

Anti-Doping Monitoring Web-Based Android for Athletes Disabilities

Fadilah Umar*Sebelas Maret University,
Indonesia**Dina Listiani**Sebelas Maret University,
Indonesia**Slamet Riyadi**Sebelas Maret University,
Indonesia**Misbah**Lambung Mangkurat University,
Indonesia

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Abstract

The usage of doping has been banned in the world of sports. This ban is regulated by law and must be adhered to by all athletes. This research aimed to identify the need for efforts to prevent doping use and develop a monitoring tool for doping prevention. The method used in this research was DESIGN-Based Research (DBR), covering the analysis, design, development, and reflection stages. The data sources involved in this research were administrators, medical officers, coaches, and disabled athletes from the NPCI (National Paralympic Committee Indonesia) Central Java Province. Data collection techniques employed were questionnaires and semi-structured interviews. The reflection stage included the validation or assessment of the product by doping experts, medical professionals, and media experts. The data obtained from this research and development were both qualitative and quantitative. Experts in the field used Aiken's V coefficient to test the validity. The product received an Aiken V value of 0.92 from doping and medical experts and 0.82 from media experts in the expert validation results. This value indicated that the experts considered the product highly valid. With the development, this product is expected to fulfill the needs of doping prevention efforts. Further research is needed to assess the effectiveness of this product in preventing the use of doping among athletes with disabilities.

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INTRODUCTION

Regulations on anti-doping measures are essential to ensure fair play and integrity in competitive sports, including in Indonesia (Clancy et al., 2022; Star & Kelly, 2021; Woolway et al., 2020). These findings highlight the global need for enhanced anti-doping education to bridge the knowledge gap and prevent rule violations in competitive sports. WADA has regulated all anti-doping rules by creating a code that athletes and other related parties must obey. From the definition of doping explained in the code, anti-doping violations can occur if doping substances are found in athlete samples (WADA, 2021). Athletes, coaches, and other athletes' supporters need to know the rules regarding the types of anti-doping rule violations (Blank et al., 2021). Athletes known and proven to violate anti-doping rules will be subject to sanctions. Sanctions are an important part of doping control. The imposition of sanctions is determined depending on the level of anti-doping rule violations. Disqualification of competition results, banning participation in competitions, and risk of losing prizes are some of the sanctions for athletes proven to violate anti-doping rules. Based on data from the Anti-Doping Rule Violation report (WADA, 2023), some athletes still violate anti-doping rules. Regarding anti-doping violations in Indonesia, the IADO (Indonesia Anti-Doping Organization) was released on the official link <https://iado.id/h/index.php/id/penyelesaian-publik/>. It stated that 17 athletes were proven to have violated anti-doping regulations between 2021 and 2024.

Understanding is a process where individuals acquire and process information to form justified beliefs, as noted by (Bolisani & Bratianu, 2018; Yani et al, 2021). In anti-doping, athletes require accurate information to understand the rules and principles governing their sports

* Corresponding author:

Umar, F., Sebelas Maret University, INDONESIA, fadilahumar@staff.uns.ac.id

behavior (Harriss et al., 2017; Harriss & Atkinson, 2015; Harriss et al., 2019). This understanding enables them to internalize these rules, ensuring compliance and adherence to fair play. Without adequate information, athletes risk unintentional or deliberate violations of anti-doping regulations, underlining the critical need for educational initiatives that provide clear and accessible information about anti-doping measures (Backhouse, 2023; Diastuti et al., 2024; Nuriev, 2019; Pielke Jr & Boye, 2019; Priadi et al., 2021).

