q9, and Q16). Specifically, the final Q-LADR-ASP consisted of questions: (i) Within one year, an athlete can be tested an unlimited number of times; (ii) The burden of proving a violation of anti-doping rules rests with the athlete, and not ASP (coaches, medical stuff, etc.); (iii) An athlete who is in the group designated for testing can fail to submit their location data 3 times in a period of 12 months without sanction; (iv) The athlete who is in the group designated for testing is obliged to send information about the location for each day in the period of the next 3 months; (v) An athlete who voluntarily admits to having violated an anti-doping rule before receiving notification of the violation may have his or her suspension period shortened; (vi) The list of prohibited substances is published by WADA (world anti-doping agency) at least once a year; (vii) The athlete who is in the group designated for testing is obliged to send information about the location for each day in the period of the next 3 months, (viii) The doping control officer must inform the athlete several hours before he will come to test him; (ix) The doping control officer can take a urine and blood sample from the athlete; (x) An appeal can be filed against a decision on a violation of anti-doping rules.

Table 2. Exploratory factor analysis with varimax rotation – identification of the latent structure of the developed questionnaire.

	F1	**F2**
Q1: The list of prohibited substances is published by WADA (world anti-doping agency) at least once a year.	0.41	0.75
Q2: Within one year, an athlete can be tested an unlimited number of times.	0.71	0.11
Q3: The burden of proving a violation of anti-doping rules rests with the athlete, and not ASP (coaches, medical stuff, etc.).	0.68	0.05
Q4: An athlete who is in the group designated for testing can fail to submit their location data 3 times in a period of 12 months without sanction.	0.60	-0.11
Q5: The athlete who is in the group designated for testing is obliged to send information about the location for each day in the period of the next 3 months.	0.20	0.71
Q6: An athlete can refuse to give a sample to the organization responsible for testing if he believes that the organization that will test him has political or other prejudices about him (for example, organizations from countries that have political conflicts with the athlete's country).	0.51	0.29
Q7: A therapeutic exemption can be requested retroactively, but before the testing is carried out.	0.55	0.05
Q8: The doping control officer must inform the athlete several hours before he will come to test him.	0.04	0.77
Q9: The doping control officer can take a urine and blood sample from the athlete.	0.06	0.80
Q10: When giving a urine sample, the athlete chooses the container to collect the sample himself.	0.11	0.28
Q11: Samples can be stored and reanalyzed over a period of 10 years.	0.08	0.45
Q12: During the period of ineligibility, the athlete is still subject to testing.	0.44	0.05

Q13: If the A sample is positive, the athlete has the right to request the B sample analysis.	0.59	0.38
Q14: A temporary suspension is mandatory if the A sample is positive.	0.44	0.39
Q15: The athlete may be present during the opening and analysis of the B sample.	0.61	0.02
Q16: An appeal can be filed against a decision on a violation of anti-doping rules.	-0.05	0.81
Q17: If an athlete is found guilty of violating anti-doping rules, that fact will be made public.	0.11	0.18
Q18: An athlete who voluntarily admits to having violated an anti-doping rule before receiving notification of the violation may have his or her suspension period shortened.	0.71	0.02
Explained Variance	3.74	3.68
Proportion Total	0.20	0.20

Figure 2 presents descriptive statistics and differences between groups in terms of Q-LADR-ASP. In brief, no significant difference was found between male and female ASP in terms of Q-LADR-ASP (t test = 0.32, p = 0.75) (Figure 2A). Moreover, when "medical staff" was compared with "other ASP" (coaches and nutritionists), medical staff achieved better results on the Q-LADR-ASP (6.71 ±1.79 and 4.21 ± 1.2 for medical staff and others, respectively; t test = 8.71, p < 0.01) (Figure 2B).

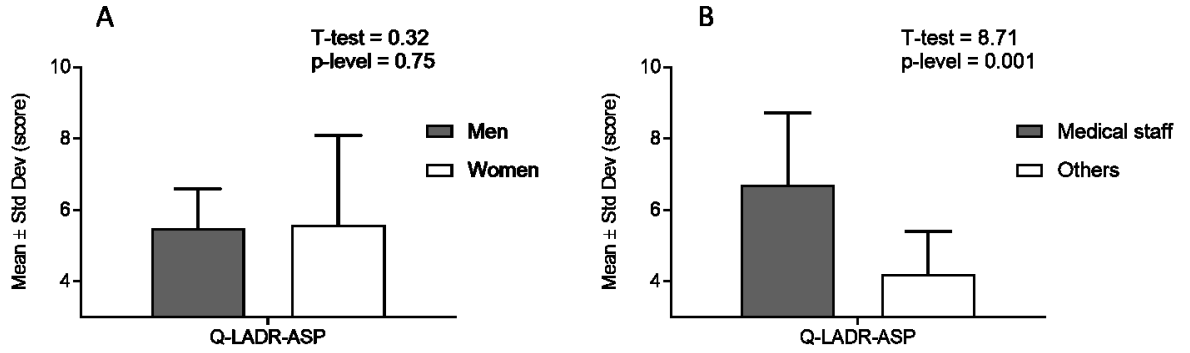


Figure 2. Descriptive statistics and t test differences between genders (Figure 2A) and between medical professionals and other ASP in terms of knowledge of legal ant-doping regulations (Q-LADR-ASP).

The associations between the study variables are presented in Table 2. In addition to the expected significant positive correlations (i.e., older ASP were more involved in higher-rank competition and had more experience in anti-doping testing), the Q-LADR-ASP result was positively associated with age (R = 0.30, p < 0.05), educational level (R = 0.51, p < 0.05), ASP sport-level (R = 0.55, p < 0.05), and number of doping tests of athletes (R = 0.21, p < 0.05).

Table 2. Pearson's correlations between study variables (* indicates statistical significance of $p < 0.05$).

	Age	**Educational level**	**Sport ASP experience**	**Sport ASP level**	**Doping testing**	**Doping presence**	**Doping penalties**
Educational level	0.71*						
Sport ASP experience	0.59*						
Sport ASP level	0.57*	0.48*	0.52*				
Doping testing	0.19*	0.61*	0.11	0.69*			
Doping presence	0.11	-0.17*	0.10	-0.01	0.35*		
Doping penalties	0.24*	0.41*	-0.11	0.31*	-0.10	-0.18*	
Q-LADR-ASP	0.30*	0.51*	0.09	0.55*	0.21*	0.04	-0.10

Notes. Q-LADR-ASP – questionnaire on knowledge of legal anti-doping regulations for athlete supporting personnel (ASP).

The results of the logistic regressions for the criterion "likelihood of suggesting doping to athletes" are presented in Table 3. Those ASPs who were convinced of the presence of doping in sports were more likely to lean toward neutral/positive personal tendencies and toward suggesting doping to athletes (OR = 1.21, 95% CI: 1.02-1.51). No significant associations between the other study variables and the criteria were found. Specifically, the Q-LADR-ASP was not significantly associated with the criterion variable (OR = 1.11, 95% CI: 0.74-1.55).

Table 3. Logistic regression results for the binarized criterion "likelihood of suggesting doping to athletes".

	OR	95%CI
Age ^{int}	0.99	0.56-1.61
Male gender	1.01	0.80-1.25
Educational level ^{int}	0.66	0.22-1.01
Sport ASP level ^{int}	0.81	0.55-1.15
Sport ASP experience ^{int}	0.91	0.21-1.84
Doping presence in sport ^{int}	1.21	1.02-1.51
Penalties for doping ^{int}	0.65	0.25-1.01
Anti-doping testing (doping control processes) during ASP career ^{int}	1.01	0.45-1.66
Q-LADR-ASP ^{int}	1.11	0.74-1.55

Notes. OR – Odds Ratio, 95%CI: 95% Confidence Interval, int - variables considered as interval for the purpose of logistic regression calculation, Q-LADR-ASP – questionnaire on knowledge of legal anti-doping regulations for athlete supporting personnel (ASP).

DISCUSSION

There are several important findings with regard to study aims First, the reliability of the newly developed Q-LADR-ASP is acceptable after some questions that were included in the first version of the measurement tool were excluded because of low reproducibility. Second, the factor validity of the questionnaire was found to be appropriate. Third, the criterion-related validity of the Q-LADR-ASP was confirmed, revealing (i) better knowledge of legal issues related to anti-doping policy among medical professionals than among coaches and sport nutritionists and (ii) a positive correlation between the competitive sport level at which ASP are involved and the results they achieved at Q-LADR-ASP. Therefore, both of our study hypotheses can be accepted.

Reliability

Although most of the questions included in the Q-LADR-ASP showed proper stability across testing and retesting, two queries were considered unstable, one of which was related to therapeutic use exemptions (TUEs). The item in question stated that “the athlete must request a TUE if he is forced to take a drug that is on the List of Prohibited Substances.” Authors of the study are of the opinion that the low reliability of this question appears to stem primarily from its wording. Specifically, the use of the phrase “must request” may have created confusion among participants, as the actual regulatory framework provides athletes with the possibility of applying for a TUE rather than imposing an absolute requirement. In practice, an athlete is not obliged to request a TUE, but this is strongly advisable if he intend to avoid potential sanctions in the event of a positive test (David, 2017). This subtle but important distinction between obligation and opportunity may have been misinterpreted, particularly by participants unfamiliar with the precise legal terminology used in anti-doping regulations.

The problem of inaccurate wording is not novel in questionnaire design, and authors have suggested that differences in question wording can create significant differences in responses (Brener et al., 2004; Glassman et al., 2023). Our results therefore highlight how small variations in wording can significantly affect comprehension and response consistency, especially in populations such as those participants who may not have direct experience with TUE

procedures (note that some of the tested participants had zero experience with anti-doping testing). This finding also suggests that legal knowledge tests must carefully balance accuracy with clarity, ensuring that questionnaire items should avoid ambiguous phrasing that can be interpreted in multiple ways. As a result, for future use, the item should be reformulated to better reflect the conditional nature of TUE applications, for example, by replacing "must" with "can" or "has the option to" (i.e., "If an athlete must take a substance that is on the Prohibited List, he/she can apply for a TUE to use it lawfully in sport.") Such adjustment would not only increase reliability but also be closer to the true nature of anti-doping policy.

The second item that showed poor reliability was the following statement: "If the analysis of sample B does not confirm the analysis of sample A, the test will be considered negative." Interestingly, this question attracted considerable attention from participants, many of whom reported being unfamiliar with the specific procedure. As a result, some participants actively sought information about the "A and B sample" analysis process between the test and retest, although they were initially informed to avoid informing themselves between testing trials. To further understand this phenomenon, we directly interviewed some of the participants whose answers had changed, and they confirmed that they had informed themselves about the A/B sample procedure in the interval between test and retest. Consequently, their responses shifted from incorrect in the first test to correct in the retest, producing an apparent inconsistency in reliability.

As with the previously discussed "inaccuracy" of the asked question, the problem of "learning" and consequent influence on reliability is also known in the literature, although closed-ended questionnaires such as the one we developed here showed better stability than questionnaires based on open-ended questions did (Gilkison et al., 1992; Schlademann, et al., 2008). This pattern does not necessarily reflect a weakness in the questionnaire itself but rather illustrates the effect of learning between measurement points. In the context of knowledge assessment, particularly on legal and procedural issues, such learning effects are expected when participants are motivated to clarify concepts, which they previously found confusing. However, methodologically speaking, this phenomenon can artificially lower statistical indicators of test–retest reliability. In this case, the increased accuracy of the responses at the retest may even be interpreted as evidence of the questionnaire's educational value.

A central question arising from previous findings is whether the item should truly be considered "nonreliable" or whether the first test result should be accepted as the correct measure of

knowledge. In classical test–retest methodology, inconsistency across time is usually interpreted as measurement error (Guttman, 1945). However, in the case of knowledge tests, discrepancies may instead reflect genuine learning that occurred between testing sessions. As mentioned previously, our follow-up interviews confirmed that participants actively sought out information about the A/B sample procedure, which suggests that the change in responses was not random but rather the result of increased understanding. In other words, the evidenced instability of an item does not necessarily undermine its reliability. One possible approach is to acknowledge the item's sensitivity to "learning effects" while still considering the test answers (e.g., before learning) as a reflection of participants' true knowledge. Thus, rather than excluding the item as nonreliable, it may be more appropriate to treat it as a valid but highly educative question whose reliability is context dependent. Nevertheless, in this study, the item was not included in further analyses because of low reliability coefficients.

Validity

The factor analysis conducted on the set of 18 reliable items produced two clearly distinguishable and interpretable factors. The first factor was saturated with items related to athletes' obligations and rights within the anti-doping system, whereas the second factor primarily encompassed items related to procedural aspects of the anti-doping protocol. This outcome aligns closely with our initial conceptual framework, in which we anticipated that knowledge in this domain could be meaningfully divided into these two dimensions. Specifically, we assumed that one set of questions would capture the legal and regulatory obligations of athletes, including issues such as responsibility, liability, and the right to a fair process. Furthermore, we theorized that another set would reflect a procedural understanding of testing and adjudication. The empirical confirmation of this structure strengthens the construct validity of the questionnaire and suggests that respondents indeed differentiate between these two domains of knowledge, similar to the structure indicated previously for athletes (Stankovic et al., 2022). Importantly, such separation of factors indicates that both dimensions should be assessed independently, as they represent distinct but complementary components of legal knowledge in anti-doping. This finding is particularly relevant for ASP, who must be familiar not only with the rights and obligations of athletes but also with the technical procedures that ensure compliance and fairness (Tahiraj et al., 2024).

Regardless of some similarities, the factorial structure observed in the present study differed from our earlier findings with athletes, where three latent dimensions were identified (Stankovic

et al., 2022). One possible explanation lies in the slightly different item pool, as the previous study included 20 items compared with 18 in the current analysis (note that two items were excluded owing to low reliability). With a larger number of items, the factor extraction process allows for greater mathematical possibility of distinguishing additional latent dimensions (Child, 2006). Another reason may be the specific characteristics of the tested population. Specifically, while athletes may perceive legal obligations, rights, and antidoping procedures as distinct domains, ASP appear to cluster this knowledge into fewer, broader categories.

No significant differences were observed between male and female ASP in the Q-LADR-ASP results. This outcome was expected, as there is no theoretical or practical basis to assume gender-related disparities in legal knowledge of anti-doping. Unlike some sport domains, where gender differences may reflect variations in experience or access to information, anti-doping regulations are standardized and disseminated equally to all ASP in sports. Both male and female ASP have access to the same educational resources, training programs, and regulatory frameworks, which ensures equal opportunities for acquiring relevant knowledge (Sipavičiūtė et al., 2020; Woolf, 2020). The absence of gender-related differences therefore not only confirms the fairness of existing educational practices but also suggests that future efforts to strengthen anti-doping education should remain gender-neutral. In this context, knowledge appears to be more closely associated with professional roles, education, responsibilities, and prior exposure to anti-doping processes than with demographic characteristics such as gender, which was practically confirmed in our study (please see later for details). Importantly, the finding that no differences emerged across gender groups supports the ecological validity of the Q-LADR-ASP, as no genuine differences were theoretically expected.

Notably, the lack of gender differences found in this study with sport ASP disagrees with the results of a previous study performed with athletes, where male athletes achieved better results than their female peers did (Stankovic et al., 2022). However, the background of differences evidenced among athletes is not applicable for ASP. Specifically, a study of athletes discussed that doping is generally more prevalent in male competitive sports, which is regularly confirmed in the majority of empirical studies and WADA reports (Sekulic et al., 2016; WADA, 2025; Zvan et al., 2017). As a result, interest in doping among male athletes is considerably greater, and consequently, male athletes logically develop better knowledge of this issue than their female peers simply because they are more informed about doping-related issues (Stankovic et al., 2022). In contrast, in this study, we sampled ASP who are involved in both male and female

sports (irrespective of their own gender). Therefore, the explanation of the "higher awareness of doping issues" among male athletes is not transferable to the ASP observed here.

Our results demonstrated that medical professionals achieved significantly higher scores on the Q-LADR-ASP than coaches and nutritionists did. This outcome is logical given the nature of their professional training and responsibilities. Physicians and other medical staff are regularly exposed to pharmacology, prescription practices, and medical ethics, which naturally overlap with the legal and procedural aspects of anti-doping regulations (Backhouse & McKenna, 2011; Roman et al., 2022). Additionally, they are frequently involved in antidoping bodies in sport federations, which provides them with valuable experience and additional knowledge in this field. In contrast, coaches and nutritionists are more focused on training strategies, performance optimization (coaches), and dietary guidance (nutritionists), areas that are poorly connected with anti-doping laws. The observed differences in the Q-LADR-ASP between groups of ASP reflect real variations in professional knowledge. Collectively, these results provide clear support for the validity of the measurement tool, as it successfully discriminates between groups where differences would reasonably be expected.

