



Doping Knowledge Among Indonesian Athletes: Sociodemographic Correlates and Educational Implications

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ABSTRACT

Doping knowledge is a vital defense against rule infractions that could endanger athlete careers and the integrity of sports. The purpose of this study was to evaluate Indonesian athlete knowledge of doping and investigate its relation to sociodemographic traits. A cross-sectional quantitative survey was completed by 436 athletes from different sport disciplines. Four knowledge domains were covered by the instrument, including national anti-doping organizations, legal regulations, prohibited substances, and the definition of doping. The findings showed that athletes were generally aware of the existence of anti-doping organizations and the idea of doping. Nonetheless, there were still a lot of common misconceptions about prohibited substances. Many respondents believed that therapeutic-use drugs such as insulin and erythropoietin (EPO) were unrestricted or confused legal supplements with doping. While no significant differences were observed by gender, sport types, competition levels, or medal achievement, knowledge varied significantly by age ($p = 0.001$), student status ($p = 0.001$), and athletic experiences ($p = 0.011$). These findings highlight the need for more contextualized and practice-oriented anti-doping education tailored to athlete backgrounds. Strengthening evidence-based education may foster a cleaner and more ethical sporting environment in Indonesia.

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INTRODUCTION

Doping in sports refers to the use of prohibited substances or methods to unlawfully enhance athletic performance (Weston, 2017). Such practices not only violate the fundamental principles of fair play but also endanger the athlete health and undermine the integrity of sports. Numerous studies have documented the adverse physiological consequences of doping, ranging from organ dysfunction to hormonal imbalance and dependency risks (Listiani et al., 2024). Despite widespread awareness campaigns and the establishment of anti-doping regulations at both national and international levels, the issue persists in many countries, including in Indonesia.

Several doping cases involving Indonesian athletes were reported in 2021 across various disciplines such as bodybuilding, aquatics, and taekwondo (Istiqomah, 2022). These incidents highlight potential gaps in both comprehension and compliance with anti-doping protocols. Although regulatory frameworks and testing mechanisms have been implemented, they appear insufficient to fully curb the misuse, particularly when athletes and coaches lack a nuanced understanding of therapeutic use exemptions, supplement safety, and the boundaries between legal and illegal performance aids. Misconceptions, such as equating dietary supplements with doping or assuming that medically prescribed substances like insulin and erythropoietin (EPO) can be freely used, remain prevalent among athletes in different contexts (Trinh et al., 2020; Hayati & Haikal, 2024).

Previous research in Indonesia had attempted to assess doping awareness, yet most investigations were conducted in limited regions or focused on specific sporting events (Gemilang & Astuti, 2023). Studies in East Java, for example, revealed that anti-doping education was inconsistently distributed across districts and local sport organizations lacked systematic prevention strategies. Other findings suggest that athletes may resort to illicit substances due to pressure from coaches or peer expectations to meet competitive standards. While international studies have explored doping knowledge among athletes in Austria, Korea, and Malaysia (Tsivitanidou et al., 2023; Kim & Kim, 2017; Chiang et al., 2018), comprehensive nationwide assessments in the Indonesian context remain scarce.

This gap indicates a pressing need to examine doping knowledge across diverse demographic profiles within the Indonesian athletic population. Understanding how factors such as age, educational status, competitive level, and training experience influence an athlete awareness of anti-doping regulations is crucial for designing more targeted and impactful educational strategies. Therefore, the present study aimed to assess the level of doping knowledge among Indonesian athletes and analyze its correlation with sociodemographic characteristics. By identifying specific areas of misconception and demographic disparities, this research sought to support the development of more contextualized and practical anti-doping interventions that reinforce both athlete well-being and the ethical foundation of Indonesian sports.

METHODS

This study employed a quantitative cross-sectional survey design to assess doping knowledge among Indonesian athletes. Data were collected in Bandung, Indonesia, between March and May 2025, during a single data collection period.

Participants

Participants included both student-athletes and non-student athletes who had achieved at least regional-level competitive results. A total of 436 athletes voluntarily participated, representing various sporting disciplines across both individual and team sports.

Sampling Procedures

Participants were selected using a non-probability voluntary sampling method. Recruitment targeted active athletes competing at a minimum of the regional level in Indonesia. Information about the study was distributed through official sport associations, coaches, and designated contact persons from the Faculty of Sport and Health Education, Universitas Pendidikan Indonesia. These contact persons provided eligible athletes with a link to the online survey platform.