Sports have inclusive philosophical values implied in everyday life. Athletes must instill the spirit of success in maintaining and improving body performance with hard training by implementing fair play norms. Justice and honesty are never absent from every sports competition (Simon et al., 2018). However, problems arise because athletes are caught in violations because they violate the rules. An example of cheating that is not directly visible in a sports competition is doping. According to UNESCO (Murofushi et al. 2018), doping is defined as the use of prohibited drugs or methods by athletes to improve training results in sports. Anti-doping violations, according to WADA (World Anti-Doping Agency), include (1) using prohibited substances or metabolites or markers in athlete samples; (2) using or attempting to use prohibited substances or prohibited methods; (3) evading, refusing or failing to submit samples; (4) failure to discover the presence; (5) tampering with or attempting to tamper with any part of a doping control; (6) Possessing prohibited substances and prohibited methods; (7) trading or attempting to trade prohibited substances or prohibited methods; (8) providing or attempting to provide prohibited substances or prohibited methods to any athlete in and out of competition; (9) involvement in prohibited association (WADA, 2021).

Anti-doping concerns the concept of fair-play. It is reasoned that athletes should compete. One purpose of the rules of sports is to define the 'level playing field' on which athletes compete and thus to articulate the notion of fair-play. Currently, anti-doping policies are part of these rules since doping practices are typically seen as cheating. Not question the need for rules in sports nor the possibility of finding workable 'level playing field' definitions. However, the anchoring of today's anti-doping regulations in the notion of fair-play to be misguided. Official thinking on these issues simply assumes the validity of the level playing field concept without coming to terms with the reality of widespread biological and environmental inequality (Kayser et al., 2007). Several researchers have studied doping in depth and tried to overcome the doping problem in sports (Bird et al., 2016; Hon et al., 2015; Vlad et al., 2018).

Anti-doping education is crucial for fostering clean and fair sports environments (WADA, 2021b). The International Standard for Education emphasizes education as a key component in preventing anti-doping rule violations, incorporating value-based education, awareness-raising, and disseminating anti-doping information (Kornia et al., 2022). Studies have shown the effectiveness of such programs; for example, Murofushi found that athletes who received anti-doping education were more accurate in identifying doping substances than those who did not (Murofushi et al., 2018b). Education programs not only increased knowledge but also positively impacted athletes' moral attitudes toward doping (Ahmed, 2023; Fitria & Hidayah, 2021; García-Martí et al., 2022; Zhumabayeva et al., 2022). These findings underscore the importance of implementing comprehensive anti-doping education programs globally to promote sportsmanship and integrity.

Para sports are vital in promoting equality and inclusion, offering individuals with disabilities opportunities to participate in sports. In Indonesia, this is supported by Article 31 of the Regulation of The Ministry of Youth and Sports (Kemenpora, 2022), which mandates the development and coaching of athletes with disabilities to ensure equal opportunities. The National Paralympic Committee (NPC), particularly the NPCI of Central Java Province, has been instrumental in advancing this vision through training and coaching programs designed to enhance the health, confidence, and performance of disabled athletes. These efforts align with broader anti-doping regulations, ensuring that all athletes, regardless of ability, comply with the rules of fair competition. Additionally, leveraging digital tools, such as website-based applications, has proven effective in educating and monitoring athletes (Doewes et al., 2021; Jacobsson et al., 2020; Noor et al., 2022; Takahashi et al., 2007; Yuningsih et al., 2021). Thus, this research aims to identify the specific needs for doping prevention among disabled athletes and to develop a website-based

application to serve as a monitoring tool, enhancing the effectiveness of doping prevention strategies in competitive sports.

