Descriptive Cross-Sectional Assessment of Pharmacists' Knowledge and Involvement in Anti-Doping Initiatives in Sports in Albayda, Libya

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Abstract—**The World Anti-Doping Agency (WADA) reports that doping cases are continuously rising and the misuse of performance-enhancing drugs (PEDs) continues to be a significant issue globally. A large percentage of unintentional doping incidents are caused by athletes' ignorance of the substances they use. Healthcare professionals, including pharmacists, are crucial in reducing the possibility of accidental doping, even though athletes are ultimately accountable for the substances they take. The purpose of this study was to evaluate the pharmacists' knowledge, attitudes, and perceptions on doping and anti-doping in sports. A descriptive cross-sectional study was conducted involving 200 pharmacists in Albayda, Libya. A standardized 15-item questionnaire was used to collect data in order to evaluate pharmacists' knowledge and opinions regarding doping and anti-doping. Our findings revealed that only 7% of pharmacists were familiar with the term "doping," and a mere** 1% **had previously attended any formal trainings or lectures on the topic. Nevertheless, a significant majority (89%) concurred that utilizing banned substances in sports is both unethical and unjust. The awareness regarding the potential presence of prohibited substances in over-the-counter (OTC) medications and dietary supplements was limited to 22%. Additionally, merely 1% of the participants recognized the International Pharmaceutical Federation's (FIP) official position concerning the involvement of pharmacists in anti-doping efforts. On a positive note, 90% of the participants indicated a strong desire to undergo formal training in the area of anti-doping, while 75% favored the development of sports pharmacy as a specialized discipline. These findings highlight a critical need for improved anti-doping education within pharmacy training programs to properly equip future pharmacists for their responsibilities in promoting clean and ethical sports.**

Keywords—**Performance-Enhancing Drugs (PEDs), World Anti-Doping Agency (WADA), Pharmacists, Doping, Anti-Doping.**

I. INTRODUCTION

Doping is a common issue that has continued for over a century in different sports [1,2]. Athletes have been found using various PEDs, including anabolic steroids, stimulants, human growth hormone, and genetic modification techniques called gene doping [3-5]. National and international regulatory agencies have recently shifted their focus from only recognizing drug usage to also understanding the attitudes and practices that contribute to it, despite the fact that many athletes have been found taking these substances. [6,7]. At a professional level, athletes may turn to substances to expedite recovery, manage injuries, or gain a competitive edge [8,9]. As reported by WADA, the percentage of adverse analytical findings (AAF) rose from 0.66% in 2020 to 0.75% in 2021 [10,11]. This uptick implies a rise in instances of doping [12]. Doping is defined by the World Anti-Doping Code (WADC) as one or more violations of anti-doping regulations, such as the presence of prohibited substances in an athlete's sample or assistance in breaking these rules [13]. Doping is becoming more complex, involving not only drugs but also mechanical aids and biological manipulation. It is now viewed as a major public health issue. Governments and sports organizations are investing heavily in scientific research, improved drug detection methods, education programs, stricter policies, and tougher penalties to tackle the problem [14-16]. However, the prevalence of PEDs remains a significant issue in sports [17]. Doping violations can be intentional or accidental. For instance, at the 2000 Sydney Olympics, an athlete tested positive because a team doctor unknowingly administered a common cold medication that included a prohibited substance [18]. One of the main causes of unintentional doping is athletes' frequent ignorance of the substances they are taking [19]. Healthcare providers, particularly pharmacists, have a significant role to play in preventing unintentional doping, even if athletes are ultimately accountable for their diet. Providing evidence-based advice and teaching athletes how to use medications safely can help reduce the risks of doping. They can assist a range of individuals—from casual gym-goers to elite athletes—by advising them on supplement safety and compliance with anti-doping regulations. In fact, the FIP issued guidelines in 2005 outlining how pharmacists can help combat doping in sports. It's interesting to note that professional sports are not the only arena where performance- and image-enhancing substances are abused. While between 1 and 3 million Americans and 50,000 to 100,000 Swedes have used anabolic steroids, about 2.8 million athletes in the US have used ephedrine as a stimulant [20]. However, research indicates that a large number of community pharmacists are still undertrained to advise athletes on how to use drugs safely during sporting events [21,22]. One possible reason for this is that pharmacy education often does not include specialized training on doping-related topics. Sports pharmacy training is becoming more and more necessary in India that promotes sports, in order to assist athlete safety and

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global health [23]. Pharmacy schools ought to consider adding sports pharmacy to their courses in order to meet this need. Providing education at the undergraduate level can considerably boost pharmacy students' understanding of doping and raise their awareness of the ethical and health problems related with sports. For example, the advanced pharmacy practice experience program at the University of California helps students gain confidence in handling drug testing procedures and better understand doping-related challenges [24]. Pharmacists are uniquely qualified to support anti-doping efforts because they are trained to manage drug records and stay up-to-date on lists of banned substances [25-27]. Consequently, the purpose of this study was to evaluate the pharmacists' knowledge, attitudes, and perceptions regarding doping and anti-doping in sports in Albayda, Libya.