Out of approximately 520 athletes approached, 436 completed the questionnaire, yielding a participation rate of 83.8%. All participants self-selected into the study by voluntarily accessing and submitting the digital consent form and questionnaire. Data collection took place entirely online over a four-week period, allowing respondents to complete the survey from their respective training centers, universities, or homes across various provinces.

No financial or material incentives were offered for participation. Participation was fully voluntary and respondents were assured of anonymity and data confidentiality. Prior to the data collection, ethical clearance was obtained from the Ethics Committee of Universitas Pendidikan Indonesia (Ethical Approval: UPI/EC/696/2025). To ensure the sufficient statistical power for inferential analyses (t-tests and ANOVA), the sample size exceeded the minimum requirement estimated through a priori power analysis ($\alpha = 0.05$, power = 0.80, medium effect size), confirming that the study was adequately powered to detect meaningful group differences.

Materials and Apparatus

The primary instrument used in this study was the Doping Knowledge Test for Athletes and Coaches, which was developed by WADA (2024) and has been widely used to assess doping-related knowledge in sport populations. It includes the assessment of four domains, namely definition of doping, legal and regulatory frameworks, prohibited substances, and awareness of national anti-doping institutions. The content validity was confirmed through the expert judgment by three professionals specializing in sports science, anti-doping education, and sports medicine. A pilot test yielded a Cronbach's alpha of 0.87, indicating strong internal consistency.

Procedures

The final version of the questionnaire was administered digitally using an online form. Prior to participation, all athletes were informed about the study objectives and provided digital informed consent. The data collection process ensured participant anonymity and voluntary participation. Ethical approval was obtained from the Ethics Committee of Universitas Pendidikan Indonesia.

Design or Data Analysis

The study followed a cross-sectional design. Data were screened for completeness and accuracy before analysis. Descriptive statistics were computed to summarize knowledge scores and distribution patterns across domains. Inferential analyses, including independent-samples t-tests and one-way ANOVA, were conducted to identify differences in knowledge based on sociodemographic factors such as age group, student status, and years of athletic experience. Statistical significance was set at $p < 0.05$. All analyses were performed using standard statistical software.

RESULTS

A total of 450 athletes completed the online questionnaire. However, 14 responses were excluded due to incomplete data, resulting in 436 valid entries included in the analysis. As shown in Table 1, the majority of respondents were between 18 and 23 years old (77%), with a slightly higher proportion of male athletes (57%). Approximately half of the participants were university students (50.2%) and most were involved in team sports (73%). More than half of the athletes (61%) had over three years of training experience, whereas only 13 individuals (3%) had been athletes for less than one year. Most respondents competed at the provincial level (75%), followed by national-level athletes (21%) and a smaller number of international-level competitors (4%). In terms of competitive achievement, 25% reported having won gold medals, while 43% had not yet received a medal in competition.

Table 1. Sociodemographic Characteristics of Respondents (N = 436)

Variable	Category	n	%
Age	13–17	83	19
	18–23	337	77
	24–30	16	4
Gender	Male	249	57
	Female	187	43
Student Status	Student	219	50.2
	Non-student	217	49.8
Sport Type	Individual	117	27
	Team	319	73
Years as Athlete	< 1 year	56	13
	1–3 years	114	26
	> 3 years	266	61
Competition Level	International	18	4
	National	91	21
	Provincial/Regional	327	75
Achievement Level	Gold	110	25
	Silver	66	15
	Bronze	72	17
	No Medal	188	43

The athlete knowledge of doping was analyzed across four domains: definition, regulation, prohibited substances, and anti-doping institutions. As shown in Table 2, the highest mean score was observed in the domain of anti-doping institutions (M = 90%), followed by knowledge of doping definition (M = 82%). Knowledge of prohibited substances demonstrated a moderate score (M = 67%), whereas the lowest performance was found in the regulation domain (M = 64%). These findings suggest that while athletes are relatively familiar with the basic concept of doping and aware of institutional enforcement bodies, they continue to struggle with the legal and procedural aspects of anti-doping rules.

Table 2. Average Knowledge Scores per Domain (N = 436)

Domain	Mean % Correct	Interpretation
Definition of Doping	82%	High
Regulation and Legal Aspects	64%	Moderate
Prohibited Substances	67%	Moderate
Anti-Doping Institutions	90%	Very High

To further examine specific areas of misconception, the five lowest-scoring items were identified and summarized in Table 3. Misunderstandings were most prevalent in questions related to the legal use of erythropoietin (EPO) and insulin, fluid transfusions during competition, and the limits of therapeutic-use allowances. These misconceptions indicate a lack of clarity among athletes regarding what distinguishes legitimate medical treatment from doping violations.