The interview data reveal that data sources were aware of the prohibition of doping in sports contained in the code (WADA, 2021). Doping is prohibited due to its detrimental effects on athletes' health, which can lead to severe illnesses or even death (Adami et al., 2022; Albano et al., 2021; Boszkiewicz et al., 2022). This practice seriously impinges on personal privacy and is unacceptable in any other setting except, perhaps, imprisonment. Yet it is considered ethically acceptable in elite sport, since it is meant to protect the noble principles of fair competition, which therefore trump the value of an individual's private sphere. Indeed, it is commonly argued that athletes must relinquish some personal privacy, in order for fair competition to be possible. Our inquiry draws on a developing body of literature within medical ethics that discusses sports related enhancement issues (Kayser et al., 2007). Similarly, IADO conducted doping tests on 623 athletes in 2023. Doping tests are conducted during and outside competitions, regulated under The Code (WADA, 2019). NPCI Central Java athletes also underwent regular doping tests during events by submitting urine samples, with no recorded violations or Anti-Doping Rule Violations (ADR) to date. However, the understanding of these regulations remains limited, as highlighted by studies in Indonesia (Doewes et al., 2020; Sepriani, 2023). This issue extends globally, with studies revealing similar gaps in anti-doping knowledge among athletes in other countries. For instance, Krishnan et al. (2022) reported that elite athletes in India have poor awareness of anti-doping agencies and violations (Krishnan et al., 2022). Similarly, Orr et al. (2018) found that Australian athletes lacked knowledge about Performance Enhancing Substances (PES) and identified a weak understanding of doping among elite athletes in Turkey (Özkan et al., 2020).

Based on previous research, software technology was developed to prevent doping. Developing website software acts as a counseling medium for athletes that provides information related to doping methods, athlete drug consumption, and the side effects of doping use (Suherman et al., 2021; Takahashi et al., 2007). Similar technology can deliver athlete health guidance information, including injury prevention, injury and illness, mental illness, and safe sports information (Jacobsson et al., 2020). Application software and website technology were developed to help people understand anti-doping, which contains a prohibited list, prohibited methods, TUE, and the definition of doping (Doewes et al., 2020). Thus, technology can be applied to sports teams (Rico-González et al., 2023) as well as a digital platform for sports (Castañón-Rodríguez & Quiroga, 2024).

This research aimed to develop a website-based monitoring media to prevent doping by NPCI Central Java athletes. The development of this product potentially influences anti-doping efforts among athletes. The straightforward application method allows athletes to communicate directly with medical personnel via the consultation facilities. These services provide athletes the opportunity to gain clarity regarding their decision-making process about the use of drugs or supplements. Moreover, this product can be used to trace the drug or supplement consumption history. The menu presented in this product also provides information about doping, including the Banned List issued by the World Anti-Doping Agency (WADA). With this menu, athletes are expected to read information related to prohibited substances and methods. The novelty of this research was developing a website that provides consultation services for complaints, illness, or disease in athletes and reports on the consumption of drugs and/or supplements consumed by athletes. Thus, these monitoring efforts are expected to prevent NPCI Central Java athletes from using doping.

METHOD

Participant

This research consisted of four main groups directly involved in doping prevention efforts at the NPCI (National Paralympic Committee Indonesia) of Central Java Province. The first group was the administrators, responsible for the organization's policies and oversight. The second group was medical officers, whose role was to monitor the health of athletes and ensure compliance with anti-doping regulations. The third group was coaches, who liaised between athletes and the medical team and directly supported athletes. The last group consisted of athletes with disabilities who

used the developed app. Their participation was important to provide insight into specific needs and experience in doping prevention.

Instrumentation

This research used instruments in the form of questionnaires and validation sheets. The questionnaire was the main instrument designed to evaluate the needs of stakeholders in anti-doping efforts as well as assess the feasibility of the web-based application developed. The questionnaire created for data collection at the needs analysis stage was adapted from Doewes et al. (Doewes et al., 2021). Meanwhile, the validation sheet, especially media validation, was adapted from Doll and Torkzadeh (1988) in Doll et al. (Doll et al., 2004). Additional instruments, such as observation lists, were used to document situational conditions in the Central Java NPCI environment/ Furthermore. A 5-point Likert scale-based validation instrument involved experts (doping, medical, and media) to assess aspects of application quality, such as content, ease of use, timeliness, and accuracy. Medical and media experts were involved at this validation stage because the doping website's material was about doping. The instrument's validity was guaranteed through input from experts in doping, media, and medicine. The reliability was measured based on the consistency of feedback during various validation stages. The assessment of Website-Based Doping Monitoring Media is shown in Table 1.

