

## ORIGINAL ARTICLE

## Awareness of Anti-Doping Rules and Regulations Among Swimmers

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## ABSTRACT

**Introduction:** Doping in competitive sports poses a significant threat to fair play, athlete health, and the integrity of sporting events. Despite strict regulations enforced by the World Anti-Doping Agency (WADA), awareness and understanding of these rules vary among athletes. This study assessed the overall level of anti-doping awareness among swimmers and identified key knowledge gaps that may affect adherence to regulations. **Methods:** A cross-sectional survey was conducted among 200 swimmers, including both competitive and recreational athletes. Data were collected through a validated questionnaire and analyzed using descriptive and inferential statistics to compare knowledge levels across groups and demographic variables. **Results:** Competitive swimmers demonstrated significantly greater anti-doping awareness compared to recreational swimmers ( $67.2 \pm 10.5$  vs.  $53.4 \pm 13.7$ ,  $p < 0.001$ ). Older swimmers (25–40 years) had higher scores than younger swimmers (18–24 years,  $p = 0.03$ ). Supplement users also showed better awareness ( $65.5 \pm 11.4$ ) than non-users ( $59.2 \pm 12.6$ ,  $p = 0.01$ ). However, notable gaps were observed in understanding TUEs and the requirement to provide accurate whereabouts information. **Conclusion:** These findings emphasize the need for structured anti-doping education, particularly for recreational and younger swimmers, to enhance compliance and uphold the integrity of sport.

*Malaysian Journal of Medicine and Health Sciences* (2026) 22(SUPP5): 33-38. doi:10.47836/mjmhs.22.s5.7

**Keywords:** Anti-doping regulations; Athlete awareness; Performance-enhancing drugs (PEDs); Therapeutic Use Exemptions (TUEs); Sports integrity

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## INTRODUCTION

In the realm of competitive sports, doping remains a pervasive and multifaceted issue that directly threatens the fundamental integrity of athletic competition. The systematic use of performance-enhancing drugs (PEDs) does more than just undermine the principle of fair play; it actively endangers the long-term health of athletes and disrupts the equitable "level playing field" that modern sports aim to foster (1). In direct response to these evolving challenges, global efforts have intensified to implement and enforce strict anti-doping regulations, a movement primarily spearheaded by the World Anti-Doping Agency (WADA). Established in 1999, WADA was created with the specific mission to promote, coordinate, and monitor the fight against doping in sports on an international scale (2, 3). Central to this

mission is the development and maintenance of the World Anti-Doping Code, which seeks to harmonize anti-doping policies across different sports and sovereign nations. This harmonization ensures that athletes, regardless of their geographic location or specific level of competition, are held to consistent and transparent standards regarding testing protocols, legal sanctions, and mandatory education (2-6).

Despite these robust global initiatives, the actual level of awareness regarding anti-doping regulations remains significantly uneven across various sports and competitive tiers. Swimming, which stands as one of the most popular and high-profile Olympic sports, is particularly susceptible to these discrepancies. While the sport operates under stringent anti-doping protocols, documented instances of doping have occurred across all levels, from local meets to the Olympic stage. High-profile scandals involving elite-level swimmers often dominate the media landscape, yet there is a profound lack of empirical data regarding the awareness of these rules among the broader population of swimmers,

specifically those competing at amateur or regional levels. Cultivating a deep understanding of these regulations is critical not only for the prevention of intentional violations but also for the protection of athlete health and the promotion of a clean competitive spirit. Education serves as the most effective tool in this endeavor, ensuring that athletes are fully informed about the prohibited substances and methods outlined in the WADA Code. This is especially vital for swimmers, who are subject to the same rigorous and unannounced testing protocols as high-performance athletes in any other discipline (7-9).

Anti-doping education is designed to go beyond mere lists of banned substances; it aims to foster a culture of integrity by informing athletes of the specific health risks and professional consequences associated with violations. WADA and various national anti-doping organizations provide an array of resources, including digital modules, workshops, and outreach programs (1-3). However, research indicates that the efficacy of these programs varies based on the athlete's access to resources and the quality of support provided by their home institutions. While elite athletes often receive comprehensive, high-stakes briefings, swimmers at lower competitive levels frequently face a support vacuum, leading to significant gaps in knowledge (10). These gaps are particularly dangerous concerning dietary supplements, which are frequently used for recovery and physical conditioning in swimming. Many athletes remain dangerously unaware that these supplements may contain banned substances not disclosed on the label, leading to "inadvertent doping" (11-13). Furthermore, the complex protocols surrounding Therapeutic Use Exemptions (TUEs)—which allow for the medically supervised use of prohibited substances for legitimate health conditions—are often misunderstood or entirely overlooked by regional athletes (14-17).