We also found a positive correlation between the sport level (the competitive level in the sport at which the ASP is involved) and the results achieved on the Q-LADR-ASP. This finding suggests that ASP who are involved at higher competitive levels possess greater knowledge of anti-doping regulations. The most likely explanation lies in their increased exposure to regulatory frameworks, testing procedures, and formal education programs implemented at elite levels of sport. This finding is consistent with the expectation that experience in high-performance contexts provides more opportunities to engage with legal aspects of anti-doping. Similarly, a similar correlation between experience and questionnaire results was found among athletes in previous studies where different types of knowledge about doping were tested (Kondric et al., 2013; Stankovic et al., 2022). This correlation further supports the validity of the Q-LADR-ASP.

On the other hand, although the correlation between the level of sport-level and knowledge was positive, the strength of the relationship ($R = 0.55$) was only moderate. One likely reason is that our sample included ASP from a wide range of sports, where the meaning of a "higher sport competitive level" varies considerably. In some sport disciplines, advancing to elite competition entails close interaction with anti-doping protocols, whereas in others, this interaction is not as evident (De Hon et al., 2015; Overbye, 2016). As a result, higher competitive status does not

uniformly translate into greater knowledge of legal regulations, which in turn lowers the overall strength of the correlation.

Limitations and strengths

This study has several limitations that should be acknowledged. First, the cross-sectional design does not allow interpretation of the causality; therefore, future intervention studies are warranted to identify possible cause–effect relationships between variables. Second, the study involved a specific sample of participants, ASP from only two countries. Although such an approach was necessary (i.e., Q-LADR-ASP was designed and applied in the local language), the generalizability of the findings is clearly limited. Therefore, in future studies, similar investigations should be performed in other countries while including more participants. Finaly, the study did not take into account eventual prior anti-doping education of participants, and in future studies the eventual influence of formal or non-formal anti-doping educations should be evidenced and interpreted.

This is probably the first study in which the legal issues related to anti-doping policy have been investigated in ASP in the southeastern Europe, and one of the rare studies addressing this problem globally. Given that supporting staff has a strong influence on athletes' behavior, we hope that investigations will initiate further research on this problem and hopefully result in better anti-doping results.

CONCLUSION

The results demonstrate that the Q-LADR-ASP is a reliable and valid tool for assessing knowledge of the legal aspects of anti-doping among ASP. Its ability to identify weaknesses caused by wording issues and "learning effects" highlights its practical value not only as an evaluative measure but also as an educative instrument. However, by refining ambiguous items, the tool can be further strengthened for use in both research and applied settings. Also, including additional specific questions related to specific ASP's rights and obligations related to doping control process would probably increase the content validity of the Q-LADR-ASP.

From a practical perspective, the factorial structure of the Q-LADR-ASP confirms that legal knowledge in anti-doping can be meaningfully divided into two dimensions: the rights and obligations of athletes and the procedural aspects of testing. This distinction allows for targeted educational interventions, where ASP with weaker understanding in one domain can receive

specialized training. Such tailored programs could improve compliance with anti-doping regulations and enhance the overall integrity of sport by ensuring that all support personnel are adequately informed.

Finally, the results demonstrating higher scores among medical professionals, as well as the positive association of the Q-LADR-ASP with involvement at higher levels of competition, confirm the tool's discriminative power. These findings suggest that the Q-LADR-ASP can be applied to monitor knowledge across different professional groups and sport contexts and to inform the development of role-specific education strategies.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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SportMont

ORIGINAL SCIENTIFIC PAPER

Evaluating an Anti-Doping Education Program for Athlete Support Personnel: Knowledge Gains Without Behavioral Shift

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Abstract

Legal anti-doping knowledge is a critical component of global anti-doping efforts, yet few studies have examined the impact of targeted interventions on legal aspects of anti-doping policy among athlete support personnel (ASP). This study aimed to evaluate (i) the effects of a structured educational intervention on legal anti-doping knowledge among ASP, and (ii) whether changes in knowledge are associated with changes in doping tendency. A total of 183 ASPs (64 females; 45.11±8.90 years of age), including 101 medical staff and 82 coaches supporting senior-level athletes, were randomly assigned to either an intervention group (n=99) or a control group (n=84). The intervention group completed a 10-lesson program on anti-doping legislation. Variables included sociodemographic data, sport-related factors, doping tendency, and legal anti-doping knowledge. A two-way repeated measures ANOVA was conducted with Measurement (pre- to post-intervention), Group (Intervention vs. Control), and their interaction analyzed separately for medical staff and coaches. Significant improvements in legal anti-doping knowledge were found in both medical staff (Group × Measurement: $F=12.11$, $p<0.05$; Measurement: $F=21.05$, $p<0.01$) and coaches ($F=37.70$, $p<0.01$; $F=20.03$, $p<0.001$) in the intervention group, while no significant changes were observed in the control group. However, increased knowledge did not translate into changes in doping tendency. These findings emphasize the value of targeted education in enhancing legal anti-doping competencies among ASPs, though further strategies may be needed to influence attitudes and behaviors.

Keywords: *sports medicine, intervention studies, anti-doping legislation, doping in sports*

Introduction

Doping remains one of the most pervasive threats to the integrity of competitive sports, undermining both the fairness of competition and the health of athletes (Mottram, 2022; Versic, Uljevic, & Pelivan, 2022). Despite decades of regulation, testing, and punitive measures, the use of performance-enhancing substances continues across various levels of sport, from amateur leagues to elite international competitions. While much attention is given to the individual athlete's responsibility, research increasingly highlights the influence of the athlete's support network—particularly coaches and medical personnel—in shaping attitudes toward doping (Tahiraj, Zenic, Musa, Zeljko, & Rodek, 2024). These figures often act as gatekeepers to both legitimate medical treatment and unethical performance enhancement practices. Studies have shown that athletes are more likely to engage in doping when they perceive implicit approval or pressure from their coaches or when medical professionals fail to communicate anti-doping norms effectively (Patterson, Backhouse, & Duffy, 2016). Moreover, a lack of legal and ethical literacy among these professionals can contribute to unintentional violations or rationalization of doping behavior.

The dynamic interplay between professional authority and

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athlete vulnerability makes the education of coaches and medical personnel a critical intervention point in anti-doping efforts (Patterson et al., 2016). These professionals occupy positions of trust and often serve as the primary source of guidance for athletes regarding training, recovery, and medical treatment (Mandic, Peric, Krzelj, Stankovic, & Zenic, 2013; Sekulic et al., 2016). When their knowledge is outdated or their ethical stance is ambiguous, athletes may be unintentionally steered toward doping practices—either through misinformation, negligence, or tacit encouragement. Therefore, anti-doping education targeted at these groups should not be seen solely as a legal or procedural requirement but rather as a vital component of athlete protection. By fostering ethical awareness, legal literacy, and a commitment to clean sport values, such education helps reinforce a supportive environment that discourages doping from the outset. Ultimately, empowering coaches and medical professionals with both knowledge and moral clarity to uphold anti-doping principles is essential in building a sustainable culture of clean sport.

Anti-doping regulations are governed by a complex legal framework that includes international conventions, national legislation, and the World Anti-Doping Code (Chester & Wojek, 2022; WADA, 2009; Vedder, 2022). This legal architecture defines not only prohibited substances and methods but also the rights and responsibilities of athletes and their support personnel. Coaches and medical professionals are explicitly recognized under the Code as athlete support personnel (ASP), making them subject to sanctions—including suspensions and bans—for involvement in antidoping rule violations (Viret, 2015). Without a solid understanding of these legal obligations, support staff may inadvertently contribute to violations or fail to protect the procedural rights of athletes under investigation. Thus, comprehensive legal literacy is not optional but essential for coaches and medical doctors to navigate their roles responsibly and uphold both athlete health and the integrity of sports.

Despite the recognized importance of legal literacy among athlete support personnel (ASPs), there is a notable gap in the literature concerning targeted educational interventions. To the best of our knowledge, no study to date has systematically examined the effects of anti-doping education programs specifically focused on legal aspects for coaches and medical professionals. Most existing research emphasizes general anti-doping knowledge or ethical attitudes, often overlooking the legal dimension as a distinct and measurable outcome (Faros & Shehu, 2024; Weber, Patterson, & Blank, 2022). This lack of empirical evidence limits our understanding of how legal education might influence ASP behavior, decision-making, or compliance with anti-doping rules. Addressing this gap is essential for designing more effective, evidence-based education strategies tailored to the real responsibilities that ASPs face under the World Anti-Doping Code.

In response to the identified gap in both practice and research, the present study aims to develop and evaluate the effects of a specifically designed legal anti-doping education-program (LADEP) targeted at ASPs, namely, coaches and medical doctors. The intervention focuses on enhancing the knowledge of key legal concepts within the World Anti-Doping Code, including liability, sanctions, procedural rights, and obligations specific to ASPs. Initially, we hypothesized that (i) applying LADEP will increase the knowledge of participants in the field of legal issues of anti-doping policy and that (ii) increased knowledge of legal anti-doping rules will be associated with a lower positive doping tendency in ASPs.

Methods

Participants

The participants in this study were athlete support team members (ASTs; N=183; 64 females; M age =45.11±8.90 years). Of these, 101 were members of medical staff (including medical doctors and physiotherapists), and 82 were coaches. All participants were actively involved in coaching or supporting senior-level athletes competing in top-tier competitions (see Table 1 for detailed participant characteristics). The participants were invited to take part in the study by the National Olympic Committee. Prior to participation, they were informed about the study's purpose, potential benefits, and associated risks. They provided informed consent and were assured that their participation was voluntary, that their responses would remain anonymous and that they could withdraw from the study at any time without providing a reason. The inclusion criteria were as follows: (1) a minimum of one year of involvement in sport as an AST; (2) support of athletes competing at least at the highest national level (e.g., national championships); (3) meeting the formal qualifications required by their national sport federation to work as a coach or medical staff; and (4) citizenship in Croatia. The participants were randomly allocated to either the intervention group (n=99; 45 coaches) or the control group (n=84; 37 coaches). Although 201 participants were initially enrolled, 18 withdrew (mostly from the intervention group), resulting in a final sample of 183 participants. This study fulfilled all ethical requirements and received prior approval from the Ethical Committee of the Faculty of Kinesiology, University of Zagreb (approval date: May 6, 2025; reference: 30/2025).

Variables and testing

The variables included sociodemographic factors, sport factors, doping factors, and legal anti-doping knowledge. Sociodemographic variables consisted of sex (male, female, other), and age (in years). Sports factors asked participants about their experience in sport (<5 years, 6--10 years, >10 years), highest level of sport achievement/success as an ASP (national-level competition, national-level medal, European and/or World Championship participation/medal, Olympic Games participation/medal). The participants were asked four questions about their self-opinion about personal anti-doping knowledge (poor, average, good), their participation in anti-doping testing as an ASP (never, 1–2 times, 3–5 times, >5 times), their personal opinion about the main problem of doping (doping is mainly health hazard, doping is against fair play, I do not see doping as a problem at all), and their likelihood of suggesting doping to athletes (No way!, I do not know (not sure), I could consider suggesting doping if there is no health hazard, I could consider it). For the purpose of later analyses, the responses to the last question (likelihood of suggesting doping to athletes) were grouped into "Negative doping tendency" (first response) and "Neutral/positive doping tendency" (remaining responses).

The legal anti-doping knowledge was tested by adapting a previously validated athlete-focused questionnaire. The version of the measurement tool used included 10 true/false items covering rights, obligations, and antidoping procedures, with a "not sure" option. Given that the original tool was developed without input from medical professionals, two medical doctors affiliated with national anti-doping agencies reviewed and revised the content to suit the target population. Athlete-specific items were modified to reflect the responsibilities of sport staff. The used version of the questionnaire consisted of 10 items, with total

range of scores from 0—10 (Stankovic, Sinkovic, Sekulic, Jelicic, & Rodek, 2022).

The testing was performed via the SurveyMonkey digital platform (SurveyMonkey Inc., San Mateo, CA, USA), and all questionnaires used in this study were validated in the local language, with details available elsewhere (Kondric, Sekulic, Uljevic, Gabrilo, & Zvan, 2013; Stankovic et al., 2022; Zenic, Peric, Zubcevic, Ostojic, & Ostojic, 2010).

Intervention and study design

The LADEP intervention consisted of 10 structured lessons, each designed to improve participants' legal knowledge related to anti-doping. The content targeted two core domains: (i) obligations and rights under anti-doping regulations and (ii) legal procedures involved in anti-doping testing. Instruction was delivered by a multidisciplinary team of experts, including certified anti-doping officers, legal professionals specializing in sports law, and experienced sport coaches. This diverse team ensured a well-rounded perspective, bridging theoretical frameworks with practical, sport-specific insights. The sessions emphasized real-world applicability over abstract legal theory. The lessons included interactive discussions, real-life case studies, and examples drawn from the instructors' personal professional experiences. The participants were encouraged to actively engage with the content, ask questions, and reflect on complex or ambiguous scenarios encountered in actual anti-doping practices. The curriculum was informed by findings from previous studies that assessed antidoping legal knowledge and identified common areas of weakness among sport professionals. As a result, the program was strategically designed to address these gaps. Special focus was placed on presenting real-world challenges and procedural nuances in doping control—ranging from notification and sample collection to managing athlete rights during testing and appeal processes. Authors of the study are at disposal for details of the intervention and educational materials. The study design is presented in Figure 1.

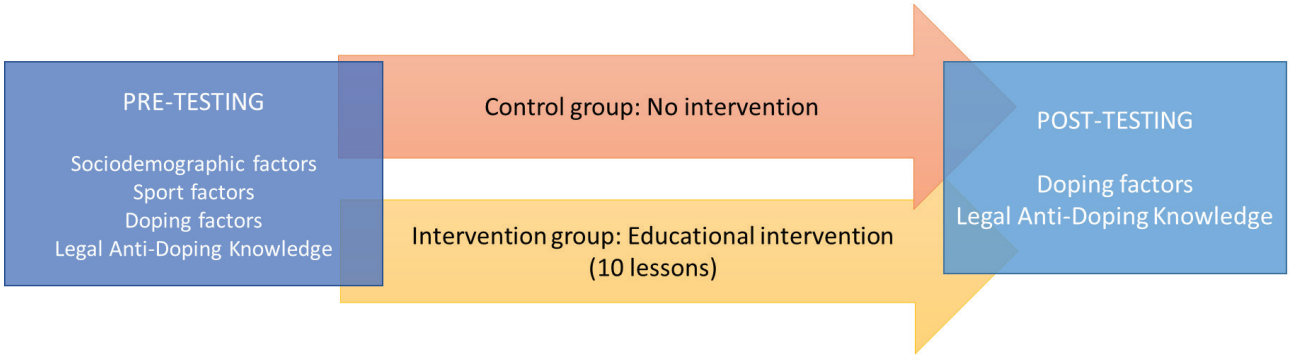


FIGURE 1. Study protocol

Statistics

The Kolmogorov–Smirnov test was used to assess the normality of data distributions. Accordingly, means and standard deviations were reported as descriptive statistics for normally distributed variables, while frequencies and percentages were reported for ordinal and interval variables.

Group differences in non-parametric variables were examined using the Chi-square test. This procedure also enabled the identification of potential associations between doping tendencies and legal anti-doping knowledge (see Results for further details).

Intervention effects were analyzed using factorial analysis of variance for repeated measures (ANOVA). The within-subject factor was Measurement (pre- vs. post-intervention), and the between-subject factor was Group (Intervention vs. Control). The interaction effect (Measurement × Group) was also evaluated. When appropriate, Scheffé post-hoc tests were conducted.

All statistical analyses were performed using Statistica, version 14.5 (TIBCO Inc., Palo Alto, CA, USA), with a significance level set at $p<0.05$.

Results

Table 1 presents the distribution of study variables across groups. Notably, the majority of participants perceived doping primarily as a health hazard. Self-reported neutral or positive attitudes toward doping were negligible, although coaches exhibited a slightly higher tendency toward doping behavior compared to medical staff.