Table 1. Website-Based Doping Monitoring Media Assessment (<https://haloatlet.com>)

Aspects	Statement	Valuation				
		SD	D	NDNA	A	SA
Content	1. Instructions for using the "Report" and "Consultation" features can be understood.					
	2. The information in the "Report" and "Consultation" features is complete.					
	3. The information in the "Report" and "Consultation" features is clear.					
	4. The menu in the athlete's account follows your needs.					
	5. The menu in the admin account (medical officer) is as needed.					
Accuracy	6. The information in the "Report" and "Consultation" features can be accounted for.					
	7. The choice of menu and information is appropriate (e.g., consultation services are aimed at medical personnel).					
Format	8. The layout is well structured.					
	9. The writing is easy to read.					
	10. The placement of the menu is neatly arranged.					
Ease of Use	11. The report and consultation feature can be opened on various devices (Handphones, laptops, or PCs).					
	12. The process of opening a website is easy.					
	13. The menu in the feature is easy to use.					
	14. Access to the "Report" and "Consultation" menus is easy.					
Timelines	15. Loading times are relatively fast.					
	16. Quick menu transfers.					
	17. Logging in to the "Report" and "Consultation" features can be done quickly.					
	18. The submission process can be done quickly.					

Note: SD: Strongly Disagree; D: Disagree; NDNA: Neither Disagree Nor Agree; A: Agree; Strongly Agree

Procedure and Research Design

This research was a Design-Based Research (DBR) development study involving the analysis, design, development, and reflection stages. In the analysis stage, this research involved data sources from administrators, medical staff, coaches, and athletes with disabilities who were members of the NPCI (National Paralympic Committee Indonesia) of Central Java Province. After obtaining information from the analysis process, the researchers identified the needs of NPCI Central Java to prevent the use of doping by athletes with disabilities. Based on these needs, the researchers designed content for the web-based application depicted in the flowchart (Figure 1), covering the main services and application limitations to meet the user's specific needs. The initial stage of product development was carried out by software developers based on the specifications and requirements of the researchers, with regular communication between the two for the evaluation and optimization of application development. Once the application has been developed, the reflection stage involves experts, including medical, doping, and media experts, to assess and validate the product's suitability with scientific studies, such as research, data collection, and planning. The product was assessed by experts consisting of two doping experts, one medical expert, and two media experts. At this stage, experts also provided suggestions for improvements before the application was put to the test. In addition, the researchers prepared a procedure for using the application and validation instruments to ensure that the application functions effectively as a doping prevention monitoring tool for athletes with disabilities at NPCI Central Java.

Quantitative data obtained from expert validation were analyzed using percentage techniques in the reflection stage. The data, gathered in Likert scale format, focused on four key aspects for doping and medical experts: importance, usefulness, monitoring, and reporting. For media experts, the validation emphasized content, accuracy, format, ease of use, and timeliness.

Data Analysis

The data obtained from the questionnaire were expressed in percentage form, and the data obtained from the validation results were analyzed using the Aiken V coefficient (Aiken, 1980). The Aiken V coefficient was used to test the validity of the assessment results of two doping experts, one medical expert, and two media experts. An Aiken index value of less than 0.4 indicates low validity, while a value between 0.4 and 0.8 indicates moderate validity. A value of more than 0.8 indicates high validity.

RESULTS AND DISCUSSION

Results

Analysis

The analysis of data sources aimed to understand the condition, efforts, and needs in preventing doping use among disabled athletes. Data collection at this stage was done through questionnaires, as can be seen in Table 2. As a supporter, the data sources signed an integrity pact, which ensured that they filled out the questionnaire with full awareness, were not burdened by anything, and did not engage in any element of coercion.