II. METHODS

This descriptive cross-sectional study was conducted between January and August 2025 in Albayda, Libya, specifically involving pharmacists residing or working in the area. The study population comprised graduated pharmacy students, including those who hold a Bachelor of Pharmacy (BPharm) or Master of Pharmacy (MPharm) degree. A total of 200 participants were included. Eligibility criteria required that participants voluntarily consent to take part in the study. The dependent variables included the participants' knowledge, attitudes, and perceptions of doping and anti-doping measures. The independent variables included the socio-demographic characteristics of the participants. A standardized, self-administered questionnaire was used to gather data for a cross-sectional survey. A 15-item instrument was designed following an extensive literature review focusing on the knowledge, attitudes, and perceptions of pharmacists, pharmacy students, and other healthcare professionals regarding doping in sports. Following collection, the data was coded and transferred into Microsoft Office's Excel for analysis. The questionnaire was organized into three core domains: knowledge regarding doping and banned substances, attitudes on anti-doping education and training, and perceptions about the role of sports pharmacists. The purpose of this questionnaire was to evaluate the participants' knowledge of banned substances. The first three questions collected socio-demographic data, including age, gender, and academic background. The remaining twelve questions explored the participants' comprehension of the concept of doping, their views on doping in sports, and their perception of how increased awareness and education may help reduce doping practices. Questionnaires were distributed directly to pharmacists, with follow-up reminders sent to ensure completion. Participants received complete information regarding the objectives of the study and were guaranteed that their participation would be voluntary, anonymous, and confidential. Only those who gave informed consent were considered for the final analysis. All 200 of the distributed questionnaires were filled out and returned to the researchers. The majority of participants held a Bachelor of Pharmacy degree (n = 189; 90%), while the remainder held other qualifications (n = 11; 10%). All participants were between the ages of 25 and 30 years.

III. RESULTS

A total of 200 pharmacists successfully completed the questionnaire, yielding a 100% response rate. The participants' sociodemographic characteristics, as well as their involvement with and perspectives on anti-doping practices, are presented in Table 1. This table provides a detailed overview of the participants' backgrounds and highlights their potential roles in supporting anti-doping efforts within the pharmacy profession.

Table 1: Socio-demographic characteristics of the participants.

Variables		Frequency (n = 200)	Percentage (%)
Age	≥ 25	120	75
	< 25	80	25
Gender	Male	140	78
	Female	60	22
Academic Background	BPharm	189	90
	Other	11	10

Among the 200 participants, 78% were males, while 22% were females. Just 7% of participants said they were familiar with the term "doping," and only 1% said they had previously attended a lecture or seminar on the topic. The vast majority (99%) had not received any formal education or training related to doping. 89% of the participants believed that it was unfair and illegal for athletes to use prohibited substances to improve their performance. While 22% of participants knew that OTC medications and dietary supplements may include prohibited substances, a 11% were unaware that ingredient listings on nutritional supplements might not disclose their presence. Regarding professional awareness, only 1% of pharmacists were familiar with the FIP statement on the role of pharmacists in anti-doping, while 99% had no prior knowledge of this. However, 98% of the participants agreed that pharmacists should take an active role in creating anti-doping regulations for sports. Furthermore, 90% indicated that they would be interested in receiving training on doping and anti-doping topics. 75% of the participants supported the idea of making sports pharmacy a distinct field of practice. The attitudes and perceptions of pharmacists toward doping and their professional responsibilities in this domain are summarized in Table 2.

Table 2: Analysis of pharmacists' attitudes and perceptions regarding doping and anti-doping concerns.

Questions	Yes	No
Are you familiar with the concept of doping in sports?	7%	93%
Did you attend any doping-related educational programs?	1%	99%

Are you aware of the International Pharmaceutical Federation (FIP) statement on the pharmacist's role in anti-doping?	1%	99%
Do you know about the concept of Therapeutic Use Exemptions (TUEs)?	11%	89%
Did you know that OTC medications and dietary supplements might contain prohibited substances?	22%	78%
Is it fair for athletes to use banned substances to enhance performance?	89%	11%
Do you believe athletes should never be allowed to use prohibited substances for legitimate medical treatment?	45%	55%
Do you believe pharmacists have a crucial role in sports pharmacy?	89%	11%
Are you interested in receiving formal training on anti-doping practices?	90%	10%
Are you interested in developing a career in sports pharmacy?	75%	25%

Table 3: WADA-banned substances recognized by the pharmacists.

WADA Banned Substances	Frequency (n = 200)	Percentage (%)
Ibuprofen	30	15
Dexamethasone	11	3
Acetazolamide	45	22
Terbutaline	20	12
Methylprednisolone	34	16
Levosalbutamol	20	12
All the above	40	20

As shown in Table 3 above, only 20% of pharmacists correctly identified WADA-banned substances. Among the healthcare and support professionals considered appropriate advisors on the use of drugs and supplements in sports, nutritionists were most frequently recognized as correctly identifying WADA-banned substances (42 responses). Other professionals identified included coaches and trainers (38 responses), pharmacists (38 responses), doctors (26 responses), and nutritionists (22 responses). The remaining participants were unable to accurately identify banned substances as defined by WADA. These distributions are illustrated in Figure 1.