Table 3. Top 5 Misconceptions among Athletes

Item Statement	% Correct	Misconception Insight
Athletes may use iron and erythropoietin (EPO) to increase blood levels.	32%	Most athletes believe EPO is medically allowed freely.
Insulin may be used freely as it is a common medication for diabetes.	46%	Confusion between therapeutic use and doping.
Athletes may receive fluid or blood transfusion when feeling fatigued.	48%	Lack of awareness of WADA regulations on IV use.
Athletes are not guilty if they do not know the contents of a banned substance provided by a coach.	52%	Misunderstanding strict liability principle.
Athletes are exempt from sanctions if unaware of the Prohibited List.	49.5%	Many assume unawareness is a valid excuse.

Table 4. Differences in Doping Knowledge across Sociodemographic Characteristics

Variable	Comparison Groups	Test Value (t/F)	p-value
Gender	Male vs Female	0.835	.505
Age Group	13–17 / 18–23 / 24–30	0.653	.001 **
Student Status	Student vs Non-Student	0.480	.001 **
Sport Type	Individual vs Team	0.122	.338
Years as Athlete	<1 / 1–3 / >3	0.651	.011 **
Competition Level	Provincial / National / International	0.484	.262
Achievement Level	Medalist vs Non-Medalist	0.038	.527

Prior to inferential analyses, assumption tests were conducted. Normality was examined using the Shapiro–Wilk test, while homogeneity of variance was assessed using Levene’s test. The results confirmed that the assumptions for parametric testing were met. Independent sample t-tests were employed for dichotomous variables, while one-way ANOVA was used for variables with more than two comparison groups.

Inferential testing revealed significant differences in doping knowledge based on age ($p = .001$), student status ($p = .001$), and years of athletic experience ($p = .011$). However, no

significant variations were observed across gender ($p = .505$), sport types ($p = .338$), competition levels ($p = .262$), or achievement levels ($p = .527$), as presented in Table 4.

DISCUSSION

Understanding versus Misconception in Doping Knowledge

The high level of correct responses in the definition domain suggests that anti-doping awareness campaigns in Indonesia have been fairly successful in communicating the basic conceptual meaning of doping. However, this understanding appears to be predominantly theoretical rather than practical. Although most athletes recognized that doping involves the use of prohibited performance-enhancing substances, one in four respondents incorrectly classified common nutritional products such as honey, multivitamins, and milk as doping. This indicates a conceptual ambiguity between enhancement and violation. A pattern was also reported in previous studies where athletes blurred the line between legal supplementation and banned performance aids (Tsivitanidou et al., 2023; Chiang et al., 2018; Fruchart et al., 2017; Barkoukis et al., 2015).

The divergence between official definitions and everyday usage is further reinforced by the semantic drift in public discourse. In Indonesian popular language, the term doping is frequently used as a synonym for any substance that enhances stamina, regardless of legality or ethical implications. Similar linguistic reassignments have been documented in semantic studies, where repeated informal usage leads to bleaching or neutralization of originally negative connotations (Fincoeur et al., 2020; Krasnoukhova & Van der Auwera, 2019; Meier et al., 2017). The commercial marketing on e-commerce platforms, advertising products as natural doping or halal doping, likely reinforces this diluted interpretation. Consequently, while athletes may recognize doping in a regulatory sense, their cultural interpretation of the term remains inconsistent with World Anti-Doping Agency (WADA) standards.

Regulatory Awareness and The EPO Knowledge Gap

The second domain, regulation and legal responsibility, revealed the widest discrepancy between correct and incorrect responses. While 93% of athletes acknowledged the existence of an annually updated Prohibited List, only 32% correctly identified erythropoietin (EPO) as a banned substance. This indicates that athletes may be aware of the regulation in principle but not in detail. Similar findings were reported in studies involving Korean and Turkish athletes, where surface-level awareness did not translate into specific knowledge of substances and procedures (Engelberg & Moston, 2016; Kim & Kim, 2017; Panggalih et al., 2025).

The misconception surrounding EPO use is particularly concerning. EPO is medically prescribed for anemia but is strictly prohibited in sports due to its blood-oxygen carrying enhancing effects (Trinh et al., 2020). WADA categorizes it under S2: Peptide Hormones, Growth Factors, and Mimetics (WADA, 2024). The lack of familiarity with this prohibition not only increases the risk of inadvertent violations but also reflects insufficient exposures to therapeutic use exemption (TUE) protocols. Given that the blood doping detection requires sophisticated testing, often unavailable at regional events, there remains a high potential for undetected misuses, particularly in endurance sports.