The consequences of failing to address these knowledge gaps are severe. Doping poses a significant threat to an athlete's physical and psychological well-being, with PED use being linked to cardiovascular disease, liver damage, and systemic hormonal imbalances (18, 19). For instance, the use of anabolic steroids can lead to profound psychological disturbances, while stimulants may trigger chronic anxiety, addiction, and depression (20-23). Beyond personal health, a doping violation can result in lifetime bans, the disqualification of career results, and permanent reputational damage. On a broader scale, these violations erode the trust of fellow competitors, spectators, and sponsors, casting a long shadow over the integrity of national swimming federations (24). While the final responsibility for compliance lies with the athlete, the "athlete support personnel"—specifically coaches—play a decisive role in shaping behaviors. Coaches are often the primary source of guidance for junior swimmers; therefore, it is essential they serve as advocates for clean sport (25,

26). Unfortunately, studies show that many coaches themselves lack adequate knowledge regarding the WADA Code and supplement safety (27, 28). To bridge these gaps, future anti-doping initiatives must expand their reach to include the entire support network, ensuring that every individual involved in the swimmer's journey is equipped to uphold the standards of fair competition.

## MATERIALS AND METHODS

### Study Design

This study utilized a cross-sectional survey design to assess the level of awareness of anti-doping rules and regulations among competitive and recreational swimmers. The survey was conducted over a period of three months, from January to May 2024, across various swimming clubs and competitions in multiple regions. Participants were required to complete a structured questionnaire that assessed their knowledge of anti-doping policies, including prohibited substances, testing procedures, and the role of support personnel.

### Participants

The study targeted competitive and recreational swimmers aged 18 and above who actively participated in local, regional, or national swimming events. Participants were recruited using a convenience sampling method from swimming clubs and competitive events. Of the 250 swimmers approached, 200 agreed to participate after providing informed consent. The inclusion criteria required participants to have competed in at least one state-level competition in the past year, be 18 years or older, and be capable of understanding and independently completing the questionnaire. Swimmers were excluded if they were currently undergoing a suspension due to doping violations or had undergone anti-doping education programs as part of their training. This approach ensured a diverse sample while minimizing biases related to prior doping violations or specialized anti-doping training.

### Instrumentation

The primary data collection tool was a structured questionnaire developed specifically for this study. The questionnaire was based on an adapted version of the WADA Play True Quiz, which is designed to test athletes' knowledge of anti-doping regulations. It contained 47 multiple-choice and true/false questions that covered topics such as: Basic knowledge of anti-doping rules, awareness of the WADA list of prohibited substances, understanding of TUEs, knowledge of doping control procedures, including in-competition and out-of-competition testing, and the role of athlete support personnel (coaches, medical staff, etc.) in anti-doping rule violations. The questionnaire also included demographic questions such as age, gender, competition level, and years of experience in swimming. The questionnaire was reviewed by three experts in sports

science and anti-doping policies to ensure content validity.

### Data Collection Procedure

Data collection was conducted during swimming events and through collaboration with swimming clubs. Participants were provided with an online link to complete the survey at their convenience or were given a paper version to fill out on-site during competitions. The survey was self-administered, with a research assistant available to address any technical issues or questions. No incentives were provided for participation. To ensure privacy, no identifying information was collected, and the data were stored securely. Participants were informed that their responses would be anonymous and used solely for research purposes. The survey took approximately 15 to 20 minutes to complete.

### Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 27. Descriptive statistics were used to summarize the demographic characteristics of the participants and their overall awareness of anti-doping rules. Continuous variables such as age and years of experience were presented as means and standard deviations, while categorical variables such as gender and competition level were reported as frequencies and percentages. The primary outcome variable was the anti-doping knowledge score, which was calculated by summing the correct responses to the 30 questions. The scores were then normalized to a 0–100 scale for ease of interpretation. Independent t-tests were used to compare knowledge scores between male and female swimmers, as well as between competitive and recreational swimmers. One-way analysis of variance (ANOVA) was used to examine differences in knowledge scores across different age groups and levels of competition. A significance level of  $p < 0.05$  was used for all statistical tests. Additionally, qualitative data from open-ended questions were analyzed thematically to identify common misconceptions or knowledge gaps related to anti-doping policies.

### Ethical Considerations

The study protocol was reviewed and approved by the Ethics Committee of the [University Name]. All participants provided informed consent before participating in the study, and they were informed of their right to withdraw at any time without any consequences. The study adhered to the principles outlined in the Declaration of Helsinki for research involving human subjects.