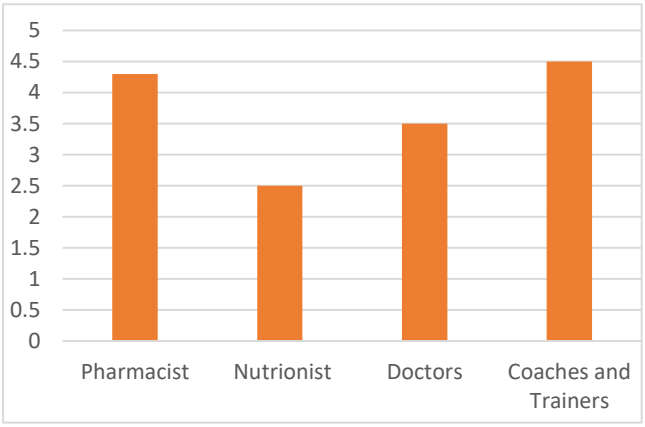

Figure 1: Pharmacists' responses regarding which professionals should receive guidelines on the use of medications and dietary supplements in sports.

IV. DISCUSSION

This study aimed to evaluate the pharmacists' knowledge, attitudes, and perceptions regarding doping and anti-doping in sports. Future pharmacists are in a unique position to offer vital guidance on how athletes should safely take medications and dietary supplements [28,29]. The study's findings indicate that most pharmacists only vaguely understood the term "doping," and only a small portion had attended formal training sessions on the topic. Comparable findings were found in a similar study in Japan, where most pharmacy students had only heard of doping. Although pharmacy curricula often cover both the therapeutic benefits and adverse effects of medications [30], students struggle to distinguish these drugs based on their potential for doping. Results from research in Syria and other countries have shown that a large percentage of participants could not correctly identify substances that are prohibited by WADA [31-34]. While most participants were aware that OTC medications and dietary supplements may contain banned substances, many were unaware that these substances might not always be explicitly disclosed on product labels [35]. Notably, 94% of the participants reported unawareness regarding the presence of banned compounds in OTC products It is crucial to include this information in pharmacy education since pharmacists' ignorance could unintentionally hurt athletes. In addition to athletes using banned substances or techniques, doping also includes the actions of anyone who helps, promotes, facilitates, hides, or otherwise supports doping infractions, including any kind of international cooperation intended to violate anti-doping regulations. Thus, pharmacists who have received specialized anti-doping training and have the requisite knowledge are well-positioned to significantly contribute to doping prevention [36]. Research indicates that just 45% of South African general practitioners (GPs) and pharmacists are aware of the country's initiatives to prevent doping in sports [37,38]. Medical personnel occasionally fail to stay current on the constantly changing list of banned drugs despite the fact that this information is easily accessible. Furthermore, fewer than one-quarter of practitioners said they were familiar with the conventional drug testing protocols used in South Africa for athlete biological samples [39]. Pharmacists are more likely than GPs to possess the latest WADA Prohibited List, with only 39% of GPs reporting possession of this resource [40]. Universities should incorporate thorough doping-related topics into their curricula in light of these findings, using

dynamic teaching techniques to increase pharmacy students' interest and comprehension. According to the current study, pharmacy students showed a modest level of awareness with an overall anti-doping knowledge and perception level of about 50%. Pharmacy students are well-equipped to assess the potential for various substances to improve performance because of their extensive understanding of pharmacological mechanisms and clinical uses. [41]. Moreover, sports pharmacists, work in tandem with other pharmacists and pharmacy students in addition to having direct contact with athletes and coaches [40,42]. This wider involvement is essential since general pharmacists will need to be more knowledgeable about doping laws and the use of nutritional supplements. It should be mentioned that because this study was only carried out at one pharmacy college in Libya, its generalizability is restricted and it might not accurately reflect the viewpoints of pharmacy students nationwide.

V. CONCLUSION

The study emphasizes how important it is to give pharmacy graduates thorough academic understanding and practical skills related to doping, as well as continual updates in this rapidly changing profession. The results indicate a significant gap in anti-doping awareness among pharmacy graduates, highlighting the importance of enhanced education and training programs. Incorporating anti-doping content into pharmacy curricula is crucial to adequately prepare future pharmacists to effectively contribute to promoting ethical and fair practices in sports.

VI. RECOMMENDATION

The researchers recommend that anti-doping topics be integrated into the pharmacy curriculum, regular seminars and workshops be organized for graduates, and collaboration be established with sports organizations and anti-doping agencies. Continuous training and community awareness programs should also be encouraged to strengthen pharmacists' roles in promoting clean sports.

CONFLICTS OF INTEREST

The authors state that they have no conflicts of interest to report.

AUTHOR CONTRIBUTIONS

This research was conducted collaboratively by all authors. YSEM and NAMI developed the study design, wrote the protocol and manuscript, and collected the data. AAAR and AMB performed the statistical analyses and managed the literature reviews. All authors reviewed the results and approved the final manuscript.

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