Selective Awareness of Prohibited Substances

The third domain showed moderate scores, with athletes demonstrating high awareness of anabolic steroid misuse, likely due to its long-standing association with bodybuilding culture, but far lower accuracy regarding insulin. This aligns with findings that athletes are more familiar with notorious substances portrayed in media than with common therapeutic drugs that may carry doping implications (Listiani et al., 2024; Roshan et al., 2020;

Underwood, 2018). Insulin, although legal when medically necessary, requires TUE approval. The failure to declare its usage constitutes doping even in diabetic athletes. The low recognition of such conditional legality reinforces the need for nuanced education on the legal but regulated substances.

Institutional Recognition versus Procedural Understanding

The final domain, knowledge of anti-doping institutions, received the highest scores. Most athletes were aware of the Indonesian Anti-Doping Organization (LADI) and recent sanctions related to non-compliance. This suggests that institutional visibility has increased, especially following WADA 2021 ban on national symbols during international competitions (Istiqomah, 2022). However, awareness of institutional existence does not guarantee understanding of institutional procedures. Without structured exposures to testing protocols, athlete rights, and sanction processes, recognitions remain superficial.

Sociodemographic Differences in Doping Knowledge and Educational Implications

Consistent with international findings (Inoue et al., 2025; Hayati & Haikal, 2024; Rintaugu & Mwangi, 2020; Murofushi et al., 2018), this study identified significant group differences in doping knowledge scores based on age, student status, and the length of athletic experience. Older athletes and those with formal educational engagement, particularly university students, demonstrated higher levels of knowledge. These findings indicate that anti-doping literacy varies across sociodemographic groups and is influenced not only by athletic exposure but also by access to formal education and information resources.

Conversely, the absence of significant differences across gender, competition levels, and medal achievement suggests that doping knowledge does not develop automatically through sporting success or participation alone. Rather, structured educational exposure, rather than competitive experience per se, appears to be a key differentiating factor.

Despite relatively high awareness in certain domains, the findings indicate that anti-doping education in Indonesia remains fragmented and largely superficial. Athletes tend to recognize the concept of doping but lack the regulatory literacy required to avoid unintentional violations. This gap suggests that existing educational initiatives emphasize institutional visibility and normative messaging more than functional understanding of prohibited substances and procedures. Without explicit instructions on therapeutic use exemptions, strict liability principles, and applied case scenarios, athletes may misinterpret compliance while remaining at risk of violations.

Taken together, these group differences point to a systemic instructional shortcoming rather than individual ignorance. When athletes can correctly define doping yet misclassify substances such as erythropoietin or insulin, the issue lies in the design and delivery of education itself. Anti-doping education in Indonesia should therefore move beyond generic campaigns toward structured and scenario-based programs tailored to specific demographic risk groups, particularly younger, non-student, and less-experienced athletes.

CONCLUSION

This study reveals that Indonesian athletes possess relatively strong foundational knowledge regarding the definition of doping and exhibit high awareness of national anti-doping institutions, such as the Indonesian Anti-Doping Organization (LADI). However, this cognitive strength is not consistently reflected in practical understanding. A considerable portion of athletes still misinterpret legal supplements as doping and fail to recognize that certain therapeutic substances, such as insulin and erythropoietin (EPO), fall within the prohibited category according to WADA regulations. These misconceptions indicate that the

existing anti-doping education predominantly focuses on formal concepts while neglecting everyday terminology and real-world decision-making scenarios.

The influence of demographic factors further strengthens this interpretation. Age, student status, and athletic experience were significantly associated with knowledge levels, suggesting that maturity, access to academic resources, and accumulated exposure to competitive environments contribute meaningfully to anti-doping literacy. Conversely, the absence of significant differences across gender, sport types, competition levels, and medal achievement implies that misinformation is widespread and not confined to specific athletic subgroups.

Taken together, these findings underscore the urgent need to reform anti-doping education in Indonesia. Rather than merely disseminating regulatory information, future interventions should dismantle prevalent misconceptions by incorporating contextualized examples, substance-specific case studies, and scenario-based learning formats. Educational strategies must be tailored toward younger athletes, non-students, and early-career competitors. These demographic groups have been shown to possess lower understanding yet face increasing exposure to performance pressures. Without a shift from ceremonial awareness campaigns toward critical operational literacy, athletes will continue to face the dual risks of inadvertent violations and systemic neglects in regulatory protections.