Table 1. Descriptive statistics for the study variables (data are presented as F(%)) values)

	Medical staff		Coaches	
	Control (n = 54)	**Intervention (n = 47)**	**Control (n = 45)**	**Intervention (n = 37)**
Gender				
Male	35 (65)	29 (61)	32 (71)	28 (75)
Female	19 (35)	18 (39)	18 (39)	9 (25)
Other	-	-	-	-
Experience in sport (as an athlete support personnel)				
< 5 years	13 (24)	14 (29)	23 (50)	14 (39)
6-10 years	24 (44)	15 (31)	10 (23)	15 (41)

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Table 1. Descriptive statistics for the study variables (data are presented as F(%)) values)

	Medical staff		Coaches	
	Control (n = 54)	**Intervention (n = 47)**	**Control (n = 45)**	**Intervention (n = 37)**
> 10 years	17 (32)	19 (40)	12 (27)	7 (20)
Sport success (as an athlete support personnel)				
National level competition	22 (41)	16 (33)	13 (29)	13 (36)
National level medal	24 (44)	24 (51)	18 (41)	9 (23)
European and/or World Championship (participation and/or medal)	4 (7)	2 (4)	10 (22)	14 (39)
Olympic Games (participation and/or medal)	4 (8)	6 (12)	4 (8)	1 (2)
Self-opinion about personal doping knowledge				
Poor	6 (11)	10 (21)	23 (51)	15 (41)
Average	33 (61)	26 (55)	19 (43)	19 (51)
Good	15 (28)	11 (24)	3 (6)	3 (8)
Anti-doping testing (as an athlete support personnel)				
Never	1 (2)	1 (2)	2 (5)	2 (6)
1-2 times	24 (44)	16 (35)	30 (66)	19 (51)
3-5 times	18 (34)	21 (45)	9 (21)	14 (39)
> 5 times	11 (20)	8 (18)	4 (8)	1 (4)
The main problem of doping in sport				
Doping is mainly a health hazard	49 (91)	42 (90)	40 (88)	33 (89)
Doping is mainly against fair-play	5 (9)	5 (10)	3 (7)	1 (4)
I don't see doping as a problem at all	0 (0)	0 (0)	2 (5)	3 (7)
Likelihood of suggesting doping to athletes				
Absolutely not!	54 (100)	46 (98)	41 (90)	33 (89)
Don't know (not sure)	0 (0)	1 (2)	3 (6)	3 (7)
I'd consider it if there will be no health hazard	0 (0)	0 (0)	1 (2)	1 (4)
I'd consider it	0 (0)	0 (0)	1 (2)	0 (0)

Table 2 provides descriptive statistics for Legal Anti-Doping knowledge across groups and time points, while Figure 2 displays the repeated-measures ANOVA results separately for medical staff (Figure 2A) and coaches (Figure 2B). Among medical staff, a significant Group × Measurement interaction was found (F=12.11, p<0.05), along with a sig-

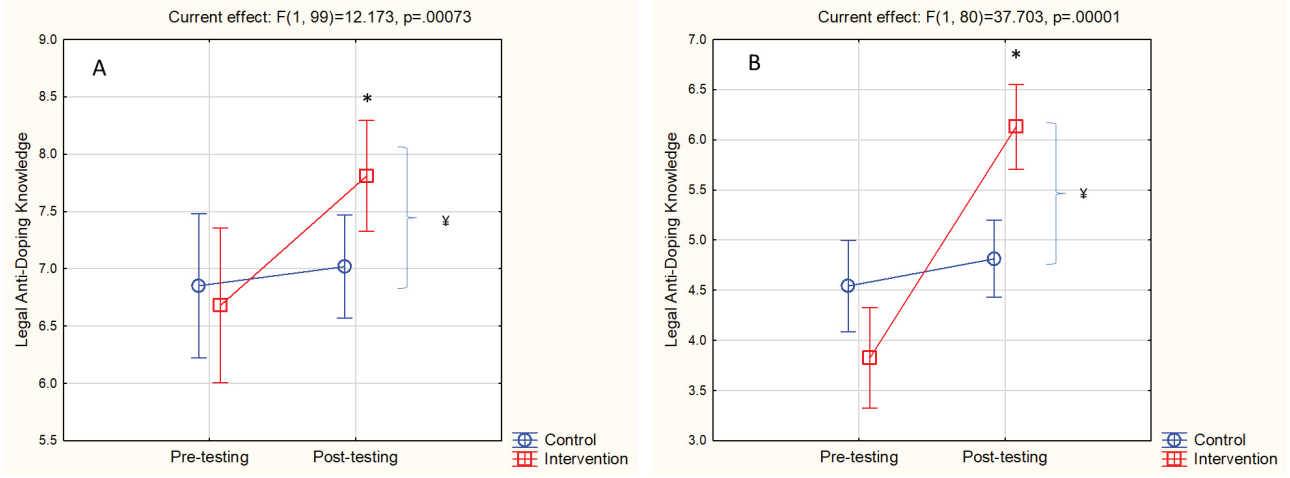


FIGURE 2. Results of the 2-way ANOVA for repeated measurements in legal anti-doping knowledge for medical staff (A) and coaches (B) with significant post-hoc differences among groups (*) and between groups (¥)

nificant main effect for Measurement (F=21.05, p<0.01), indicating that the Intervention group demonstrated greater improvement in knowledge than the Control group (see Table 2). Similarly, among coaches, the ANOVA revealed a significant main effect for Measurement (F=20.03, p<0.001) and a significant Group × Measurement interaction (F=37.70, p<0.01), with knowledge gains observed only in the Intervention group.

Table 2. Descriptive statistics for legal anti-doping knowledge before and after testing across study groups

	Pre-testing				Post-testing			
	Control		Experimental		Control		Experimental	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Coaches	4.54	1.62	3.83	1.41	4.81	1.32	6.13	1.25
Medical staff	6.85	2.22	6.68	2.33	7.02	2.01	7.80	1.15

Table 3 shows descriptive statistics for doping tendency across groups and measurement points. For medical staff, a Chi-square test could not be performed due to zero frequencies in the neutral/positive doping tendency category. Nevertheless, no change in doping tendency was observed from pre- to post-measurement. Among coaches, no significant differences were found between the Intervention and Control groups either at pre-test (Chi-square =0.01, p>0.05) or post-test (Chi-square =0.01, p>0.05). There results suggest that the intervention had no measurable impact on doping attitudes.

Table 3. Distribution of the doping tendency across study groups and measurements

	Pre-testing				Post-testing			
	Control		Intervention		Control		Intervention	
	F	%	F	%	F	%	F	%
Medical staff - doping tendency								
Negative tendency	54	100	46	98	54	100	46	98
Neutral/Positive tendency	0	0	1	2	0	0	1	2
Coaches - doping tendency								
Negative tendency	41	90	33	89	42	91	46	98
Neutral/Positive tendency	5	10	4	11	4	9	1	2

Discussion

With respect to the study aims, we can highlight the two most important results, which are discussed in the following text. First, the applied educational program (LADEP) resulted in increased knowledge of legal anti-doping issues among both coaches and medical personnel. Second, increased knowledge of legal anti-doping issues did not doping tendencies among coaches or medical personnel. Therefore, our first study hypothesis can be accepted, and the second study hypothesis should be rejected.

An improvement in the knowledge of the legal issues of anti-doping policy as a result of the applied LADEP was generally expected. There are several important reasons for such results. First, at the beginning of the study, participants demonstrated relatively low levels of knowledge regarding antidoping legal regulations (please see average results at the study baseline). This was particularly evident among coaches, many of whom lacked familiarity with core legal principles such as strict liability, the scope of athlete support personnel responsibilities, or procedural rights during disciplinary proceedings. Although disappointing, the poor knowledge of coaches is consistent with previous literature indicating that doping literacy is often overlooked in both coaching certification programs and continuing medical education (Patterson et al., 2016). Additionally, studies dealing with general anti-doping knowledge in athletes and coaches have frequently reported similar levels of knowledge in athletes and coaches, although athletes regularly report coaches as the most important figures in their anti-doping knowledge (Mandic et al., 2013; Sajber, Rodek, Escalante, Olujić, & Sekulić, 2013). The gap in baseline understanding is additional concern given that ASPs can be sanctioned under the World Anti-Doping Code even in cases of indirect or unintentional involvement in rule violations.

Despite the poor initial knowledge of legal issues, which almost certainly contributed to improvements in knowledge as a result of the LADEP intervention, the organization and overall concept of applied education cannot be ignored as contributing factors. Specifically, the design of the educational intervention was based on prior research and needs assessments highlighting specific areas of legal misunderstanding in sports (Stankovic et al., 2022). In brief, the authors previously evaluated the psychometric properties of the applied measurement tool, which allowed us to identify critical issues in antidoping legal knowledge. Therefore, the LADEP curriculum was tailored to address commonly misunderstood elements such as procedures, roles in doping investigations, and legal consequences of complicity or failure to report. This focused approach ensured that the content was not only relevant but also immediately applicable to participants' professional responsibilities. In other words, rather than offering broad or theoretical overviews, the LADEP prioritized real-world scenarios and case studies to contextualize legal obligations in day-to-day support roles. This targeted strategy appears to

have been key to achieving measurable improvements in legal knowledge following the intervention.

Another significant factor contributing to the effectiveness of the intervention was the involvement of trained anti-doping educators with both legal and sport-specific expertise. These professionals were able to translate complex regulatory language into accessible, context-specific guidance tailored to the realities of coaching and medical practice. Their ability to facilitate discussion, answer practical questions, and relate legal frameworks to actual cases helped bridge the gap between theory and application. This type of expert-led instruction is a well-documented feature of effective education across various disciplines, especially in professional training environments where learners must apply abstract concepts in high-stakes real-world contexts, also known as Kolb's model of experiential learning (Kolb, 2014).

Most specifically, Kolb's model of experiential learning is an educational theory developed by David A. Kolb in 1984 (Kolb, 2014). It is based on the idea that learning is a process whereby knowledge is created through the transformation of experience. This model emphasizes that effective learning occurs through a cyclical process involving concrete experience, reflective observation, abstract conceptualization, and active experimentation. The approach was found to be particularly relevant in professional education, where learners benefit from engaging directly with realistic scenarios and applying knowledge in context. Therefore, the use of real-life doping cases and interactive discussions in our intervention almost certainly assured a deeper understanding and retention of legal principles. From the perspective of legal anti-doping learning, the presence of skilled educators—the officials of the national anti-doping agency—played a central role in participant engagement and comprehension, resulting in measurable gains in legal knowledge. Moreover, their credibility and ability to build trust fostered a psychologically safe learning environment, allowing participants to openly discuss uncertainties and misconceptions about anti-doping laws.

Contrary to our initial expectations, the increase in participants' legal knowledge regarding anti-doping regulations did not correspond with a measurable decrease in their positive tendency toward doping. There are several possible reasons for such results, which will be discussed in the following text. First, we must highlight that although it disagrees with our initial expectations (e.g. 2nd hypothesis), the lack of correlation between improved legal anti-doping knowledge and doping tendencies in ASPs actually aligns with previous findings indicating that knowledge alone is often insufficient to alter behavior or attitudes, especially in complex ethical domains such as doping. Doping tendency is influenced by a constellation of factors, such as sport-specific culture, the perceived prevalence of doping, gender, the level of competition, and individual moral disengagement. Most of these factors of influence are not directly addressed by legal education alone (Barkoukis, Lazuras, Tsorbatzoudis, & Rodafinos, 2013; Morente-Sánchez & Zabala, 2013). In this context, it is plausible that while participants became more legally informed, their broader value systems and perceptions remained unchanged, limiting the impact on behavior-related outcomes. Therefore, although their knowledge improved, it did not translate to their (more) negative doping tendency. This is probably augmented by the fact explained in the following text as a second possible reason for the lack of correlation between legal knowledge and doping tendency.

Second explanation for the lack of a significant effect lies in the initial distribution of attitudes toward doping. At the study baseline, more than 90% of the participants declared a clear negative stance toward doping, reflecting a "ceiling effect" that naturally truncated the variance in the dependent variable (Austin & Brunner, 2003; Ho & Yu, 2015). Statistically speaking, the "ceiling effect" occurs when a measurement tool cannot detect higher (or lower) scores beyond a certain point because participants are already scoring near the top (or bottom) limit. This results in a compressed range of data at the upper (or lower) end, reducing variability and potentially masking pre- to post-measurement differences. In other words, when the majority of scores cluster at one end of the scale, detecting any further changes becomes statistically difficult. In our study, this actually means that even if knowledge improvements occurred, the already low endorsement of doping meant that there was little room for further reduction, leading to an artificial impression of no change.

Although the distribution of results in our case was highly skewed, it may reflect not only genuine attitudes but also strong social desirability bias. Social desirability is a well-documented phenomenon in doping research. Studies have shown that athletes and ASPs often underreport favorable attitudes toward doping to conform to social and professional expectations (Gucciardi, Jalleh, & Donovan, 2010; Petróczi, Aidman, & Nepusz, 2008). Given the legal and moral stigma surrounding doping, participants may have felt pressured to present themselves as firmly anti-doping, especially in an educational context. This tendency likely inflated baseline anti-doping attitudes, masking any real variability and making it difficult to detect meaningful postintervention changes in doping tendencies. As such, while the data suggest high initial rejection of doping, the extent to which these responses reflect the true beliefs of the participants remains uncertain.

This study has several limitations that should be considered. First, the educational intervention was relatively short-term, which may have limited its impact on deeper attitudes or behavior changes. Second, participants reported low doping tendencies at baseline, creating a ceiling effect that reduced the ability to detect correlations between legal knowledge and doping tendencies. Finally, the potential influence of social desirability bias cannot be ignored, as participants may have reported more socially acceptable anti-doping attitudes than their true beliefs. On the other hand, this study has several notable strengths. This is one of the first investigations to specifically examine the effects of antidoping legal education targeting ASPs. The intervention was delivered by qualified anti-doping authorities with both legal and sport-specific expertise, which added credibility and ensured accurate, context-relevant instruction. Additionally, the study involved a relatively large sample of coaches and medical professionals, enhancing the generalizability of the findings and providing a robust basis for evaluating knowledge change.

Conclusion

This study demonstrated that educational intervention effectively improved legal anti-doping knowledge among ASPs. This finding supports the first hypothesis and highlights initial gaps in legal understanding, especially among coaches. The program's tailored content, expert educators, and experiential

methods likely contributed to the positive outcomes.

In contrast, the second hypothesis was not confirmed since improved legal knowledge did not reduce the likelihood of doping among ASPs. This may be due to the complex, multifactorial nature of doping attitudes, which are influenced by personal, cultural, and situational factors. Moreover, ceiling effects and social desirability bias likely limit the ability to detect meaningful changes in doping attitudes.

Nonetheless, legal education remains an essential component of antidoping efforts. These findings suggest that knowledge alone is insufficient to change the doping tendency of ASPs. Therefore, future programs should integrate legal education with ethical and psychological elements to better support long-term changes in anti-doping attitudes and doping behavior in ASPs.

The study findings highlight the importance of targeted educational programs in strengthening anti-doping competencies within professional sports environments.

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Conflicts of interest

The authors declare no conflict of interest.

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Article

The Effect of Educational Intervention on Legal Anti-Doping Knowledge and Doping Tendency in Elite Athletes

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Abstract

Studies have rarely examined the effects of changes in legal anti-doping knowledge (LADK) on doping tendencies in athletes. This study aimed to evaluate the effectiveness of a structured educational intervention focused on LADK and to analyze how LADK changes affect elite athletes' doping tendency. The participants were athletes (n = 310; 156 females; 24.1 ± 4.2 years of age), all actively competing at the senior national or international level in either individual (N = 119) or team sports (N = 191), tested on sociodemographic-, sport-, doping-factors (including doping tendency—DT), and LADK. Participants were randomly divided into an experimental group (E: N = 140) and a control group (C: N = 170). The E group participated in a structured educational program on LADK. A pre- and posttest design was used to evaluate changes in LADK (dependent variable). Logistic regression was calculated to evaluate the association between LADK and binarized DT (negative vs. neutral/positive DT). Factorial ANOVA for repeated measurements revealed significant improvement in LADK in the E group, with significant ANOVA effects for time (F test = 35.8, $p < 0.05$) and time × group interaction (F test = 12.27, $p < 0.05$). The logistic regression did not reveal significant correlations between LADK and DT. Further studies exploring younger athletes, as well as long-term, multidimensional interventions, are warranted.

Keywords: health education; randomized controlled trial; doping in sports; logistic models

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1. Introduction

Doping remains one of the most important threats to the integrity of sport, undermining both the fair-play and the health of athletes [1,2]. Global anti-doping efforts, led by the World Anti-Doping Agency (WADA) and enforced through the World Anti-Doping Code (WADC), aim to ensure a level playing field and uphold the core values of clean sport [3]. These efforts are critical not only in identifying violations but also in fostering a sporting culture on the basis of ethics, safety, and respect for rules. The consequences of doping behavior extend beyond the individual athlete, potentially damaging the reputation of teams, nations, and entire sporting disciplines. As a result, some sporting communities are known to be stigmatized with regard to doping [4]. Moreover, there is no doubt that

doping presents serious health risks, including cardiovascular, hormonal, and psychological complications [5]. Therefore, sustaining anti-doping efforts requires not only effective testing procedures but also comprehensive education and doping-related literacy in sports societies worldwide.