Table 2. Percentage of Needs Identification

Question	Response (%)	
	No	Yes
Do you have a laptop or smartphone?	0%	100%
Should athletes comply with anti-doping regulations in sports?	0%	100%
Do athletes need to make efforts to prevent doping in sports?	0%	100%
Do athletes need anti-doping education?	0%	100%
Do athletes need monitoring or supervision to prevent doping use?	0%	100%
Do athletes need health consultations?	0%	100%
Is documentation of the athlete's health/injury/illness history necessary?	0%	100%
Do athletes need prescriptions for doping-free medication to treat illness/injury/health conditions?	0%	100%
Do athletes need to report the medicines/supplements they consume?	0%	100%
Is documentation of athletes' consumption of medicines/supplements necessary?	0%	100%

Question	Response (%)	
	No	Yes
Is documentation of athletes' health/injury/illness history and the consumption of medicines/supplements necessary to apply for TUE?	0%	100%

The results of the need identification show that all NPCI Central Java athletes fully support doping prevention efforts. None of the respondents answered "No" to any of the questions in the table. Athletes emphasized the importance of compliance with anti-doping regulations, intensive supervision, health consultations, and anti-doping education to raise awareness. They also assessed that documentation of drug consumption and medical history is an important element, not only for doping prevention but also as a requirement in the submission of TUE (Therapeutic Use Exemption). This information provides a solid basis for developing technology-based systems that support these needs more systematically and efficiently.

Design

Planning is the initial process of developing a web-based application tailored to a need's analysis. At this stage, researchers developed a flowchart of a web application designed to monitor health and prevent doping in athletes with disabilities under the NPCI. This flowchart illustrates the workflow of the application, starting with the registration feature, where users are asked to enter important information such as email, phone number, full name, NPCI province and district, sport, as well as type of disability, which is then stored in a database for validation. After registration, users can access the app's main dashboard, which provides two key features: Report and Consultation. The Report feature allows athletes to report their health conditions, whether sick or injured, and record their consumption of medications or supplements.

Meanwhile, the Consultation feature allows direct communication with the medical team via WhatsApp to get medical guidance regarding health complaints, ensuring a fast and efficient service for users. The developed website-based application is available at <https://haloatlet.com/>. The product flow diagram design is shown in Figure 1.

In addition, this application is equipped with a user profile feature that records personal information and a History feature, which records the history of health reports and drug consumption. This history is important to thoroughly understand athletes' health and monitor their compliance with anti-doping rules. All data users enter is stored in an integrated database, which NPCI can access for real-time monitoring of athletes' health. The design reflects attention to the specific needs of athletes with disabilities with easy-to-use features. This application helps prevent doping and improves efficiency in athletes' health supervision, providing a solid foundation to support TUE (Therapeutic Use Exemption) applications and improve the quality of medical services at NPCI.