## RESULTS

### Participant Demographics

A total of 200 swimmers participated in the study. The majority were male (65%,  $n = 130$ ), with females accounting for 35% ( $n = 70$ ). Participants' ages ranged

from 18 to 40 years, with a mean age of  $24.5 \pm 5.1$  years. Most participants were competitive swimmers (70%,  $n = 140$ ), while the remaining 30% ( $n = 60$ ) were recreational swimmers. The average years of swimming experience were  $7.3 \pm 4.2$  years, and the details were mentioned in the Table I.

### Anti-Doping Knowledge Scores

The overall knowledge score for the participants was  $62.8 \pm 12.3$  out of 100. Competitive swimmers exhibited a significantly higher average score ( $67.2 \pm 10.5$ ) compared to recreational swimmers ( $53.4 \pm 13.7$ ) ( $p < 0.001$ ). Knowledge was assessed across five key areas: prohibited substances, doping control procedures, TUEs, penalties for violations, and the role of athlete support personnel. The details of the anti-doping were given in the Table II including the knowledge scores by swimming level.

**Table I: Details of the Participant Demographics Characteristics**

Characteristic	Total (n = 200)	%
<b>Gender</b>		
Male	130	65%
Female	70	35%
<b>Swimming Level</b>		
Competitive	140	70%
Recreational	60	30%
<b>Mean Age (years)</b>	$24.5 \pm 5.1$	
<b>Years of Experience</b>	$7.3 \pm 4.2$	

**Table II: Anti-Doping Knowledge Scores by Swimming Level**

Knowledge Area	Competitive Swimmers (n = 140)	Recreational Swimmers (n = 60)	p-value
Prohibited Substances	$69.4 \pm 11.1$	$55.8 \pm 12.5$	<0.001
Doping Control Procedures	$65.2 \pm 10.4$	$52.7 \pm 14.2$	<0.001
Therapeutic Use Exemptions	$66.8 \pm 9.8$	$50.4 \pm 13.1$	<0.001
Penalties for Violations	$67.9 \pm 8.3$	$54.2 \pm 12.6$	<0.001
Role of Support Personnel	$67.6 \pm 10.5$	$54.0 \pm 13.8$	<0.001
<b>Overall Score</b>	$67.2 \pm 10.5$	$53.4 \pm 13.7$	<0.001

### Knowledge by Age Group

Age also influenced anti-doping awareness. Swimmers aged 18–24 exhibited significantly lower awareness ( $59.3 \pm 12.7$ ) compared to those aged 25–40 ( $67.1 \pm 11.1$ ,  $p = 0.03$ ). The older participants were more familiar with doping control procedures and TUEs, likely due to their extended experience and exposure to anti-doping regulations during competitions. The details of the knowledge scores by age group were given in the Table III.

**Table III: Knowledge Scores by Age Group**

Age Group	Knowledge Score (Mean ± SD)	p-value
18–24 years (n = 120)	59.3 ± 12.7	0.03
25–40 years (n = 80)	67.1 ± 11.1	

**Use of Dietary Supplements**

Of the 200 participants, 42% (n = 84) reported the use of dietary supplements. Swimmers who used supplements scored higher (65.5 ± 11.4) in anti-doping knowledge compared to non-users (59.2 ± 12.6, p = 0.01). This may indicate greater familiarity with anti-doping rules among those who are more conscious of what they consume to enhance performance. The details of the knowledge scores by supplement use were given in the Table IV.

**Table IV: Knowledge Scores by Supplement Use**

Supplement Use	Knowledge Score (Mean ± SD)	p-value
Yes (n = 84)	65.5 ± 11.4	0.01
No (n = 116)	59.2 ± 12.6	

**Common Knowledge Gaps**

Analysis of individual questionnaire items revealed several key areas where knowledge was lacking. The question with the lowest correct response rate was regarding the purpose and importance of TUEs, with only 48% of participants answering correctly. Similarly, less than 50% of swimmers knew that failure to update their whereabouts information could lead to a violation of anti-doping rules. In contrast, more than 80% of participants were aware of the penalties for using prohibited substances.

**DISCUSSION**

The findings of this study provide valuable insights into the level of awareness of anti-doping rules and regulations among swimmers, revealing both strengths and areas in need of improvement. Overall, the results indicate that while there is a reasonable level of understanding, significant gaps remain, particularly among recreational swimmers and younger athletes. This highlights the need for a more structured and comprehensive approach to educating athletes across all levels of competition.

**Differences Between Competitive and Recreational Swimmers**

The study revealed a clear distinction between competitive and recreational swimmers in terms of their knowledge of anti-doping rules. Competitive swimmers scored significantly higher on overall anti-doping knowledge, as well as in specific areas such as prohibited substances, doping control procedures, and TUEs. This is not entirely surprising, as competitive swimmers are more likely to be exposed to anti-doping education through their involvement in higher-level competitions where doping controls are more rigorous.