To support the prevention of doping behavior in sports, substantial global efforts have been invested in anti-doping education, particularly through programs such as WADA's International Standard for Education, national anti-doping campaigns, and sport-specific educational initiatives [2,6]. These programs aim to promote clean sport values, raise awareness of banned substances, and clarify procedural issues of anti-doping policy. However, the effectiveness of these educational interventions remains contested. Most importantly, data from WADA and national reports suggest that the rate of adverse analytical findings has remained relatively stable over the last 20–30 years [7]. This stagnation raises concerns about whether current educational strategies are sufficiently targeted and comprehensive to alter the doping behavior of athletes. It also highlights the need to evaluate not only whether athletes are informed but also what they are taught.

Since doping behavior is generally observed as a practice that undermines both athletes' health and fair play, these topics dominate most anti-doping education campaigns [8]. On the other hand, although it is highlighted as one of the crucial facets of anti-doping efforts, the legal dimension of the anti-doping policy framework remains significantly underemphasized [9,10]. In other words, it seems that educational efforts overlook critical legal principles of anti-doping policy, such as strict liability, procedural fairness, and the right to appeal. In the meantime, WADC functions as a binding legal instrument, and athletes are held accountable for its violations regardless of intent or awareness [3]. Therefore, it is logical to expect that the lack of "legal literacy" can lead to unintentional infractions, delayed appeals, or failure to exercise due process rights and ultimately expose athletes to sanctions. As such, understanding the legal framework is a key factor in protecting athletes' autonomy and promoting procedural justice in sports. To address this gap meaningfully, the first step in evaluating the effectiveness of any legal education intervention is the availability of a valid and reliable measurement tool; without this tool, there is no accurate way to assess baseline knowledge, monitor changes, or determine whether the intended educational impact has been achieved.

Recognizing the absence of validated tools for assessing legal anti-doping knowledge, a previous study developed and tested the original questionnaire designed to evaluate athletes' understanding of core legal principles embedded in anti-doping regulations [11]. The instrument demonstrated acceptable levels of reliability and validity, offering a standardized means of measuring legal anti-doping knowledge in sport contexts. The application of this measuring tool among professional athletes revealed notable disparities, with male, older, and more competitively successful athletes scoring significantly higher than their female and less experienced peers [11]. Crucially, lower legal knowledge was associated with more permissive attitudes toward doping behavior, particularly among younger and infrequently tested athletes [11].

Concerns about athletes' limited understanding of antidoping legal frameworks have been raised in several earlier studies, which have helped inform the development of a measurement tool. For example, Viret (2015) emphasized that ignorance of legal obligations increases the risk of procedural violations and undermines the fairness of disciplinary proceedings [12]. More recently, studies by Weber, Patterson, and Blank (2022) and Faros and Shehu (2024) confirmed that legal literacy remains inadequate among both athletes and coaches, compromising their ability to respond appropriately to anti-doping testing procedures and allegations [13,14]. Together, these findings reinforce the structural importance

of integrating legal education into antidoping strategies to ensure regulatory compliance, to uphold procedural justice and, most importantly, to protect athletes' autonomy [9,10].

Although legal anti-doping knowledge primarily reflects athletes' understanding of obligations, procedures, and potential sanctions, several theoretical perspectives imply that such knowledge may indirectly shape decision-making related to doping behavior itself. Probably, the most important is deterrence theory, originating from classical criminology, which proposes that people are less likely to engage in prohibited behavior when they perceive a high likelihood of detection and believe that consequences will be severe and fairly enforced [15]. This theoretical concept was found to be plausible in different fields [16,17], while in the context of anti-doping, could imply that athletes who understand how testing works, what sanctions apply, and how strictly rules are implemented may become more cautious about using banned substances. Additionally, improved understanding of procedural fairness and athletes' rights may enhance perceived legitimacy of the anti-doping system. Indeed, there is evidence that athletes' perceptions of legitimacy are closely tied to fair implementation of anti-doping rules [18,19]. Finally, there is recent evidence that transparent, equitable procedures and clear communication of athletes' rights should be observed as a key to building trust in the anti-doping system [20]. As a result, better legal literacy could reduce moral disengagement and encourage prosocial adherence to clean sport values. Therefore, examining whether legal literacy can affect doping-related orientations remains warranted.

Despite increasing recognition of the importance of legal knowledge in anti-doping efforts, empirical studies examining the effects of legal anti-doping education remain scarce. To the best of our knowledge, no published studies have systematically evaluated whether structured legal education can enhance athletes' legal literacy and/or influence their attitudes toward doping. This gap limits our understanding of how legal knowledge contributes to doping-clean sports. Therefore, the present study aimed to evaluate the effectiveness of a structured educational intervention focused on antidoping legal knowledge in senior-level athletes at the high-competitive level. Furthermore, we analyzed the relationships between legal knowledge transfer and changes in athletes' doping tendencies. Initially, we hypothesized that (i) participation in educational interventions would lead to a significant improvement in legal anti-doping knowledge and that (ii) the eventual improvement in knowledge would be associated with a reduction in doping-positive attitudes among participants.

2. Materials and Methods

2.1. Participants

The participants in this randomized controlled trial study were elite athletes (N = 310; 156 females; 24.1 $\pm$ 4.2 years), all of whom were actively competing at the senior national or international level in either individual or team sports. The sample included athletes from a range of Olympic sports, with 119 athletes involved in individual sports (i.e., athletics, swimming, judo, Olympic sailing) and 191 in team sports (i.e., football, basketball, handball, volleyball, water polo). The participants were invited to take part in the study through collaboration with national sport federations and the Olympic Committee. Prior to participation, all the athletes were informed about the study's aims, potential benefits, and any associated risks. They provided written informed consent and were assured of anonymity, voluntary participation, and the right to withdraw from the study at any point without explanation.

To be included in the study, participants had to meet the following criteria: (1) being older than 18 years, (2) having an active status as a senior-level athlete, (3) having at least one year of competitive experience at the national level or higher, and (4) having

Croatian citizenship. Athletes were stratified by sport type (individual vs. team) and randomly allocated to either the experimental (intervention) or the control group. The final sample comprised 68 individual sport athletes in the control group and 51 in the experimental (intervention) group, along with 102 team sport athletes in the control group and 89 in the experimental group, with no significant difference between control and experimental group in distribution of athletes according to type of sport across study groups (Chi square = 0.41, $p > 0.05$).

This study was approved by the Ethical Committee of the Faculty of Kinesiology, University of Zagreb (approval date: 6 May 2025; reference: 30/2025).

2.2. Variables

The study included three main categories of variables: sociodemographic and sport factors, doping-related variables, and legal anti-doping knowledge. Sociodemographic variables consisted of sex (male, female) and age (in years). The sport-related variables included the type of sport (individual vs. team sport), years of active participation in senior-level competition (<5 years, 6–10 years, >10 years), and highest level of sport achievement (national-level competition, national-level medal, European and/or world championship participation/medal, Olympic Games participation/medal).

Doping-related variables were assessed through the following self-report items: athletes' self-perceived anti-doping knowledge (poor, average, good), their history of anti-doping testing (never, 1–2 times, 3–5 times, >5 times), their opinion about the main problem of doping (doping is mainly a health hazard; doping is against fair play; doping is not a problem), the number of times they were in a situation to participate in antidoping education organized by legal sport associations (No, Rarely, Frequently), the main source of information on doping (coach, medical staff, nutritionist, friend/teammate, formal education/schooling, nonformal education), personal trust with regard to doping issues (coach, medical staff, nutritionist, friend/teammate, I trust no one), and their likelihood of using doping (No way!; I do not know/not sure; I could consider it if there is no health hazard; I could consider it). For subsequent analyses, responses to the likelihood of doping were dichotomized into "negative doping tendency" (first response) and "neutral/positive doping tendency" (all other responses).

Legal anti-doping knowledge was assessed via the previously validated tool measuring the understanding of key legal aspects of the World Anti-Doping Code. The final version of the questionnaire used in this study consisted of 10 true/false items addressing rights, responsibilities, and procedural elements of doping control, with an additional "not sure" option for each item. Specifically, the questionnaire items were as follows: (i) Within one year, an athlete can be tested an unlimited number of times; (ii) the athlete who is in the group designated for testing is obliged to send information about the location for each day in the period of the next 3 months; (iii) an athlete can refuse to give a sample to the organization responsible for testing if he believes that the organization that will test him has political or other prejudices about him (for example, organizations from countries that have political conflicts with the athlete's country); (iv) the doping control officer must inform the athlete several hours before he will come to test him; (v) the doping control officer can take a urine and blood sample from the athlete; (vi) samples can be stored and reanalyzed over a period of 10 years; (vii) if the analysis of sample B does not confirm the analysis of sample A, the test will be considered negative; (viii) an appeal can be filed against a decision on a violation of anti-doping rules; (ix) if an athlete is found guilty of violating anti-doping rules, that fact will be made public; and (x) an athlete who voluntarily admits to having violated an Each correct answer was scored one point, with total scores ranging from 0 to 10.

All measurement tools were previously used in the local language and have been found to be reliable and valid, while details are available elsewhere [11,21]. Specifically, in the validation study of the legal-anti-doping knowledge questionnaire, the authors demonstrated acceptable test–retest reliability (Cohen's $\kappa = 0.65$) and 84% exact agreement on repeated items. Also, the study reported gender-specific discriminative validity, showing that the instrument distinguished meaningfully between male and female professional athletes [11]. Testing was conducted through the SurveyMonkey digital platform (SurveyMonkey Inc., San Mateo, CA, USA). The participants completed the survey individually, and all the items were presented in the local language (Croatian).

2.3. Intervention and Study Protocol

The legal anti-doping education program consisted of 10 structured educational sessions aimed at enhancing participants' legal understanding of anti-doping regulations and procedures. The curriculum focused on two primary domains: (i) athletes' rights and obligations under the World Anti-Doping Code and (ii) legal procedures and safeguards involved in the doping control process. The sessions were delivered by a multidisciplinary team that included certified anti-doping officers, sports law experts, and experienced coaches, ensuring a balanced approach that combined theoretical legal content with practical, sport-specific relevance.

To maximize engagement and real-world applicability, the program emphasized experiential learning strategies rather than abstract legal instruction. Each session featured interactive discussions, real-case scenarios, and examples drawn from the instructors' professional experience in doping control and legal proceedings (note that educators were medical and legal authorities actively involved in anti-doping protocols). The participants were encouraged to actively participate, pose questions, and reflect critically on ethically or procedurally complex situations. The curriculum design was directly informed by prior research on antidoping legal knowledge, particularly studies identifying common knowledge gaps among sport stakeholders in southeastern Europe [11,22]. Special attention was given to procedural nuances in doping control, such as notification, sample collection, documentation requirements, and athletes' rights during appeals and disciplinary hearings. These elements were deliberately integrated into the program to address the specific areas where legal literacy has been shown to be weakest. The educational materials and structure of the intervention are available upon request from the authors. The characteristics of the educational program are presented in Table 1.

According to WADA's International Standard for Education, anti-doping education employs both cognitive and affective approaches [3]. Cognitive models focus on delivering information-based programs to enhance knowledge about anti-doping, while affective models aim to instill this knowledge through the development of personal values and ethical principles. These approaches are grounded in different theoretical frameworks (i.e., social learning theory, health belief model, and socio-affective theories), which offer complementary insights into how athletes can be supported in building the self-efficacy needed to resist the use of prohibited substances [2]. Furthermore, preventive interventions also take into account the nature of athlete involvement. Most specifically, participation can be active, where individuals are directly engaged in the learning process, or passive, where they receive information with minimal interaction [2,23].

Table 1. Overview of the Legal Anti-Doping Education Intervention.

Component	Description
Target audience	Senior-level elite athletes (national and international competitors)
Number of sessions	10 structured educational sessions (10 × 45 min)
Delivery team	Certified anti-doping officers, sports law experts, and experienced coaches (medical and legal authorities involved in anti-doping processes)
Pedagogical approach	Experiential learning: interactive discussions, real-case scenarios, practical examples from testing and legal proceedings
Learning engagement	Active participation encouraged: athletes asked to share personal experiences, ask questions, and reflect on procedural or ethical dilemmas
Theoretical foundation	Cognitive approach aligned with WADA International Standard for Education; complemented by socio-affective elements (reflection and discussion)
Content emphasis	Procedural nuances: notification, sample collection, documentation requirements, appeals, and disciplinary processes
Evidence-based design	Curriculum informed by prior research identifying knowledge gaps among sport stakeholders in Southeastern Europe
Relevance	Sport-specific contextualization to enhance applicability and support informed legal decision-making
Materials availability	Full content and educational materials available upon request from the authors

In our educational approach, we followed the cognitive model by providing information and encouraging reflection on doping-related issues. Also, athletes were actively involved in the program, sharing their personal experiences and expressing their opinions during the educational sessions. Educators deliberately encouraged this active participation in order to frame discussions within specific, relatable educational contexts rather than relying solely on abstract or theoretical concepts.

An overview of the study design and intervention timeline is provided in Figure 1.

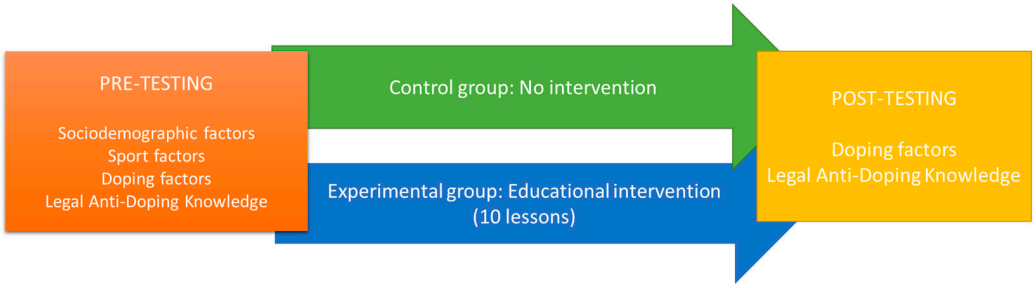


Figure 1. Study protocol.

2.4. Statistics

After the normality of the distributions was assessed, the means and standard deviations were calculated for age and legal anti-doping knowledge scores, whereas the frequencies and percentages were reported as descriptive statistics for the remaining variables.

To identify the differences in categorical and ordinal variables between the control and experimental groups, the chi square (χ^2) test was performed.

To assess the effects of the intervention on legal anti-doping knowledge, a multifactorial repeated measures analysis of variance (ANOVA) was performed. The model included three fixed (main) factors (effects): Group (experimental vs. control), Time (pretest vs. posttest), and Sport type (individual vs. team). All main effects and the following interaction effects were tested: Group × Time, Group × Sport type, Time × Sport type,

and the three-way interaction Group × Time × Sport type. Effect sizes were reported via partial eta squared (η^2), with values interpreted as follows: $\eta^2 = 0.01$ (small effect), $\eta^2 = 0.06$ (medium effect), and $\eta^2 \geq 0.14$ (large effect). Where significant interactions were identified, Bonferroni-adjusted post hoc comparisons were conducted.

To evaluate the relationship between legal anti-doping knowledge (predictor) and binarized doping tendency (criterion; negative vs. neutral/positive doping tendency), univariate logistic regression was performed with pre- and post-testing results, separately for the experimental and control groups, with odds ratios (ORs) and 95% confidence intervals (95% CIs) reported.

All analyses were performed via Statistica ver 13.5 (Tibco Inc., Palo Alto, CA, USA), and a *p*-level of 95% was applied.

3. Results

Descriptive statistics and differences between the control (C) and experimental (E) groups for the sociodemographic and sport variables analyzed in the study at pre-measurement are presented in Table 2. Most importantly, the majority of the participants had substantial experience in sports, with significant differences between C and E among individual sport athletes ($\chi^2 = 6.22$, $p < 0.05$). Because of the null frequencies, the differences between groups could not be calculated for the variable of sport success (sports competitive achievement), but it might be said that the C and E groups in both subsamples (individual- and team-sport athletes) had similar sport achievements, while a significant proportion of the studied athletes participated in international competitions.

When observed specifically for athletes involved in individual sports, groups C and E did not differ in the studied doping factors. No significant difference between E and C in doping factors was found for individual sport athletes. Among the team-sport athletes, those in the C group participated in antidoping testing more often than those in the E group did ($\chi^2 = 12.83$, $p < 0.05$). The majority of the studied athletes considered doping to be a fair-play issue (approximately 60% of all participants), whereas >60% of them reported that they were not familiar with organizing anti-doping education by their sporting authorities. Coaches and medical staff were declared to be the main sources of information on doping in >60% of the studied athletes. Finally, the neutral/positive doping tendency is low, with more than 90% of athletes reporting a negative doping tendency (Table 3).

Table 2. Descriptive statistics for sociodemographic and sport factors (F—frequencies, %—percentages) with differences between the control (C) and experimental (E) groups (Chi square—χ^2).