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AUTHORS' NOTE

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REFERENCES

- Barkoukis, V., Lazuras, L., Lucidi, F., & Tsorbatzoudis, H. (2015). Nutritional supplement and doping use in sport: Possible underlying social cognitive processes. *Scandinavian journal of medicine & science in sports*, 25(6), 582-588.
- Chiang, L. M., Shamsuddin, A. F., & Mahmood, T. M. T. (2018). Knowledge, attitude, and practice on doping of Malaysian student athletes. *Asian Journal of Pharmaceutical and Clinical Research*, 11(5), 72-76.
- Engelberg, T., & Moston, S. (2016). Inside the locker room: a qualitative study of coaches' anti-doping knowledge, beliefs and attitudes. *Sport in Society*, 19(7), 942-956.
- Fincoeur, B., Henning, A., & Ohl, F. (2020). Fifty shades of grey? On the concept of grey zones in elite cycling. *Performance Enhancement & Health*, 8(2-3), 1-10.
- Fruchart, E., Rulence-Pâques, P., & Mullet, E. (2017). Mapping adults' and young athletes' views regarding how acceptable it is to use a nutritional supplement in sport. *International Journal of Sport and Exercise Psychology*, 17(5), 477-492.
- Gemilang, P. S., & Pudji Astuti, S. H. (2024). Upaya Pencegahan Penggunaan Doping dalam Porprov Jatim 2023. *Novum: Jurnal Hukum*, 272-283.
- Hayati, N., & Haikal, M. R. (2024). The relationship between body image and steroid use in bodybuilding athletes. *Science Midwifery*, 12(2), 662-669.

- Inoue, Y., Tanaka, M., Ezure, H., Ito, J., Sasaki, A., Takaki, T., Hata, H., Takayanagi, M., & Otsuka, N. (2025). Age-related differences in information gathering among nursing students: Implications for nursing education. *Open Journal of Nursing*, 15 (1), 60–66.
- Istiqomah, E. R. (2022). Upaya Indonesia Dalam Menyelesaikan Sanksi World Anti Doping Agency (WADA). *eJournal Ilmu Hubungan Internasional*, 10(2), 416-426.
- Kim, T., & Kim, Y. H. (2017). Korean national athletes' knowledge, practices, and attitudes of doping: a cross-sectional study. *Substance abuse treatment, prevention, and policy*, 12(1), 1-8.
- Krasnoukhova, O., & Van Der Auwera, J. (2019). Negation in Kulina: A double polarity swap. *Journal of Historical Linguistics*, 9(2), 208-238.
- Listiani, D., Umar, F., & Riyadi, S. (2024). Athletes'(anti) doping knowledge: a systematic review. *Retos*, 56, 810-816.
- Meier, H. E., Rose, A., & Hölzen, M. (2017). Spirals of signification? A corpus linguistic analysis of the German doping discourse. *Communication & Sport*, 5(3), 352-373.
- Murofushi, Y., Kawata, Y., Kamimura, A., Kamimura, A., Hirosawa, M., & Shibata, N. (2018). Impact of anti-doping education and doping control experience on anti-doping knowledge in Japanese university athletes: a cross-sectional study. *Substance Abuse Treatment Prevention and Policy*, 13(1), 1–15.
- Penggalih, M. H. S. T., Muslichah, R., Niamilah, I., Solichah, K. M. A., Reswati, V. D. Y., Muarifati, S. H., & Adi, A. L. (2025). Anti-doping Knowledge and Information Sources Among Indonesian Athletes: Strengthening Clean Sport. *Amerta Nutrition*, 9(4), 710–721.
- Rintaugu, E. G., & Mwangi, F. M. (2020). Knowledge, attitudes and perceptions on doping among university students in physical education and sport science related degree programmes. *Journal of Human Sport and Exercise*, 16(1), 174–186.
- Roshan, A., Ganapathy, D., & Sasanka, L. K. (2020). Awareness on Use of Anabolic Steroids Among Basketball Players in Tirupur- A Survey. *The Journal of Contemporary Issues in Business and Government*, 26(2), 1725–1733.
- Trinh, K. V., Diep, D., Chen, K. J. Q., Huang, L., & Gulenko, O. (2020). Effect of erythropoietin on athletic performance: a systematic review and meta-analysis. *BMJ open sport & exercise medicine*, 6(1)1-16.
- Tsivitanidou, O., Christodoulides, E., & Petrou, M. (2023). High-School Athletes' Knowledge, Attitudes, and Perceptions on Doping: The Cyprus Sport-School Study. *Youth*, 3(2), 596-622.
- Underwood, M. (2018). Slin is the safest and most anabolic hormone": exploring bodybuilders' use of insulin as a performance and image enhancing drug. *Drug Alcohol Rev*, 37, S70.
- Weston, M. (2017). The regulation of doping in US and international sports. *The Oxford handbook of American sports law*, 83, 1-31.