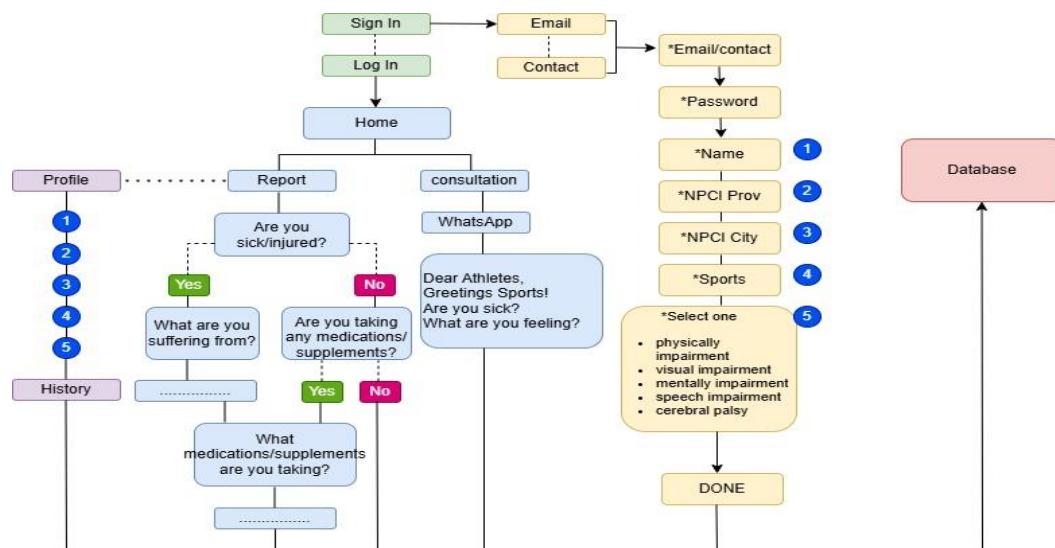


Figure 1. Product Flowchart Design

Development

This application provides various main features to make it easier for users to access the available services. The Login Feature allows users to log in to the app using an already registered account. In contrast, the Register Feature allows new users to create the necessary accounts to log in. To report health-related complaints, users can use the Report Feature, while the Consultation Feature is designed to facilitate consultations related to medications or supplements consumed. For users who need guidance, the Manual Book feature provides PDF documents explaining how to use the app. These features are organized in the Main Menu, the main navigation center for easily and efficiently accessing various in-app services. The appearance of the developed product is shown in Figure 2.

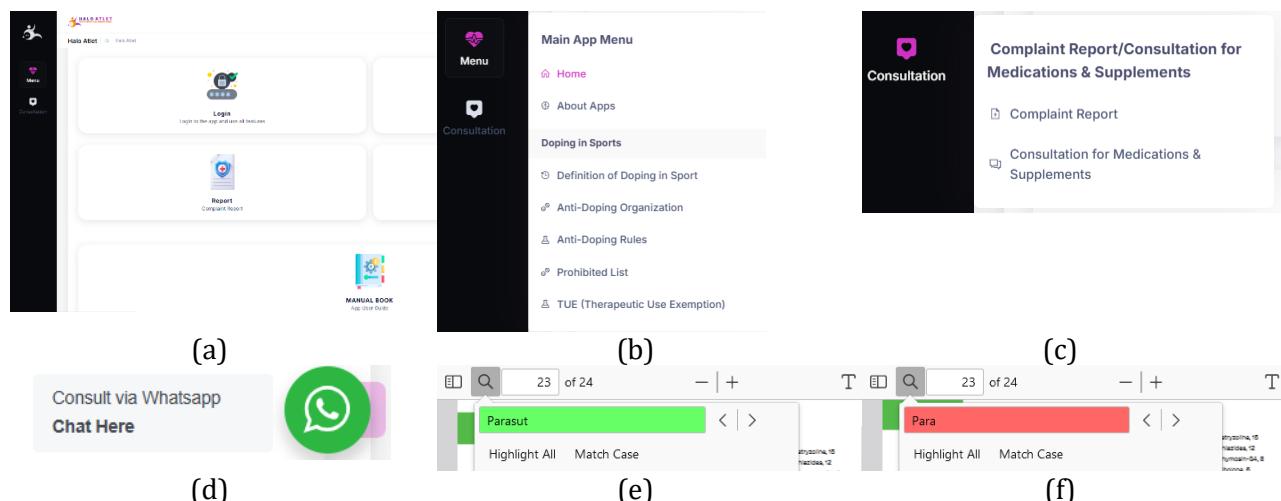


Figure 2. (a) Homepage, (b) Main Menu Display, (c) Consultation Menu Display, (d) WhatsApp Consultation Display, (e) Display of Non-Detected Substance Name, and (f) Display of Substance Name Included in the Prohibited List

The main menu of this application contains general information and can be accessed by all users without needing to log in first. The Consultation Menu is the app's main feature, and it can be accessed by users who already have an account. For users who do not have an account, registration can be done by using an active email to gain access to this feature. Consultations can also be done directly through WhatsApp, providing easy communication between users and the medical team. In addition, the app provides a PDF/Content Preview feature to make it easier for users to access relevant guides or information directly. *In the additional menu, the "prohibited list" feature allows users to search for substances or methods on the prohibited list. Users can enter the names of substances they wish to check via the search button if the entered substance is found on the prohibited list.*

Reflection

At this stage, it includes assessments from doping, medical, and media experts. The assessment results are shown in Tables 3 and 4.