Variables	Individual Sports			Team Sports		
	C *n* = 68	E *n* = 51	χ^2	C *n* = 102	E *n* = 89	χ^2
	F (%)	F (%)	χ^2 (*p*)	F (%)	F (%)	χ^2 (*p*)
Gender			0.07 (0.79)			0.08 (0.77)
Male	37 (54.4)	29 (56.9)		48 (47.1)	40 (44.9)	
Female	31 (45.6)	22 (43.1)		54 (52.9)	49 (55.1)	
Missing	0 (0)	0 (0)		0 (0)	0 (0)	
Experience in sport			6.22 (0.04)			1.63 (0.44)
<5 years	14 (20.6)	12 (23.5)		32 (31.4)	27 (30.2)	
6–10 years	21 (30.9)	26 (51)		36 (35.3)	26 (29.4)	
>10 years	31 (45.6)	13 (25.5)		32 (31.4)	36 (40.4)	
Missing	1 (1.5)	0 (0)		2 (2)	0 (0)	

Table 2. *Cont.*

Variables	Individual Sports			Team Sports		
	C ***n* = 68**	**E** ***n* = 51**	χ^2	**C** ***n* = 102**	**E** ***n* = 89**	χ^2
	F (%)	**F (%)**	**χ^2 (*p*)**	**F (%)**	**F (%)**	**χ^2 (*p*)**
Sport success			NC			NC
National level competition	14 (20.6)	12 (23.5)		30 (29.4)	36 (40.4)	
National level achievement (medal)	35 (51.5)	17 (33.3)		40 (39.2)	32 (36)	
European and/or World Championship (participation and/or medal)	18 (26.5)	21 (41.2)		31 (30.4)	16 (18)	
Olympic Games (participation and/or medal)	1 (1.5)	0 (0)		0 (0)	5 (5.6)	
Missing	1 (1.5)	0 (0)		1 (1)	1 (1.1)	

Note: Missing values were not included in the calculation of the χ^2 test; NC—χ^2 test was not calculated because of null frequencies.

Table 3. Descriptive statistics for doping-related factors (F—frequencies, %—percentages) with differences between the control (C) and experimental (E) groups (Chi square—χ^2).

Variables	Individual Sports			Team Sports		
	C ***n* = 68**	**E** ***n* = 51**	χ^2	**C** ***n* = 102**	**E** ***n* = 89**	χ^2
	F (%)	**F (%)**	**χ^2 (*p*)**	**F (%)**	**F (%)**	**χ^2 (*p*)**
Self-opinion about personal doping knowledge			0.67 (0.71)			4.75 (0.09)
Poor	36 (52.9)	29 (56.9)		62 (60.8)	51 (57.3)	
Average	14 (20.6)	12 (23.5)		24 (23.5)	16 (18)	
Good	16 (23.5)	9 (17.6)		11 (10.8)	20 (22.5)	
Missing	2 (2.9)	1 (2)		5 (4.9)	2 (2.2)	
Participation in anti-doping testing			1.56 (0.45)			12.83 (0.001)
Never						
1–2 times	39 (57.4)	27 (52.9)		69 (67.6)	58 (65.2)	
3–5 times	12 (17.6)	14 (27.5)		20 (19.6)	10 (11.2)	
>5 times	13 (19.1)	8 (15.7)		3 (2.9)	16 (18)	
Missing	4 (5.9)	2 (3.9)		9 (8.8)	6 (6.7)	
The main problem of doping						NC
Doping is health hazard	18 (26.5)	11 (21.6)		32 (31.4)	36 (40.4)	
Doping is against fair-play	48 (70.6)	35 (68.6)		61 (59.8)	44 (49.4)	
I do not see doping as a problem at all	1 (1.5)	0 (0)		0 (0)	7 (7.9)	
Missing	1 (1.5)	5 (9.8)		9 (8.8)	3 (3.4)	
Organization of the anti-doping education (by Team, Federation, etc.)			0.83 (0.65)			5.99 (0.06)
No, I cannot remember that it was organized	38 (55.9)	32 (62.7)		62 (60.8)	61 (68.5)	
Yes, but rarely	26 (38.2)	16 (31.4)		27 (26.5)	27 (30.3)	
Yes, often	4 (5.9)	2 (3.9)		9 (8.8)	1 (1.1)	
Missing	0 (0)	1 (2)		3 (3)	0 (0)	

Table 3. *Cont.*

Variables	Individual Sports			Team Sports		
	C n = 68	E n = 51	χ^2	C n = 102	E n = 89	χ^2
	F (%)	F (%)	χ^2 (p)	F (%)	F (%)	χ^2 (p)
The main source of information on doping						NC
Coach	26 (38.2)	21 (41.2)		21 (20.6)	22 (24.7)	
Medical staff	21 (30.9)	13 (25.5)		35 (34.3)	19 (21.3)	
Nutritionist	2 (2.9)	1 (2)		1 (1)	4 (4.5)	
Friend, teammate, etc.	5 (7.4)	5 (9.8)		23 (22.5)	21 (23.6)	
Formal education	1 (1.5)	0 (0)		3 (2.9)	0 (0)	
Nonformal education	10 (14.7)	6 (11.8)		11 (10.8)	14 (15.5)	
Missing	4 (5.9)	5 (9.8)		9 (8.8)	9 (10.1)	
Personal trust with regard to doping			0.78 (0.94)			1.43 (0.83)
Coach	22 (32.4)	16 (31.4)		36 (35.3)	30 (33.7)	
Medical staff	28 (41.2)	20 (39.2)		37 (36.3)	34 (38.2)	
Nutritionist	1 (1.5)	2 (3.9)		1 (1)	2 (2.2)	
Friend, teammate, etc.	7 (10.3)	6 (11.8)		17 (16.7)	16 (18)	
No one	4 (5.9)	3 (5.9)		2 (2)	4 (4.5)	
Missing	5 (7.4)	4 (7.8)		9 (8.8)	2 (2.2)	
Likelihood of doping behavior			NC			NC
No way!	61 (89.7)	45 (88.2)		96 (94.1)	84 (94.4)	
Do not know (not sure)	4 (5.9)	2 (3.9)		2 (2)	3 (3.4)	
I'd consider if there will be no health hazard	1 (1.5)	2 (3.9)		2 (2)	2 (2.2)	
I'd consider	0 (0)	1 (2)		0 (0)	0 (0)	
Missing	2 (2.9)	2 (3.9)		1 (1)	1 (1.1)	

Note: Missing values were not included in the calculation of the χ^2 test; NC—χ^2 test was not calculated because of null frequencies.

The results of the multifactorial ANOVA for repeated measurements for legal antidoping knowledge as the dependent variable are presented in Table 4. In brief, the ANOVA main effects were significant for Group (F test = 5.05, $p < 0.05$, small effect) and Time (F test = 35.80, $p < 0.05$, medium effect). The interaction effects were significant for Sport × Group (F test = 8.30, $p < 0.05$, small effect) and Time × Group (F test = 12.27, $p < 0.05$, small effect).

Table 4. Main and interaction effects of the multifactorial ANOVA for repeated measurements, and effect size (η^2).

ANOVA Effects	SS	df	MS	F Test	p	η^2
Intercept	12,331.06	1	12,331.06	3372.32	0.001	0.92
Main effect: Sport (Individual vs. Team)	1.05	1	1.05	0.29	0.593	0.00
Main effect: Group (Intervention vs. Control)	18.48	1	18.48	5.05	0.025	0.02
Interaction effect: Sport × Group	30.35	1	30.35	8.30	0.004	0.03
Error	1082.34	296	3.66			
Main effect: Time (Pre- to Post-measurement)	147.26	1	147.26	35.80	0.001	0.11
Interaction effect: Time × Sport	9.85	1	9.85	2.39	0.123	0.01
Interaction effect: Time × Group	50.46	1	50.46	12.27	0.001	0.04
Interaction effect: Time × Sport × Group	4.47	1	4.47	1.09	0.298	0.00
Error	1217.59	296	4.11			

Note: SS—sum of squares, df—degrees of freedom, MS—mean square.

The E group achieved better results in terms of legal anti-doping knowledge than the control group did (4.94 ± 0.12 and 4.57 ± 0.10 for the E and C groups, respectively) (Figure 2A). The anti-doping legal knowledge in the total sample was greater at post- than at pretest (4.24 ± 0.15 vs. 5.28 ± 0.08 for pre- and post-measurement, respectively) (Figure 2B).

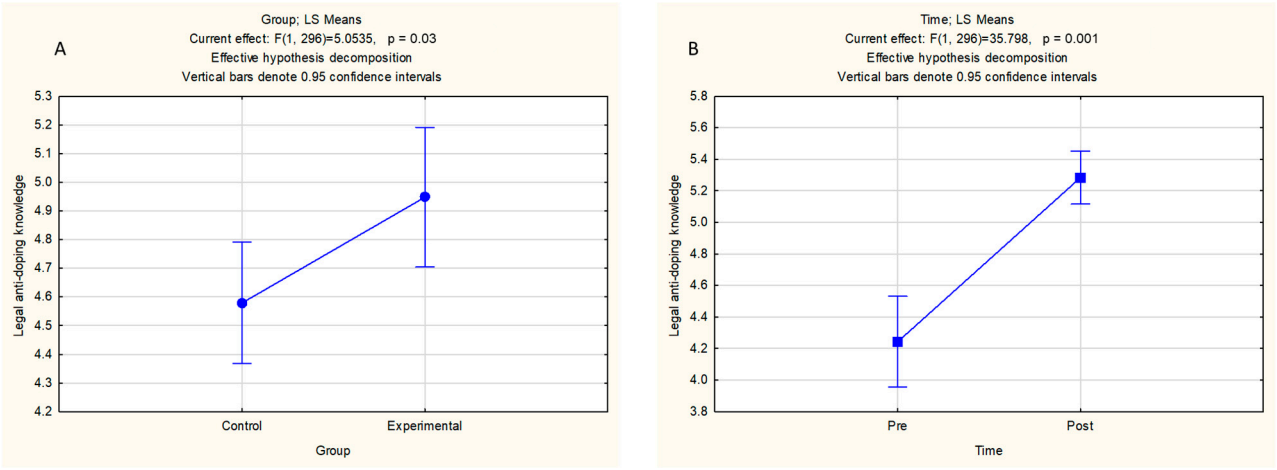


Figure 2. Descriptive statistics for ANOVA main effects for Group—differences between experimental and control group for both measurements (**A**) and Time—differences between pre- and post-measurement for both groups (**B**).

Significant ANOVA interaction effects with post hoc differences are presented in Figure 2. Significant post hoc differences were found between athletes involved in individual and team sports (for C group only), with better results in legal antidoping testing in individual sport athletes (4.85 ± 0.16 vs. 4.29 ± 0.13). Additionally, team-sport athletes from the E group achieved better results than E group team sport athletes (5.14 ± 0.14 and 4.30 ± 0.13 for E and C, respectively) (Figure 3A). The E group significantly improved their legal anti-doping knowledge during the study course (from 4.12 ± 0.22 to 5.77 ± 0.13) (Figure 2B). Finally, C and E differed significantly in the dependent variable at posttest, with better knowledge in the E group (4.70 ± 0.11 and 5.77 ± 0.13 in C and E, respectively) (Figure 3B).

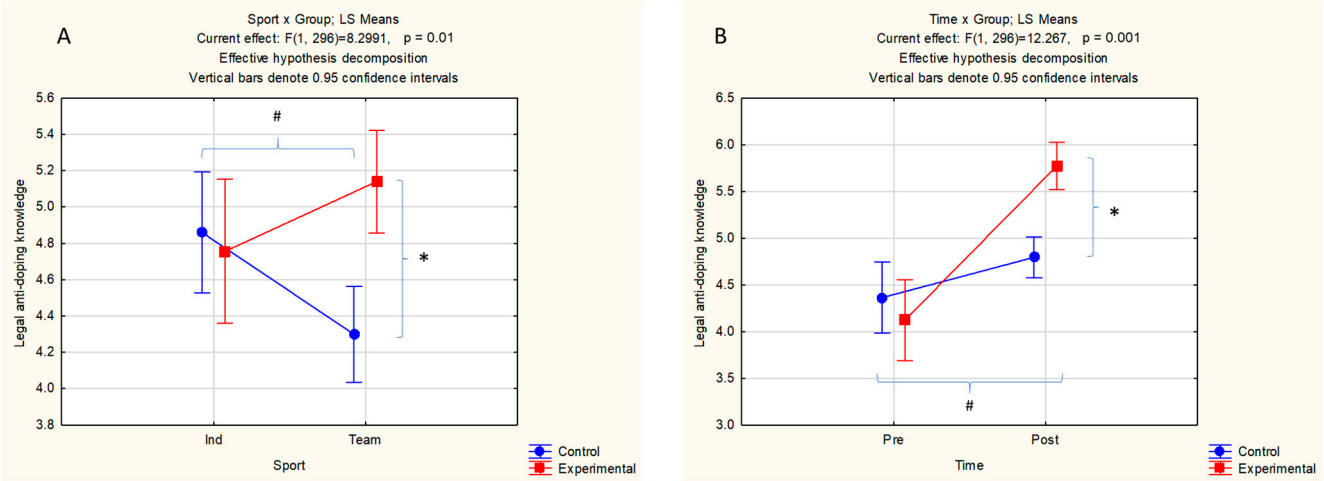


Figure 3. Descriptive statistics and significant post hoc differences for ANOVA interaction effects for sport × group for both measurements ((**A**): * $p < 0.05$ within the team sport group, $^{\#}$ $p < 0.05$ within the control group) and time × group for both type of sports ((**B**): * $p < 0.05$ between groups at post-measurement, $^{\#}$ $p < 0.05$ between measurements for the experimental group).

When legal anti-doping knowledge was correlated with a binarized doping tendency (negative vs. neutral/positive doping tendency), no significant associations were found for the E group (OR = 1.25, 95% CI: 0.90–1.73, p = 0.17) or for the C group (OR = 0.95, 95% CI: 0.76–1.19, p = 0.70) in the pretest. Similarly, correlations did not reach statistical significance in the posttest data (OR = 0.79, 95% CI: 0.55–1.29; OR = 1.35, 95% CI = 0.80–2.29 for C and E, respectively).

4. Discussion

This study aimed to evaluate the effects of a specific educational program on changes in legal anti-doping knowledge in elite athletes from Croatia. The results revealed several important findings. First, educational intervention improved the participants' legal anti-doping knowledge, with a more evident effect on those athletes involved in team sports. Second, increased knowledge was not reflected in changes in doping tendency. Therefore, our first study hypothesis can be accepted, whereas the second hypothesis should be rejected.

4.1. The Improvement in Antidoping Legal Knowledge as a Result of Education

A significant improvement in athletes' legal anti-doping knowledge as a result of the educational intervention was expected. Specifically, this result mirrors our recent findings in athlete support personnel (ASP), where coaches and medical professionals who underwent similar educational programs also achieved substantial gains in legal anti-doping knowledge [22]. Importantly, in both studies, the participants initially demonstrated a limited understanding of key legal concepts, including strict liability, procedural rights, and the scope of anti-doping sanctions. When the initial results of both studies were compared, the low level of knowledge was even more evident in the athletes studied here than in those previously studied with the ASP. This is mostly a result of relatively good knowledge among medical professionals, whose greater knowledge logically increased the average score for all ASPs [22]. For the current study, it is important to note that such a baseline deficit provided considerable room for educational impact, consequently resulting in significant improvement in legal knowledge among athletes. However, another issue that deserves attention is the significant improvement in athletes' knowledge.

The authors are convinced that a key factor contributing to the success of the intervention was the application of experiential learning principles, which are initially considered appropriate in the context of our study (i.e., adult education in professional sporting contexts). As presented in the Methods section, the education was led by certified anti-doping officers and legal experts. They grounded the legal anti-doping content in real-world examples drawn from actual disciplinary cases, doping control scenarios, and appeal processes. Initially, we tried to develop the education process on the basis of Kolb's experiential learning theory, which posits that knowledge is best acquired through a cycle of concrete experience, reflection, conceptualization, and active experimentation [24].

In more detail, it is generally accepted that courses designed around experiential learning increase student engagement and motivation, which are the issues we were specifically interested in this experiment [25]. Additionally, this type of learning has been shown to be highly effective in education characterized by limited time, which was one of the greatest challenges in our study [26]. Therefore, initially we believed that the effectiveness of the educational program would be improved if education included the anti-doping legal concepts within authentic sport situations. After being actively involved in the whole process, the authors of the study may witness that the participating athletes were not merely passive recipients of educational material. In contrast, they were actively engaged, asked questions, and applied legal frameworks to realistic scenarios, whereas athletes

who had experience with anti-doping tests presented their own experiences and actively discussed some specific issues together with other athletes and educators. As a result, educational intervention was informative, dynamic, and evidently effective. Supportively, studies repeatedly report better outcomes of the educational interventions where students were actively involved in learning, which was explained by increased student participation and engagement, but also by better perception of the studied problem in more active students from different fields [27,28].

