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Binaural Beats as Digital Drugs: Assessing Awareness and Usage Patterns in Nigerian Sports Communities

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ABSTRACTS

Purpose	The emergence of digital drugs (binaural beats) presents a novel and under-researched challenge within sports, particularly in contexts like Nigeria where psychological support structures are often underdeveloped. This study aimed to assess the level of awareness, sources of information, and usage patterns of digital drugs among Nigerian sports personnel (athletes, coaches, medical staff) and to examine the relationship between awareness and indicators of addiction-like behaviour.
Materials and Methods	A cross-sectional survey design was employed, with data collected from 297 personnel via a validated questionnaire (α=.89). Data analysis utilized descriptive statistics, Pearson correlation, one-way ANOVA, and chi-square tests.
Result	Findings revealed a critical knowledge deficit: only 28.6% of respondents were familiar with the term "binaural beats," and 12.8% reported usage. Crucially, no significant relationship was found between awareness levels and addictive behaviour ($r = -0.028$, $p = 0.627$). Dependence on informal information sources (e.g., social media, peers) was high and consistent across all professional categories ($p > 0.05$), indicating a systemic issue.
Conclusion	The study identifies a widespread and systemic vulnerability to digital psychoactive aids within the Nigerian sports ecosystem.
Keywords	Digital drugs; Binaural beats; Nigerian athletes; Awareness; Addiction behaviour; Sports personnel.

INTRODUCTION

When people hear about 'drugs' or 'drug use' in sports, their minds go to doping not bearing in mind the use of ergogenic aids or substances. Doping is the unethical use of substances to enhance performance, giving undue advantage to the user (Adegbesan et al., 2024; Olowoleni et al., 2025). Although, violators are caught eventually, people still venture into its usage. In developing countries like Nigeria, this is still the case, as recent as the just concluded National Sports Festival in Ogun state, no fewer than six athletes were disqualified on the first day and many more to face sanctions (Adewale, 2025). This established culture of substance-based doping provides a critical backdrop for

the emergence of a new, digital threat. Theoretically, this digital intervention operates on the principle of brainwave entrainment. Developed countries have now sought ethical ways to improve performance. Sports psychologists still hold the view that all actions and inactions in sports originate from the mind. Therefore, to win, they must devise tools to hack the mind to its full potential and even break elastic limits; therefore, the introduction of digital drugs (binaural Beats).

Psychoactive drug administration involves introducing different forms (e.g., powdered forms, pills, a liquid, or plant matter) into the body through injection, inhalation, insufflation, or ingestion (Mohammed & Othman, 2021; Sampaio et al., 2024). The existence of digital drugs, which may or may not be used in conjunction with edible psychoactive substances, complicates this seemingly straightforward claim. Digital drug use involves listening to binaural beats, which are allegedly intended to mimic the effects of psychoactive substances or to elicit specific emotional or cognitive states. When two tones with slightly different frequencies are delivered to each ear independently, the brain perceives a third pulsating tone (the beat) at the difference frequency, creating the auditory illusion known as binaural beats (Abadin et al., 2021; Baseanu et al., 2024; Kausel et al., 2024). Delta (1-4 Hz), theta (5-8 Hz), alpha (9-14 Hz), and beta (15-30 Hz) are the frequency bands into which these beats are divided. These bands are linked to various brain states, including sleep, relaxation, focus, and alertness (Hamza et al., 2023; Ingendoh et al., 2023).

One important new development in the field of digital wellness and substance alternatives is the creation and widespread use of "digital pharmaceuticals," often known as binaural beats. These readily available audio files on the internet are promoted as legitimate means of enhancing concentration, promoting relaxation, or changing awareness through aural stimuli (Askarpour et al., 2024; Kaplánová, 2020; Platt & Hammond, 2025). The adoption of such technology might be especially enticing for athletes, who are always looking for a competitive edge, as a potential way to reduce stress, manage pain, or train the mind without using illegal narcotics.