Table 3. Feasibility Assessment by Doping and Medical Experts

Rater	S1	S2	S3	ΣS	N(c-1)	V	Validity Level
1	2	3					
64	62	70	50	48	56	154	168 0.92 Very High

No.	Evaluation	V-value	Validity Level
1	The relevance of the media in efforts to comply with anti-doping rules.	0.83	Very high
2	The role of the media in preventing the use of performance-	0.83	Very high

No.	Evaluation	V-value	Validity Level
3	enhancing drugs.		
3	The role of the media in the prevention of anti-doping rule violations	0.91	Very high
4	The relevance of media as a form of anti-doping socialization in sport	0.5	Medium
5	The visibility of the media has the potential to enhance athletes' accountability in preventing doping in sports.	1	Very high
6	The presence of the media can increase the athlete's responsibility for all drugs/supplements taken.	1	Very high
7	A menu of options is available for consultation regarding athletes' condition, injury, or disease.	0.91	Very high
8	The media's involvement facilitates communication between athletes and medical professionals regarding injuries and illnesses.	1	Very high
9	A menu of reporting options is available for monitoring athlete drug and supplement consumption.	1	Very high
10	The role of the media in facilitating the process of prescribing the appropriate medication and ensuring the athlete's freedom from doping substances.	1	Very high
11	The documentation of an athlete's medical history, including any previous injuries, illnesses, or conditions that may be relevant to their current state of health.	1	Very high
12	The role of supporting media in conveying athletes' histories of drug and supplement consumption.	1	Very high
13	The role of the supporting media is to convey the history of the athlete's condition, injury, or disease.	1	Very high
14	Assisting media outlets in applying for a Therapeutic Use Exemption (TUE).	0.83	Very high

Table 4. Feasibility Assessment by Media Experts

Rater	S1	S2	ΣS	N(c-1)	V	Validity Level
1	2					
76	79	58	61	119	144	0.82

No.	Evaluation	V Value	Validity Level
1	Content	0.75	Medium
2	Accuracy	0.63	Medium
3	Format	0.92	Very High
4	Ease of Use	0.88	Very High
5	Timelines	0.91	Very High

Discussion

The validity test for the web-based application was conducted during the reflection stage, with the input of doping, medical, and media experts. Table 3 shows that the Android web-based anti-doping monitoring system for athletes with disabilities achieved an Aiken V value of 0.92, which doping and medical experts interpreted as indicative of high validity. Table 4 shows that the Android web-based anti-doping monitoring for athletes with disabilities attained an Aiken V value of 0.82 by media experts, who conducted a comprehensive review based on content, accuracy, format, ease of use, and time. The product, which was found to have high validity by the experts, can then be used in the trial stage by athletes with disabilities as a monitoring and consultation

service for athletes' complaints of illness or disease and for reporting on the consumption of drugs and/or supplements consumed by athletes.

The athlete's support system, including coaches, medical teams, and administrators, significantly impacts decision-making regarding anti-doping. NPCI Central Java facilitates health consultations during centralized training as a preventive measure against doping use. This consultation allows athletes to communicate health issues with medical teams either directly or through their coaches. However, concerns arise during decentralized training when athletes return to their respective regions with less supervision regarding their medication and supplement use. Medication consumption is often questioned during doping tests as part of tracing investigations (IADO, 2022).