The greater improvement observed among team sport athletes than among their individual sport peers can largely be attributed to differences in pretesting legal knowledge. Specifically, team sport athletes began the intervention with significantly lower pretest scores than their colleagues involved in individual sports did (see Results for more details). Moreover, lower knowledge (or ability) generally leads to greater improvement in the studied capacity [29]. Therefore, the initial difference in legal anti-doping knowledge between team and individual sports provided greater scope for educational gains in the former ones.

However, although the subgroup of team-sport athletes showed more pronounced improvement across the intervention period, the posttest scores did not significantly differ between team- and individual-athletes. This indicates that the educational program actually closed the initial knowledge gap. In this context, we highlight that the more evident gains among team athletes do not reflect superior learning capacity but rather a more substantial need for targeted legal education. Even a recent study on athlete support personnel revealed more evident improvements in legal anti-doping knowledge among coaches than among medical personnel, while the latter possessed better knowledge during pretesting [22].

We may say that initial differences in legal knowledge between team athletes and individual sport athletes were expected. Specifically, previous studies addressing general anti-doping knowledge have frequently revealed better knowledge among athletes involved in individual sports than among their team-sport peers [21,30,31]. From the perspective of antidoping (legal) knowledge, it can be understood through two interrelated factors. First, the anti-doping testing frequency tends to be higher in individual sports, which is supported even herein (please see Results for details). This approach almost certainly increased their knowledge of relevant legal content because this repeated procedural engagement undoubtedly serves as a learning mechanism. It logically increased athletes' familiarity with legal issues even if they were not involved in some type of formal education.

Second, our results indicate that coaches (and medical staff) are the main sources of information on doping for athletes, which is consistent with previous research [32]. Moreover, athlete-support personnel dynamics in individual sports are typically more intimate and continuous than those in team sports. In individual sports, athletes often rely on a small, consistent team of coaches and medical staff. On the other hand, the support structures in team sports are broader and somewhat "scattered" across different compartments. Therefore, interactions between team-sport athletes and coaches and medics may be less personal.

Supportively, previous research has shown that individual athletes often receive more direct guidance on doping-related matters from their support teams, which is connected to a higher prevalence of doping in individual sports [33,34]. Although we could not find direct empirical evidence on this topic, this fact can naturally be translated to legal anti-doping knowledge, resulting in higher baseline legal literacy among individual sport athletes. Therefore, the weaker support network integration in team sports may partially explain both (i) the lower initial scores and (ii) the better responsiveness to structured legal education we have achieved.

In addition, variations in doping-test frequency may contribute to the observed differences in legal knowledge between types of sports. Namely, athletes involved in individual sports were evidently tested more frequently than their peers involved in team sports. This could be a result of the performance-based qualification systems and individualized tracking protocols, which altogether, provide them with more exposure to procedural elements of anti-doping control, logically resulting in their better legal knowledge. In contrast, team-sport athletes observed herein experienced less frequent testing, which is probably a result of collective testing policies in these sports [35]. This logically reduces their opportunity to learn specific anti-doping rules and procedures in "real-world" settings.

Finally, cultural and normative influences may also play a role. Team sports are highly group-oriented, and shared values can reduce individual risk-taking by emphasizing collective responsibility and public scrutiny within the team environment [36]. Conversely, individual sports tend to foster a stronger performance-focused culture where personal success is observed as an "achievement goal". This altogether can result in higher motivation to seek any kind of advancement (including doping). However, the logical consequence of such higher motivation is the necessity to understand rules associated with it (in our case, anti-doping legal knowledge). These cultural differences between individual and team sports could shape athletes' baseline awareness of anti-doping regulations and modulate athletes' responsiveness to the educational program evaluated in this study.

4.2. Lack of Correlation Between Legal Anti-Doping Knowledge and Doping Tendencies

Although we hypothesized that improved knowledge of antidoping legal knowledge would be correlated with a lower likelihood of doping, this did not happen, as we did not find any correlation between legal knowledge and doping tendency. There are several possible explanations for such findings. First, it can be partly related to the fact that the study sample consisted of adult, advanced-level athletes. At this stage in sporting careers, most of the behavioral tendencies (i.e., those associated with ethical issues and decisions, those related to specific career-related risks) are established and resistant to change. Research suggests that adult populations tend to exhibit greater attitudinal stability than adolescents or younger people do, especially in regard to deeply internalized beliefs or "value-driven behaviors" [37].

Overall, the evidence consistently supports the idea that attitudes become more stable with age across various domains, including social group attitudes, risk-taking, and values, all of which are clearly connected to doping attitudes among athletes. This increased stability is likely due to the formation of attitudes early in life and a decline in susceptibility to change as individuals grow older [38]. In addition, most (if not all) of the athletes involved in the study are already embedded in structured, competitive environments with clear expectations and routines. This is simply evident from their competitive achievements (please see Results for details). This could further reinforce their relative rigidity and explain why the evident improvement in antidoping legal knowledge was not related to their doping tendency.

Apart from the previously discussed "attitudinal stability", another important issue limiting the detection of significance of correlation is related to a specific "statistical issue". Our initial results clearly indicated a small proportion of athletes who reported a neutral/positive attitude toward doping at study baseline (<10% of athletes). This low prevalence limits the potential for measurable changes in this variable over time. Statistically, this creates a "floor effect," where responses cluster at the end of the scale, leaving little room for further decrease [39]. Although this low prevalence of neutral/positive doping tendencies could reflect genuine anti-doping convictions, it is also possible that social desirability influences the initial results. Specifically, doping is generally stigmatized

in sporting communities [40,41]. Therefore, some participants could respond in a socially acceptable manner and therefore report negative doping tendencies despite their true opinions. Irrespective of the background, the lack of variability at pretest reduces the sensitivity of the measure to capture correlations.

From this perspective, authors are convinced that the composition of the educational team likely reinforced the effects of social desirability bias during the intervention. As previously mentioned, the sessions were delivered by certified anti-doping agents and legal professionals, some of whom were directly affiliated with the national anti-doping organization. While their expertise undoubtedly enhanced the quality of education, their authoritative roles may have also heightened participants' sensitivity to judgment and evaluation. In such settings, athletes may have been unwilling to disclose permissive attitudes toward doping, even in an anonymous testing environment. In other words, they could have been concerned that their responses could be associated with them personally. If we take into account that all participants were advanced-level athletes, the problem is even more likely because of the high reputational risk [42].

Taken together, these considerations indicate that the absence of a detected relationship between improved legal knowledge and doping tendency in the present study should not be interpreted as evidence of a true lack of association. Rather, the findings are more plausibly explained by methodological constraints, including the mature competitive status of the sample, restricted variability and floor effects in attitudes, and the potential influence of social desirability on self-reported outcomes. Under such circumstances, even meaningful attitudinal changes may remain statistically undetectable. Therefore, our results should be viewed as context-dependent, highlighting the need for future research to incorporate more sensitive attitudinal measures, recruit younger or more heterogeneous samples, and implement longer-term or multi-component interventions. Such improvements will be essential to adequately test whether enhanced legal literacy can ultimately contribute to ethically grounded decision-making and reduce positive doping tendency.

Irrespective of the previous explanations, our findings of the lack of transfer of the legal knowledge on changes in doping tendency actually align with evidence from the recent systematic review which reported that although cognitive (knowledge-based) and affective/values-based anti-doping programs often yield short-term reductions in doping intention and behavior, their effects on deep-seated moral behavior remain negligible [2]. This suggests that while knowledge dissemination is necessary, it is likely insufficient on its own to induce lasting value-driven behavioral change. Most specifically, it is probable that interventions focused solely on information transfer may temporarily shift attitudes or intentions, but not the underlying moral compass or doping tendency.

4.3. Limitations and Strengths

This study has several limitations that should be acknowledged. First, the duration of the intervention was relatively short, consisting of only 10 sessions, which may have limited its potential to produce more evident changes in doping attitudes. Additionally, the sample was composed exclusively of senior-level athletes, whose cognitive frameworks and ethical positions are probably well formed. This fact makes attitudinal change through educational intervention inherently more difficult. Therefore, the generalizability of the findings may be limited, especially when considering younger or less experienced athletes, who may be more open to shifts in their attitudes. Third, the same individuals who delivered the educational content were also subjected to pre- and postintervention testing. As discussed, this could have introduced social desirability bias or unintentional influence on how participants approached the assessments. Finally, the doping tendency in this study was evaluated by a dichotomous variable (negative vs. neutral/positive tendency), which

could result in non-sensitivity of the criterion. Therefore, in future studies, more sensitive variables examining the doping tendency should be used.

Moreover, to the best of our knowledge, this is one of the first studies to evaluate the effects of a structured legal anti-doping education intervention directly among elite athletes. Second, the sample consisted of high-level senior athletes actively competing at the national and international levels, which enhances the ecological validity of the findings. In other words, the sample of athletes studied ensures the relevance of the results to real-world sport settings. Third, the study employed a validated, athlete-specific tool for assessing legal anti-doping knowledge, allowing for accurate, reliable measurement and meaningful interpretation of educational outcomes. Therefore, we believe that although not the last word on a topic, the study will improve the body of knowledge and initiate further research in this field.

5. Conclusions

The present study demonstrated that a structured legal anti-doping education program can successfully improve athletes' legal literacy, particularly among those who initially displayed lower knowledge levels. These findings highlight the effectiveness of experiential, context-driven education in addressing procedural knowledge gaps.

However, improvements in legal knowledge were not accompanied by measurable changes in doping tendency. Importantly, these null findings should be interpreted cautiously due to methodological characteristics of our study (i.e., highly experienced athlete sample, the strong social stigma surrounding doping, and clear indications of floor effects in attitudinal measures). It is altogether likely to limit the detection of subtle changes in value-based outcomes. Therefore, the absence of a statistical association does not imply that legal knowledge is irrelevant to behavior, but rather underscores the complexity of factors associated with doping tendency in advanced-level athletes.

Future educational programs should consider incorporating longer education and samples more open to attitudinal change (e.g., youth athletes) to better evaluate whether enhanced legal literacy can change attitudes toward doping. Additionally, interventions targeting ethical reasoning, motivational factors, and broader sociocultural influences are warranted.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data will be provided to all interested parties upon reasonable request.

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8 Discussion

This dissertation is based on four published studies that, from different perspectives, examined the relationships among knowledge of the legal aspects of anti-doping regulation, the effectiveness of educational interventions, and attitudes towards doping among athletes and athlete support personnel. The first study focused on the development and validation of an instrument to assess knowledge of the legal aspects of anti-doping regulation and on examining the relationship between legal knowledge and attitudes towards doping (Stankovic et al., 2022). The second study focused on the adaptation and validation of an instrument for assessing legal anti-doping knowledge among members of athlete support personnel and on examining its metric properties and criterion validity (Sinkovic, Pivalica, Jukic, Pehar, & Sekulic, 2026). The third and fourth studies examined the effects of an educational program on the legal aspects of anti-doping regulations among elite athletes and support personnel (Sinkovic, Pivalica, Jukic, Pehar, Pivalica, et al., 2026; Sinkovic et al., 2025).

The results obtained provided insight into the importance of the legal framework of the anti-doping system, as well as into its limitations when it comes to changing attitudes towards doping. The studies conducted showed that knowledge of the legal aspects of anti-doping regulation is associated with attitudes towards doping, and that educational interventions can significantly improve knowledge. However, it turned out that increased knowledge alone does not necessarily lead to a change in doping inclination; rather, to change attitudes towards doping, educational programs must also include psychological and value-based factors. The second study showed that the level of legal anti-doping knowledge among support personnel varies by professional role, level of sporting engagement, and prior exposure to doping control, suggesting the need for a more precise, professionally tailored education approach.

In this chapter, the results of the published studies will be presented through a joint discussion, with the aim of integrating them into a unified theoretical–interpretive framework. Particular emphasis will be placed on the relationship between the legal aspects of anti-doping regulation

and attitudes towards doping, the effects of the educational program, the specific features of legal anti-doping knowledge across different participant groups, and the importance of legal and psychological factors in interpreting doping.

The primary theoretical framework guiding the interpretation of these findings is General Deterrence Theory. Its relevance to the dissertation lies in the assumption that knowledge of anti-doping rules, control procedures, and sanctions may inform athletes' and support personnel's assessments of the likelihood and consequences of rule violations, thereby potentially discouraging doping-related decisions. This theoretical rationale underpinned the expected preventive role of the LADEP intervention, while the studies directly assessed legal knowledge and doping tendency rather than the full set of perceived deterrence mechanisms (Johnson, 2019; Van Rooij, 2016; Verboon & van Dijke, 2012).

Accordingly, the following thematic units will be discussed below:

- Legal aspects of anti-doping regulation as a normative framework for understanding doping
- Effects of the educational program on athlete support personnel
- Results of the intervention study on athletes
- A unified legal–psychological model of doping based on the four studies
- Psychological theories of doping and the limitations of an exclusively legal approach
- Limitations and strengths

8.1 Legal aspects of anti-doping regulation as a normative framework for understanding doping

As already noted, legal aspects of anti-doping regulation have rarely been studied in previous research dealing with doping in sport. I consider that the legal aspects are an important but often neglected part of anti-doping policies. In this sense, the results of the studies conducted show that a higher level of knowledge of the anti-doping legal framework is associated with more pronounced negative attitudes towards doping (Muwonge et al., 2015). However, simply increasing knowledge through educational programs was not sufficient to change attitudes or reduce the inclination towards doping (Sinkovic, Pivalica, Jukic, Pehar, Pivalica, et al., 2026; Sinkovic et al., 2025). Such findings further emphasize the need for a more comprehensive approach that considers the anti-doping legal framework alongside psychological and social factors that shape participants' attitudes and behavior in sport.

In line with the normative approach to the anti-doping system, which derives from the World Anti-Doping Code and from national legal acts, knowledge of the rules, procedures, and sanctions constitutes the foundation of responsible participation in sport (World Anti-Doping Code). The first study showed that the developed instrument for assessing knowledge of the legal aspects of anti-doping regulation is a reliable tool for assessing understanding of anti-doping rules among athletes, with poorer knowledge of the legal aspects being associated with more tolerant attitudes towards doping (Stankovic et al., 2022). Athletes with lower scores on the questionnaire more often expressed neutral or permissive attitudes towards doping (Stankovic et al., 2022). At the same time, the results indicate the existence of at-risk groups — younger and less experienced athletes whose level of knowledge of the anti-doping legal framework is lower.

The second study also confirms the importance of the anti-doping legal framework while extending it beyond that perspective alone (Sinkovic, Pivalica, Jukic, Pehar, & Sekulic, 2026). The results of that paper showed that the adapted Q-LADR-ASP instrument is reliable and valid for assessing knowledge of the legal aspects of anti-doping regulation among members of athlete support

personnel. It was established that medical professionals achieve significantly better results than coaches and nutritionists, that the level of knowledge is higher among persons working at a higher level of sport, and that it is positively associated with prior experience in doping control situations. At the same time, no differences were found in relation to sex, which suggests that professional role, experience, and level of involvement in sport are more important predictors of legal anti-doping knowledge than basic demographic characteristics.

In the context of the legal system for combating doping, the principle of strict liability is particularly significant: it obliges athletes to be familiar with the rules and prohibited substances because every athlete is solely responsible for everything that is found in his or her body, regardless of how a particular substance entered the body and whether or not the athlete had any intention to cheat. Such a regulatory model presupposes a high level of individual responsibility but, at the same time, raises questions about procedural fairness if familiarity with the legal aspects of anti-doping regulation is not equal among athletes and support personnel. Therefore, results showing lower knowledge levels among younger, less experienced athletes further emphasize the need for systematic education focused on the anti-doping legal framework (Stankovic et al., 2022).

Within the framework of General Deterrence Theory, the knowledge gaps identified in the first two studies are relevant because accurate knowledge of testing procedures, obligations, and sanctions may be necessary for informed perceptions of anti-doping enforcement. However, an association between legal knowledge and doping-related attitudes in a cross-sectional study does not demonstrate that knowledge causes deterrence. In particular, the perceived probability of detection and the perceived severity or certainty of sanctions were not directly assessed; thus, these findings support the rationale for legally oriented education without establishing the proposed psychological mechanism (Johnson, 2019; Stankovic et al., 2022; Verboon & van Dijke, 2012).

8.2 Effects of the educational program on athlete support personnel

The fourth published paper examined the effects of an educational program directed at the legal aspects of anti-doping regulation among coaches and medical personnel (Sinkovic et al., 2025). The study's findings, which validated the measurement instrument, allow these results to be interpreted more specifically. Specifically, the validation work conducted with members of athlete support personnel confirmed that medical professionals have a higher level of knowledge than coaches and nutritionists, and that this level is greater among those working at higher levels of sport and with more experience in doping control.