Competitive swimmers also have more frequent interactions with coaches, medical professionals, and sports organizations that emphasize the importance of maintaining clean sport practices. Their exposure to doping control procedures in both in-competition and out-of-competition settings, as well as their participation in anti-doping education programs, likely contributes to their higher levels of awareness [8,17]. These findings are consistent with previous research that suggests athletes at higher levels of competition tend to have greater knowledge of anti-doping rules due to more regular testing and education (Anti-Doping Knowledge score). In contrast, recreational swimmers exhibited lower levels of awareness across all domains, with particular deficiencies in their understanding of doping control procedures and TUEs [16]. Recreational swimmers may not face the same level of scrutiny as their competitive counterparts and are often excluded from formal anti-doping education programs [29]. This lack of exposure could explain the lower awareness of key anti-doping regulations, putting recreational athletes at a greater risk of inadvertently violating these rules.

**Age and Experience Influence Knowledge**

The study found that swimmers aged 25–40 had significantly higher anti-doping knowledge compared to those aged 18–24. This difference could be attributed to the greater experience and exposure to anti-doping policies among older swimmers, who have likely participated in more competitions and had more opportunities to engage with anti-doping education. Younger swimmers, on the other hand, may not yet have had the same level of interaction with these educational initiatives, which might explain their lower awareness levels. These findings suggest that more targeted anti-doping education is needed for younger swimmers, particularly those transitioning from recreational to competitive levels. Providing early education on anti-doping regulations could help bridge the knowledge gap and ensure that younger athletes are adequately prepared to navigate the complexities of anti-doping rules as they advance in their sporting careers [2,3]

**The Role of Supplement Use in Awareness**

Another significant finding of the study was the higher anti-doping knowledge observed among swimmers who reported using dietary supplements. This group scored notably higher in areas such as prohibited substances and doping control procedures compared to those who did not use supplements [30]. This may be due to the increased likelihood of supplement users to seek out information on the contents and safety of the products they consume, making them more aware of the potential risks of inadvertent doping. The link between supplement uses and anti-doping knowledge aligns with previous studies that suggest athletes who use supplements tend to have a greater understanding of the risks and benefits associated with their use (Anti-Doping Knowledge). However, it is important to note that while these athletes

may have higher awareness, they are also at a greater risk of unintentionally consuming banned substances through contaminated supplements. This highlights the need for clear guidance on safe supplement use as part of anti-doping education programs, ensuring that athletes are not only aware of the risks but also equipped with the tools to make informed decisions.

### Common Knowledge Gaps

One of the most striking findings of the study was the widespread lack of understanding regarding TUEs and the doping control process, particularly among recreational swimmers. Less than half of the participants knew the purpose of TUEs, which allow athletes to use certain prohibited substances for legitimate medical reasons, provided they have received prior approval. This lack of knowledge could lead to athletes inadvertently violating anti-doping rules if they fail to follow the proper procedures for obtaining a TUE [14]. Additionally, a significant number of swimmers were unaware of the importance of updating their whereabouts information, which is crucial for out-of-competition testing. Failure to provide accurate whereabouts information can result in a violation of anti-doping rules, even if the athlete has not taken any prohibited substances. These gaps in knowledge underscore the need for more comprehensive education on the practical aspects of doping control, ensuring that athletes understand not only what substances are prohibited but also how to comply with testing procedures.

### Implications for Anti-Doping Education

The findings of this study have important implications for the design and implementation of anti-doping education programs. While competitive swimmers are generally well-informed, there is a clear need for targeted interventions aimed at recreational swimmers and younger athletes who may not have access to formal anti-doping education. Educational programs should focus on key areas where knowledge is lacking, such as the purpose and application of TUEs, doping control procedures, and the importance of providing accurate whereabouts information. In addition, supplement use should be addressed in anti-doping education, with a focus on helping athletes understand the risks associated with contaminated supplements. Providing athletes with practical tools to verify the safety of supplements and encouraging them to consult with qualified professionals before using these products could help reduce the risk of inadvertent doping.

### CONCLUSION

This study highlights the significant knowledge gaps in anti-doping awareness among swimmers, particularly recreational athletes and younger competitors. While competitive swimmers displayed a higher level of understanding, there are critical areas where awareness is lacking, such as the use of Therapeutic Use Exemptions

and doping control procedures. Addressing these gaps through targeted education is essential to prevent inadvertent violations. Enhanced anti-doping education should be implemented across all levels of swimming to ensure athletes have the necessary knowledge to maintain fair competition and adhere to clean sport practices.

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