The World Anti-Doping Agency (WADA) in 2009, has caused more positive tests than any other stimulant. Supplement contaminant and doping agent, beginning with an historical overview. Sections addressing its status as both a performance-enhancing substance and potential health threat follow, it offers advice for athletes and athletic organizations (Denham, 2017). Athletes with specific medical conditions may apply for a Therapeutic Use Exemption (TUE) to use prohibited substances under conditions outlined in The Code (WADA, 2021). This exemption requires a rigorous application process supported by medical documentation and approval by IADO. Anti-doping education is equally crucial in promoting clean sports practices. Studies show that athletes who receive anti-doping education have better knowledge and moral attitudes toward doping compared to those without such education (García-Martí et al., 2022; Murofushi et al., 2018b; Zhumabayeva et al., 2022). As mandated by the Code, the National Anti-Doping Organization (NADO) oversees doping control and education (IADO, 2022). Data sources emphasize the need for anti-doping socialization for athletes and their support systems, as these individuals significantly influence compliance with anti-doping regulations. Furthermore, technological advancements, such as website-based applications, offer a promising tool to support doping prevention, enabling athletes to access education, consultation, and monitoring features efficiently (Doewes et al., 2021; Jacobsson et al., 2020; Takahashi et al., 2007).

The development of this product can have a tangible impact on efforts to prevent athletes from using doping. With its easy application method, athletes can communicate directly with medical personnel through consultation facilities. From this service, athletes can break their doubts in making decisions to consume drugs or supplements. On the other hand, this product can facilitate tracing the history of drug or supplement consumption. This helps athletes by providing information on filling out forms included in a series of doping tests. The menu presented in this product also provides information about doping, such as the Prohibited List menu issued by the World Anti-Doping Agency (WADA). With this menu, athletes are expected to be able to read information related to prohibited substances and methods.

Research Contribution

This research contributes to developing a web-based application as a novel anti-doping education and monitoring tool specifically designed for athletes with disabilities under NPCI Central Java. The platform provides critical features such as health consultations, reporting mechanisms, and a "Prohibited List" menu to enhance compliance with anti-doping regulations. By integrating medical guidance with digital technology, the application supports adherence to the World Anti-Doping Agency (WADA) code and addresses gaps in documentation and education regarding doping prevention. Furthermore, this research demonstrates the utility of technology in facilitating centralized and decentralized athlete monitoring, offering practical solutions for improving athlete decision-making and compliance with doping regulations.

Limitation

The study's primary limitation is its focus on athletes with disabilities in NPCI Central Java, which may limit the generalizability of findings to other populations or regions. The effectiveness of the application relies heavily on user engagement and the availability of consistent internet access, which could pose challenges in less connected areas. Additionally, the study did not conduct long-term trials to evaluate the sustained impact of the application on athlete behavior and compliance.

The limited number of expert validators may also affect the comprehensiveness of the validation process, potentially leaving room for unidentified technical or usability issues.

Suggestion

Future studies should expand the scope of research to include diverse athlete populations and regions to enhance the generalizability of findings. Longitudinal studies are recommended to assess the application's sustained impact on anti-doping compliance. Collaborating with international anti-doping agencies and stakeholders could further enrich the application's content and functionality. Incorporating additional features, such as AI-driven health analytics and multilingual support, may improve accessibility and usability. Enhancing educational modules and engaging broader athlete support systems could strengthen the application's role as a comprehensive anti-doping tool.

CONCLUSION

Athletes and their supporting personnel (coaches, managers, parents, etc.) require information, knowledge, and anti-doping socialization. The Central Java Province's National Paralympic Committee of Indonesia (NPCI) attempted to prevent doping use. This website-based monitoring application was developed through analysis, design, development, and reflection stages, which included expert validation stages. From the reflection stage, this website-based application was deemed feasible for testing. Therefore, future research is expected to conduct actual trials with disabled athletes to assess the effectiveness of the website-based application as a medium for preventing doping use. Given the constraints imposed by the author's material limitations, the domain in question has a finite lifespan. Consequently, this product necessitates periodic maintenance. Furthermore, the operator must be engaged to ensure optimal system performance on the consultation menu. Future research is expected to include efficacy testing in athletes.

AUTHOR CONTRIBUTIONS STATEMENT

FU and DL contributed to developing the research concept, data collection, analysis, interpretation, article drafting, and revision. SR contributed to data collection and data analysis. MM assisted in data interpretation, article drafting, and article revision.

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