The study found that after the education, participants' knowledge increased significantly, confirming the effectiveness of the educational model in conveying legal information (Sinkovic et al., 2025). The level of knowledge increased in both groups observed — both coaches and medical personnel — while in the control groups no comparable changes were recorded. The results also show that at the initial measurement, coaches had a lower level of knowledge than medical personnel, especially regarding the principle of strict liability, the scope of responsibility of support personnel, and procedural rights in anti-doping proceedings, which is why they had more room for improvement. At the same time, the higher initial level of knowledge among medical personnel can be linked to their professional education and greater exposure to medico-legal issues in everyday practice; nonetheless, the education led to additional, statistically significant improvement even in that group.

I believe the education provided was effective because of its structure, particularly because it was aimed at a specific legal area where lower levels of legal knowledge had been identified in earlier research. The educational content covered responsibilities and rights within the anti-doping system, the legal procedures of doping control, and the possible consequences of complicity, omissions, and failure to report. In addition, emphasis was placed on real examples from sport and sporting competitions, as well as on anti-doping testing, thereby linking the legal content to everyday situations in which coaches and medical personnel find themselves. The education was

conducted by educators with legal and sporting experience, including officials from the anti-doping system, who presented the complex content of anti-doping law through practical examples and everyday situations. It was probably for this reason that the education was effective at the cognitive level, as evidenced by the higher level of knowledge and better understanding of the legal aspects of anti-doping regulation that emerged after it.

However, despite increased knowledge levels, no statistically significant change occurred in attitudes towards doping (Sinkovic et al., 2025). This points to the limitations of the education provided, which was directed exclusively at the legal aspects of anti-doping regulation. In other words, although participants better understood the rules, sanctions, and procedural rights, this did not change their perception of doping. One possible explanation is that the intervention lasted relatively briefly, which was not enough to change already-formed attitudes towards doping, and that, even at the first testing, participants expressed predominantly negative attitudes towards doping, limiting the room for additional change. Such results suggest that attitudes towards doping among support personnel are not solely determined by legal knowledge but also by other factors, such as professional identity, sporting norms, organizational cultures, and personal value systems. Since the anti-doping code imposes legal responsibility on support personnel, this finding further underscores the need for educational models that integrate legal content with ethical and psychological approaches.

The findings concerning athlete support personnel can be further interpreted in relation to General Deterrence Theory. LADEP provided information about the responsibilities of coaches and medical professionals, the procedures through which anti-doping rule violations may be identified, and the consequences of non-compliance. Such information could theoretically shape assessments of enforcement and professional accountability. Nevertheless, the observed improvement in knowledge, without a corresponding change in doping tendency, indicates only that the cognitive educational objective was achieved; it does not establish whether participants' subjective perceptions of detection or sanctions changed. These perceptions would need to be measured directly in future research (Johnson, 2019; Sinkovic et al., 2025; Verboon & van Dijke, 2012).

8.3 Results of the intervention study on athletes

The third study examined the effects of education focused on the legal aspects of anti-doping regulation among elite athletes. The results show that the targeted educational intervention was effective in transferring legal anti-doping content, as the experimental group demonstrated a statistically significant increase in knowledge. The greatest progress was recorded in athletes in team sports, which can be explained by their lower initial level of legal anti-doping knowledge, that is, by the greater room for progress after the education. At the same time, the fact that the differences between athletes in team and individual sports could no longer be clearly distinguished at the final measurement suggests that education, to a certain extent, closed the initial knowledge gap between these groups (Sinkovic, Pivalica, Jukic, Pehar, Pivalica, et al., 2026).

The difference in knowledge levels between athletes in individual and team sports can be explained by differences in their exposure to the anti-doping system and in the sporting environment. Athletes in individual sports are more often subject to anti-doping testing and are therefore more often in direct contact with the procedural aspects of anti-doping, which, in itself, can serve as a form of informal legal education. In addition, in individual sports, relationships with the professional staff are often more direct and continuous, so information on doping and anti-doping rules is also more personalized. By contrast, in team sports, support is organisationally broader and more diffuse, and contacts with coaches and medical personnel can be less individualized, which can contribute to a lower initial level of legal knowledge but also to greater responsiveness to a targeted educational intervention. These explanations are plausible contextual interpretations rather than differences in testing exposure or support arrangements directly established by the present study; variation in legal anti-doping knowledge by sport and previous doping-control experience has been discussed in related research (Stankovic et al., 2022; Sinkovic, Pivalica, Jukic, Pehar, Pivalica, et al., 2026).

The effectiveness of the intervention among athletes should not be explained solely by the amount of information conveyed, but also by the way the education was designed. The educational program consisted of ten structured sessions focused on the rights and obligations of athletes under the World Anti-Doping Code and on the procedural aspects of doping control, including notification of testing, sample collection, documentation, appellate procedures, and disciplinary processes. Emphasis was placed on practical examples from sport, with athletes being actively involved, asking questions, and connecting the legal content with their own sporting experience. It was probably for this reason that a significant increase in knowledge was observed in the experimental group within a relatively short time (Sinkovic, Pivalica, Jukic, Pehar, Pivalica, et al., 2026).

However, despite increased knowledge, no change occurred in attitudes towards doping or in any reduction in doping inclination. This suggests that the education is effective for transferring legal information, but is not sufficient to change attitudes towards doping that are already deeply rooted. In other words, the third study partially refutes the simplified assumption that greater familiarity with the rules, sanctions, and procedural rights will, in itself, lead to a reduction in the inclination towards doping (Sinkovic, Pivalica, Jukic, Pehar, Pivalica, et al., 2026; Filleul et al., 2024).

There are several explanations for the findings obtained. First, the sample consisted of adult athletes at a high competitive level, whose attitudes, values, and decision-making patterns are already relatively stable. At that stage of a sporting career, attitudes towards ethically sensitive issues, including doping, are likely to be more resistant to changes induced by short-term educational interventions. Second, even at the initial measurement, more than 90% of the athletes expressed a negative attitude toward doping, indicating very limited room for further reduction. In such circumstances, even real changes can remain statistically invisible. The possibility of limited responsiveness among experienced athletes is an interpretation rather than a directly tested age effect; studies of more comprehensive interventions illustrate that doping-related attitudes can change in other athlete populations (Nicholls et al., 2020; Kavussanu et al., 2021). The baseline

distribution and lack of an observed intervention effect are reported in Sinkovic, Pivalica, Jukic, Pehar, Pivalica, et al. (2026).

More precisely, since doping is strongly stigmatized in elite sport, and the education was conducted by certified anti-doping officials and legal experts, some of the athletes may already at the initial measurement have expressed more pronounced negative attitudes than they actually hold. Such a combination of the moral sensitivity of the topic, the authority of the educators, and reputational risk is particularly important among elite athletes, who may be more cautious in expressing even slightly permissive attitudes towards doping. For that reason, the absence of a statistically significant association between knowledge and doping inclination does not necessarily mean that such an association does not exist; rather, it may reflect measurement limitations and sample characteristics. This potential social-desirability bias was not independently quantified in the present study and should therefore be treated as a methodological possibility, not a demonstrated explanation (Sinkovic, Pivalica, Jukic, Pehar, Pivalica, et al., 2026).

Therefore, the results should be interpreted cautiously and in context. Legal education proved effective in increasing anti-doping legal literacy, but not sufficient to change value-based and socially rooted orientations towards doping. This confirms the need for longer-term and multidimensional interventions that, alongside legal content, would include ethical reasoning, motivational factors, and broader socio-cultural influences on athletes' behavior. Precisely in this lies the wider contribution of the third paper, which shows that the legal framework is an important part of anti-doping education but that it evidently has limited potential as a mechanism for changing doping attitudes and inclinations among elite athletes (Filleul et al., 2024; Nicholls et al., 2020; Kavussanu et al., 2021).

From the perspective of General Deterrence Theory, the athlete intervention was expected to support doping prevention by improving understanding of anti-doping controls and the consequences of violations. The results, however, distinguish acquisition of legal information from a demonstrable deterrent effect: improved knowledge was not associated with a statistically

significant reduction in doping tendency. Because perceived detection probability and perceived sanction certainty or severity were not measured, this outcome should be interpreted as a limitation of the tested knowledge-based pathway, not as direct evidence against deterrence theory itself (Johnson, 2019; Sinkovic, Pivalica, Jukic, Pehar, Pivalica, et al., 2026; Verboon & van Dijke, 2012).

8.4 A unified legal–psychological model of doping based on the four studies

Considered as a whole, the results of all four studies point to a complex relationship between knowledge of the legal aspects of anti-doping regulation and attitudes towards doping. The results of the second study show that legal knowledge is not evenly distributed among support personnel; rather, it depends on professional role, level of sporting engagement, and experience with anti-doping procedures.

Unlike the results of the cross-sectional studies conducted, which show a statistically significant association between poorer knowledge of legal aspects and more permissive attitudes (Stankovic et al., 2022), the intervention studies show that an increase in knowledge does not necessarily lead to a change in attitudes towards doping or to a reduction in doping inclination (Sinkovic, Pivalica, Jukic, Pehar, Pivalica, et al., 2026; Sinkovic et al., 2025). This difference shows that, to understand doping, legal aspects alone are not enough; psychological factors must also be taken into account. The legal aspects of anti-doping regulation define rules, obligations, responsibilities, and sanctions, but how an individual interprets those rules depends on psychological factors. In other words, mere familiarity with anti-doping rules does not necessarily mean acceptance of them at the level of personal beliefs and values. The association between poorer knowledge and more permissive attitudes may indicate that persons with poorer knowledge of the legal framework simultaneously show a lower level of orientation towards norms and rules in general. However, when knowledge is subsequently increased through education, this need not automatically lead to

a change in already-formed attitudes, since these are also shaped by broader experiential, social, and motivational factors.

In this context, the perception of the legitimacy of the anti-doping system, social norms, and athletes' moral identity proves particularly important. If an athlete perceives the anti-doping rules as fair, consistent, and purposeful, there is a greater likelihood that he or she will internalize and accept them as an integral part of his or her own sporting identity. Conversely, if the rules are perceived as imposed, selectively applied, or remote from everyday sporting reality, an increase in knowledge may remain limited to the cognitive level, with no effect on the athlete's attitudes or actual intentions regarding doping behavior. Likewise, attitudes towards doping are shaped by the sporting environment, team culture, expectations of coaches and peers, and personal moral beliefs about fairness, success, and permissible means of achieving results. For this reason, the relationship between knowledge and attitudes cannot be interpreted linearly, but as the result of an interaction of legal, psychological, and social processes.

Accordingly, the integrated model proposed in this dissertation should be understood as a conceptual framework rather than a fully tested causal model. General Deterrence Theory provides its principal explanatory starting point: legal anti-doping knowledge may inform perceived enforcement risks and consequences, which could in turn influence doping-related orientations. The four studies empirically examined legal knowledge, selected participant characteristics, self-reported doping tendency, and educational changes in knowledge, but did not directly test these intermediate perceptions or actual doping behaviour. The additional social and psychological factors discussed here therefore represent plausible complementary influences that require direct examination in subsequent studies (Johnson, 2019; Verboon & van Dijke, 2012).

The distinction between legal knowledge and applied anti-doping literacy also helps contextualize the intervention findings. The absence of a statistically significant change in doping tendency despite gains in legal knowledge does not establish that broader competencies would have changed the outcome; rather, it highlights an area for future research. Subsequent versions of LADEP could

assess decision-making skills, perceived legitimacy, and the ability to respond to sport-specific doping pressure, alongside deterrence-related perceptions (Blank et al., 2022; Petróczi & Boardley, 2022).

8.5 Psychological theories of doping and the limitations of an exclusively legal approach

The findings of this dissertation are interpreted primarily in relation to General Deterrence Theory, which informed the expected preventive role of legally oriented anti-doping education (Johnson, 2019; Van Rooij, 2016; Verboon & van Dijke, 2012). The intervention was expected to enhance understanding of anti-doping rules, control procedures and sanctions, with the possibility that better-informed assessments of enforcement and consequences would be associated with less favourable doping attitudes and lower doping tendency.

Although legal anti-doping knowledge improved significantly, a statistically significant association between increased knowledge and reduced doping tendency was not established (Sinkovic et al., 2026). This finding indicates that information about rules and sanctions alone may not be sufficient to change doping-related orientations. Deterrence Theory places particular emphasis on perceived likelihood of detection and perceived consequences, yet neither of these perceptions was directly measured in the present studies. Consequently, the findings partially support the proposed hypothesis, as the educational intervention led to a statistically significant increase in knowledge of the legal aspects of anti-doping regulations, but no statistically significant association was established between increased knowledge and reduced doping tendency.

Although it was expected that a better understanding of the legal aspects of anti-doping regulation would reduce doping inclination and change attitudes towards doping, the results obtained refuted this assumption. The educational program conducted with athletes increased knowledge of the legal aspects of anti-doping regulation but did not lead to a significant change in attitudes towards doping (Sinkovic, Pivalica, Jukic, Pehar, Pivalica, et al., 2026). Similar results were obtained for

coaches and medical personnel (Sinkovic et al., 2025). It follows that education focused on legal content is effective at the cognitive level, since it leads to a better understanding of anti-doping rules, procedural rights and responsibilities, but is not sufficient to change deeply rooted attitudes towards doping. This points to the limitations of the deterrence model, which holds that information about rules and sanctions should, in itself, be sufficient to reduce deviant behavior.

The results of this dissertation can be partly viewed in the light of procedural justice theory (Star & Kelly, 2022). According to this theory, acceptance of anti-doping rules depends on athletes' perception that the testing, investigation, and decision-making procedures are fair, transparent, and consistent. When an athlete perceives the anti-doping rules as procedurally fair, there is a greater likelihood that he or she will accept them and consider them correct. Specifically, the results of the third paper show that, after education, athletes have a better understanding of the rules, procedures, and rights in the anti-doping system, but this in itself was not sufficient to change doping inclination. This may suggest that perceptions of the fairness of the anti-doping system do not stem solely from being informed, but also from a broader experience of its legitimacy. In other words, an athlete may be well acquainted with the right of appeal, the principle of strict liability, and the procedural steps of doping control, yet not internalize anti-doping norms if he or she does not experience the system as consistent, transparent, and fair. In this sense, the findings of this dissertation suggest that the perception of the legitimacy of the anti-doping system may mediate the relationship between knowledge and attitudes towards doping.

Previous research indicates that increasing anti-doping knowledge does not necessarily change doping-related attitudes or intentions. However, interventions incorporating psychological, social, and practical components have demonstrated more promising outcomes. For example, the iPlayClean programme reduced favourable attitudes towards doping (Nicholls et al., 2020), while the ATLAS programme integrated education, peer involvement, and resistance skills (Goldberg et al., 1996). Similarly, interventions addressing moral reasoning have reduced doping likelihood (Kavussanu et al., 2021). Nevertheless, systematic reviews highlight variability in intervention

effectiveness and the sustainability of outcomes (Filleul et al., 2024; Reynoso-Sánchez et al., 2025).

These findings help explain the results of the present dissertation. LADEP primarily focused on legal anti-doping knowledge, including rules, testing procedures, rights, and sanctions. Although interactive methods were employed, the programme did not systematically address broader psychological determinants of doping attitudes. Consequently, improvements in knowledge without corresponding changes in doping tendency suggest limitations of a predominantly legal educational approach rather than the ineffectiveness of anti-doping education in general.

From the perspective of General Deterrence Theory, future interventions should address perceived detection probability and the certainty and severity of sanctions, rather than assuming that legal knowledge automatically changes these perceptions. However, these deterrence-related perceptions were not directly measured in the present studies. Integrating moral dilemmas, peer discussions, resistance skills, and repeated educational sessions could further strengthen LADEP's potential to influence doping-related attitudes and intentions, although these effects require empirical evaluation (Filleul et al., 2024; Kavussanu et al., 2021; Reynoso-Sánchez et al., 2025).

The results can also be considered within the framework of the theory of planned behavior (Ajzen, 1991), which seeks to explain how and why people make decisions about behavior, especially when these are intentional behaviors under cognitive control. According to this theory, intention is the main predictor of actual behavior, and numerous studies confirm that athletes with positive attitudes towards doping, who perceive support from those around them and have access to means, show a greater likelihood of using doping (Lucidi et al., 2004). The first study showed that poorer familiarity with the legal aspects of anti-doping regulation is associated with more permissive attitudes towards doping, suggesting that knowledge is an important element in the formation of attitudes. However, the intervention studies showed that changing this individual factor was not sufficient to alter doping inclination. Such a finding is consistent with the assumption that attitudes towards doping are not formed solely on the basis of information, but are also influenced by

subjective norms and perceived behavioral control. In a sporting environment in which coaches, medical personnel, teammates, sport culture, and result-oriented pressures play an important role, legal education can increase knowledge but need not be sufficient to change the broader normative framework within which the athlete makes decisions. The same applies to support personnel, in whom professional culture and organizational patterns can strongly influence attitudes towards doping, regardless of the level of familiarity with the legal framework.

An additional interpretive framework is provided by self-determination theory (Deci & Ryan, 1985). Self-determination theory emphasizes the importance of satisfying three basic psychological needs (autonomy, competence, and relatedness), which are universal and key to optimal functioning, well-being, and motivation. According to this theory, athletes who are autonomously motivated think less about doping, while controlled forms of motivation can increase the inclination towards such behavior. Controlled motivation (e.g., fear of failure, pressure from coaches) is associated with a greater inclination towards doping, whereas autonomous motivation (e.g., personal development, love for the sport) is associated with a lower readiness to use doping (Ring & Kavussanu, 2018). After the education, the participants thus had a higher level of knowledge, but this knowledge did not necessarily become part of their value system. For this reason, alongside legal content, educational programs should also include a psychological and value-based component.

The most direct link with the results of this dissertation is provided by social cognitive theory, especially the concept of moral disengagement (Bandura, 1991). This theory emphasizes internal (cognitive) mechanisms, especially how people process information and make decisions by observing others, whereas social learning theory emphasizes learning through modeling. In the discussion of the fourth paper, it was emphasized that doping inclinations are influenced by sport-specific culture, perceived prevalence of doping, level of competition, and individual patterns of moral reasoning, while the third paper shows that even among elite athletes, an increase in legal knowledge was not associated with a reduction in doping inclination. Such findings suggest that participants can be well acquainted with anti-doping rules and yet retain patterns of thought that

relativize their meaning. If an athlete or a member of support personnel rationalizes doping as usual in sport, necessary for success, or a consequence of an unfair system, then legal education remains limited to the level of information. It is precisely for this reason that this dissertation shows that the relationship between legal knowledge and attitudes towards doping is not linear: the legal framework is important, but its effect depends on how the individual interprets it within his or her own moral beliefs, sporting experience, and social environment.

8.6 Limitations and strengths

There are several important limitations of this thesis.

First, the generalizability of the findings is limited by the characteristics of the investigated samples. The studies were conducted among athletes and athlete support personnel from a relatively small number of countries in Southeastern Europe, primarily Croatia and neighbouring countries. Consequently, the findings cannot necessarily be generalized to other sociocultural environments and countries.

Second, the cross-sectional design of the two studies evaluating legal anti-doping knowledge and the validity of newly developed measurement instruments did not allow causal relationships to be established. Although associations between legal knowledge, sporting characteristics, and doping-related attitudes were identified, these findings cannot determine whether greater knowledge directly contributes to less favourable attitudes towards doping. Furthermore, the studies did not comprehensively assess all potential confounding variables, including socioeconomic characteristics, family influences, educational background, and previous exposure to formal or informal anti-doping education.

Third, although the applied questionnaires demonstrated acceptable reliability and validity, their focus was primarily on selected legal aspects of anti-doping regulations. Consequently, they may

not fully capture the complexity of legal competence or the broader psychological and social determinants of doping behaviour. Additionally, doping tendency was assessed through self-reported responses and, in the intervention studies, categorized into negative versus neutral or positive tendencies. This simplified classification may have reduced measurement sensitivity, particularly because most participants initially expressed strongly negative doping tendencies. Also, the socially sensitive nature of doping may have encouraged socially desirable responses rather than completely accurate reporting of participants' beliefs.

Fourth, the educational interventions were relatively short and primarily focused on increasing legal anti-doping knowledge. The limited intervention duration, the established attitudes of experienced participants, and the predominantly cognitive orientation of the educational content may have restricted the potential for deeper attitudinal changes. Moreover, the involvement of anti-doping authorities and legal experts in delivering educational sessions may have influenced participants' responses through perceived authority or social desirability.

Finally, the research did not directly assess actual doping behaviour or all psychological mechanisms proposed by General Deterrence Theory, particularly the perceived probability of detection and the perceived severity of sanctions. Therefore, the findings do not allow definitive conclusions regarding whether increased legal knowledge influences these deterrence mechanisms or subsequently reduces doping behaviour.

Despite these limitations, this dissertation has several important strengths. First, it integrates findings from four published scientific studies, providing a comprehensive examination of legal anti-doping knowledge, doping-related attitudes, and the effects of educational interventions among both athletes and athlete support personnel. By including different participant groups, the dissertation offers a broader understanding of legal anti-doping knowledge and its relevance across professional roles and sporting environments.

Second, an important methodological strength is the development, adaptation, and validation of measurement instruments designed to assess knowledge of the legal aspects of anti-doping

regulations. These instruments provide a basis for identifying knowledge gaps and evaluating educational needs among athletes and athlete support personnel, thereby contributing to future research and the development of targeted anti-doping education.

Third, the dissertation combines cross-sectional studies with controlled educational intervention studies, allowing the examination of both associations between legal knowledge and doping-related attitudes and changes in knowledge following structured education. The inclusion of experimental and control groups strengthens the evaluation of the LADEP programme, while its application among athletes and athlete support personnel provides evidence of its effectiveness in improving legal anti-doping knowledge across different populations.

Finally, the dissertation makes a theoretical and practical contribution by examining legal anti-doping education primarily within the framework of General Deterrence Theory. Although the proposed deterrence-related psychological mechanisms were not directly measured, the findings clarify the distinction between improving legal knowledge and influencing doping tendency. This distinction is particularly relevant for developing future educational interventions that combine legal information with psychological, ethical, and decision-making components.

9 Conclusion

9.1 General conclusions

The main purpose of this dissertation is to examine the relationship between knowledge of the legal aspects of anti-doping regulation and attitudes towards doping among participants in sport. In addition, it aimed to develop and evaluate a targeted educational program to analyze changes in legal knowledge and attitudes towards doping before and after the education. From the presented results, it is clear that integrating the four papers contributes to a certain extent to understanding doping as a phenomenon situated at the intersection of legal norms, psychological processes, and the social context of sport.

The results of the first study showed that the developed instrument for assessing knowledge of the legal aspects of anti-doping regulation is a reliable and valid tool for professional athletes, and that poorer knowledge of these aspects correlates with more permissive attitudes towards doping (Stankovic et al., 2022). This finding confirms the importance of normative understanding of anti-doping rules and procedures as part of preventive strategies. At the same time, it points to the need for systematic educational programs to ensure that athletes understand the legal consequences of their decisions within the anti-doping system.

The results of the second study show that the adapted Q-LADR-ASP questionnaire is also a reliable and valid instrument for assessing knowledge of the legal aspects of anti-doping regulation among members of athlete support personnel (Sinkovic, Pivalica, Jukic, Pehar, & Sekulic, 2026). The results showed that a higher level of legal knowledge was recorded among medical personnel and persons involved in high-level sport, indicating that professional status and experience do influence understanding of anti-doping rules. As stated in the previous study, this adapted measurement instrument can also contribute to the development of targeted educational programs, to a better understanding of anti-doping rules, and to a reduction of unintentional violations of anti-

doping rules among athletes and their support personnel (Sinkovic, Pivalica, Jukic, Pehar, & Sekulic, 2026).

The third and fourth studies extend this perspective by analyzing the effects of educational interventions on athletes, coaches, and medical personnel. The results show that education focused on the legal aspects of anti-doping regulation significantly increases knowledge levels but does not necessarily change attitudes towards doping (Sinkovic, Pivalica, Jukic, Pehar, Pivalica, et al., 2026; Sinkovic et al., 2025). This result has important theoretical and practical significance because it shows that the legal framework is important but, in itself, insufficient to change behavioral intentions.

Presenting the results through psychological theories of doping makes it clear that attitudes towards doping are not determined solely by the level of being informed about legal rules, but also by a series of psychological factors. The theory of planned behavior, social cognitive theory, and the concept of moral disengagement emphasize the importance of social norms, perceptions of system legitimacy, and personal values in shaping behavior. It follows that the legal aspects of anti-doping regulation serve as a statutory framework, but their effectiveness depends on how participants interpret and adopt those rules.

Particularly interesting is the finding that education targeted at coaches and medical personnel did not lead to changes in attitudes despite increased knowledge (Sinkovic et al., 2025). This result is especially important because the Criminal Code provides for criminal liability for anyone who induces another person, or gives them substances prohibited in sport to use, which is why it is not enough for educational programmes in which members of support personnel participate to be focused exclusively on the transfer of information; they also need to focus on the development of professional ethics and responsibility, since it has been shown that coaches and medical personnel have a key role in the prevention of doping.

By correlating the results of all four papers, it is possible to propose a unified model of doping that, in addition to the legal aspects of anti-doping regulation, includes perceptions of procedural

justice, the legitimacy of the system, and the intrinsic motivation to comply with rules. It follows that an effective anti-doping policy is not only the result of a strict normative framework but also depends on the perception of its fairness and transparency.

The dissertation points to the need to develop multidisciplinary educational programs that, in addition to legal content, include psychological and ethical content. It is not enough for participants in sport to be informed during educational programs only about legal rules; rather, it is important how they interpret and internalize those rules. For this reason, the legitimacy of the anti-doping system and its institutions is important, as participants are more likely to accept anti-doping norms when they perceive the system as consistent, transparent, and fair, which can ultimately lead to a change in attitudes towards doping and a reduction in doping inclination.

9.2 Significance of the results for improving the anti-doping system and educational practices

The dissertation's results suggest the need to redefine educational strategies in the field of anti-doping. Education focused exclusively on the legal aspects of anti-doping regulation has proved effective in increasing knowledge, but not sufficient to change attitudes towards doping. This means that future educational models should not remain limited to the transmission of information about rules, sanctions, and procedures; rather, they should be linked to the psychological and value-based components that shape athletes' and support personnel's actual decisions. Particular attention should be directed at groups in which a lower initial level of legal anti-doping literacy has been observed, since it is precisely in their case that there is the greatest room for educational progress.

First and foremost, particular attention should be devoted to younger and less experienced athletes, since the first study showed that they have a lower level of knowledge of the anti-doping legal framework. In their case, education should begin earlier in the sporting career, before attitudes and behavioral patterns become stabilized. Such education should not be a one-off event but be

developmentally tailored and repeated across different stages of sporting progression, so that legal rules can gradually be linked to the athlete's personal responsibility and identity. In this way, legal education could be used not only as an informational tool but also as part of the early prevention of permissive attitudes towards doping.

In addition, the third paper's findings show that particular attention should be paid to athletes in team sports. Among them, a lower initial level of legal anti-doping knowledge was recorded, along with greater progress after the education, suggesting that this group has a particularly pronounced need for targeted educational programs. Such a pattern is probably linked to the rarer anti-doping testing in team sports and to the lesser individualization of relationships with the professional staff, which is why athletes in those sports are less often directly exposed to the procedural aspects of the anti-doping system. In practical terms, this means that, in team sports, it is necessary to introduce more systematic, structured legal education within clubs and national-team programs, rather than relying on occasional contact with anti-doping procedures.

Regarding support personnel, the second and fourth papers find that educational interventions are particularly important for coaches. It was precisely the coaches who, at the initial measurement, showed a lower level of legal anti-doping knowledge than medical personnel, especially on questions of strict liability, the scope of responsibility of support personnel, and procedural rights in disciplinary proceedings. Since athletes often rely on coaches as their main source of information about doping, insufficient legal knowledge among coaches poses a particular risk not only for them but also for the athletes they direct. For this reason, coach education should be a mandatory, regularly renewed part of licensing and professional development, with an emphasis on practical situations from everyday training.

Although the medical personnel showed a higher initial level of knowledge, the findings also confirm that, even in their case, the education led to additional improvement. This is particularly important because doctors and physiotherapists not only participate in the treatment and recovery of athletes but also in decisions on therapy, supplementation, and medical documentation, that is,

in areas in which the legal and ethical aspects of anti-doping have direct consequences. For this group, education should focus not only on basic rules but also on more complex questions of professional responsibility, the protection of athletes' procedural rights, and the recognition of situations in which an inadvertent error can lead to a violation of anti-doping rules. In this sense, for medical personnel, particularly important is content that links the legal framework with clinical practice and with the responsibility for making medical decisions.

The dissertation's findings also indicate that educational programs should include the analysis of real cases of anti-doping rule violations. In both intervention papers, it was shown that real examples, case studies, and interactive discussion were likely an important factor in the successful increase in knowledge, as they enabled participants to link abstract legal norms with concrete sporting situations. Such an approach is particularly useful for both athletes and support personnel, since it helps to understand not only what the rules prescribe but also how they are applied in everyday practice, including situations of unintentional omissions, joint responsibility, and procedural errors. It is precisely for this reason that future programs should not remain confined to the declarative presentation of rules; rather, they should systematically use real anti-doping cases to develop legal reasoning.

It is equally important that the education include a discussion of procedural justice. The results of the third paper show that a better understanding of the rules and procedures did not automatically lead to a change in doping inclination, suggesting that mere information alone is not sufficient if participants do not perceive the anti-doping system as legitimate and fair. For this reason, educational programs should openly address questions such as the right of appeal, the proportionality of sanctions, the transparency of the procedure, and the protection of athletes' rights during doping control. This is particularly important for elite athletes, who, through their own experience of testing and competitive pressures, shape a personal experience of the anti-doping system and of its legitimacy.

Furthermore, the results indicate the need for the development of moral reasoning and value-based identity to be systematically included in educational programs. Since the increase in knowledge was not associated with a change in doping inclination among athletes or support personnel, it is evident that legal education does not sufficiently address the mechanisms linked to the moral justification of doping, sporting culture, and the personal value system. This is particularly important among adult and experienced athletes, in whom attitudes are likely already stabilized, as well as among coaches and doctors, whose professional identity strongly influences the messages they transmit to athletes. In this sense, anti-doping education should, alongside legal knowledge, also develop the ability to recognize doping rationalizations, to think critically about sporting norms, and to adopt the values of fair sport as a personal and professional standard.

Finally, the dissertation's findings suggest that the most effective approach would be a multi-level model of education in which action is taken simultaneously with athletes and their immediate environment. Since coaches and medical personnel are among the main sources of information about doping, education focused solely on athletes cannot be sufficient if their support networks are not strengthened at the same time. This is particularly important in team sports, where relations with the professional staff are organisationally broader and less individualized, so there is a greater risk that legal knowledge and responsibilities will be "dispersed" among several persons. Future anti-doping strategies should therefore link individual education of athletes, mandatory education of coaches and medical personnel, and club and federation policies that consistently support a culture of clean sport.

9.3 Review of the hypotheses

In relation to the hypotheses set out, the dissertation results allow confirmation or rejection of some of them, depending on the group examined and the type of relationship analyzed.

The first hypothesis (H1), which posited that a higher level of knowledge of anti-doping rules will be statistically significantly and positively associated with negative attitudes towards doping, was confirmed in the part relating to elite athletes. The results of the first study showed that poorer knowledge of the legal aspects of anti-doping regulation is associated with more permissive attitudes towards doping, that is, that a higher level of knowledge is associated with less tolerant attitudes towards doping among professional athletes (Stankovic, Sinkovic et al. 2022). This confirmed that legal anti-doping literacy can have an important role in shaping attitudes towards doping in this population.

On the other hand, the first hypothesis was not confirmed among coaches and healthcare personnel. Although the intervention studies showed that education statistically significantly increases knowledge of the legal aspects of anti-doping regulation, it was not confirmed that this increase in knowledge also leads to more negative attitudes towards doping. H1 may therefore be considered partially confirmed, exclusively in relation to elite athletes, while for coaches and medical personnel, it did not receive sufficient empirical support.

The second hypothesis (H2), which posited that educational programs on anti-doping rules will statistically significantly reduce positive attitudes towards doping among elite athletes, coaches, and healthcare professionals, was not confirmed. Although the second and third studies showed that the educational programs effectively increase the level of knowledge of anti-doping rules, no statistically significant change in attitudes towards doping after the education was recorded either among the athletes or among the coaches and medical personnel (Sinkovic, Pivalica et al. 2025, Sinkovic, Pivalica et al. 2026). In this sense, the second hypothesis must be considered rejected for all three groups observed.

An outcome of the testing of the hypotheses further confirms the dissertation's basic conclusion that the relationship between legal knowledge and attitudes towards doping is not linear. Although a higher level of knowledge is, in certain circumstances, associated with more negative attitudes towards doping, an increase in knowledge alone was not sufficient to change attitudes through

educational interventions. This shows that the legal aspects of anti-doping regulation represent an important but not self-sufficient factor in the prevention of doping, and that their effectiveness depends on their interaction with psychological, social, and value-based factors.

In conclusion, this dissertation confirms that the legal aspects of anti-doping regulation are an important but insufficient factor in preventing doping. Their effectiveness depends on integration with psychological theories and with the social context of sport. Thereby, the dissertation's contribution lies in developing an interdisciplinary approach that links sport regulation, the psychology of doping, and educational strategies, offering guidelines for the further development of anti-doping policy and practice.

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