Binaural beats are illusory artefacts created by the interference of two independently pitched sine tones, both of which are from the frequency of 100Hz - 1000Hz (Abadin et al., 2021; Cintra et al., 2023; Rao et al., 2024). When the tones are presented simultaneously (presented differently in each ear), a sensation of beating is generated when no physical beating is taking place. This is because, when the tone frequency (difference between tones) falls between 1- 30 Hz, the hearing mechanism in humans does not differentiate the tones and hence, fuse them as a single (third) beat inside the listener's neural pathway (Jebabli et al., 2025; Kausel et al., 2024). Binaural beats could be delta (1-4 Hz), theta (5-8 Hz), alpha (9-14 Hz), and beta (15-30 Hz), depending on their frequency differences. However, a significant research gap exists regarding their efficacy and safety in athletic populations. Adopting this comes with its own risks, as scientific studies have not clearly buttressed its efficacy or demerits. Research Askarpour et al. (2024) and Ingendoh et al. (2023) has demonstrated that the evidence for brain entrainment and psychological effects remains inconclusive, and other studies have suggested a link between regular binaural beat usage and addiction-like behaviours, including compulsive use and emotional reliance, which could severely disrupt the discipline and consistency required for peak athletic performance. Athletes and their support personnel are left with a susceptible knowledge gap due to the discrepancy between extensive availability and promotion and the absence of solid scientific proof, especially when it comes to sports performance.

Sports performance is the yardstick for measuring sports participation. Performance in most sports is determined by the athlete's biomechanical, tactical, technical, somatic and mental characteristics (Abubakar et al., 2023; Jebabli et al., 2025; Olowoleni et al., 2025). Most times, the psychological aspects of performance are ignored by athletes, coaches and trainers (Adegbesan et al., 2019, 2024). This creates a significant vulnerability. Anxiety is a psychological reaction to stress

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in relation to task performance under pressure (Kaplánová, 2020; Puce et al., 2023). It is an unpleasant response to a perceived stimulus (affective, cognitive, physiological) with unpredictable effects over a period of time (Cintra et al., 2023; Flore, 2021; Platt & Hammond, 2025). State anxiety (choking) is always short-lived, as it is a response to a particular perceived stressful situation athletes find themselves (e.g., taking a decisive spot kick). It is therefore necessary for athletes to set their goals right and create a steady mindset both in competition and training in order to achieve these goals (Chen et al., 2024; Tang et al., 2023; Thiessen et al., 2024). Conversely, the level of alertness and mental acuity an athlete brings to performance is hinged on several factors, but not limited to physical fatigue, personal circumstances, education, or employment pressures, among others (Flore, 2021; Hartogsohn & Vudka, 2023; Shirawia et al., 2025). This combination of performance pressure and a lack of psychological support makes digital drugs a tempting, if risky, solution for athletes.

Despite their growing popularity, there is a critical lack of awareness and accurate knowledge about the potential implications of digital drugs, especially within the athletic community. Athletes, who often face immense psychological pressures, may be vulnerable to the purported benefits without understanding the risks, such as attention impairments, diminished motivation, and social detachment associated with solitary use (Akintayo, 2025; Dougherty & Baron, 2022; Hartogsohn & Vudka, 2023). This knowledge gap is not limited to the athletes themselves; it extends to the support staff tasked with their care. This gap is particularly acute in Nigeria, where sports science infrastructure is still developing. The specific socio-economic pressures on Nigerian athletes, including financial awards and job insecurity (Adegbesan et al., 2024; Olowoleni et al., 2021), may uniquely predispose them to experiment with unregulated digital aids. Therefore, this research is important and urgent for sports organizations in Nigeria, this underscores a need for targeted education for both athletes and sports medicine professionals to address this digital threat, ensuring that the pursuit of mental performance enhancement does not come at the cost of long-term psychological well-being, a concern supported by broader research on the mental health of elite athletes (Dougherty & Baron, 2022; Hartogsohn & Vudka, 2023; Kim, 2023; Rao et al., 2024).

The rapid advancement of technology and internet usage has introduced a new and insidious global challenge: digital drugs, a criminal trend that poses a threat to youth and families by transcending conventional drug consumption methods. In Nigeria, this global trend intersects with a local context of doping challenges and underdeveloped mental training frameworks. Thus, digital drugs constitute a consumable experience at the intersection of digital sound production and listener physiology, an affliction that effortlessly traverses borders via internet technologies and mobile applications, facilitating its spread among younger cohorts (Al-Sawy & Al-Sawy, 2023; Bertaccini et al., 2022; Dougherty & Baron, 2022; Flore, 2021). This study is novel because it focuses specifically on the Nigerian sports environment. In order to fill a contextual gap in the literature and develop effective public health and sports policy interventions tailored to this particular environment, it is imperative to investigate the awareness levels and usage patterns of digital drugs among Nigerian sports personnel (athletes, coaches, and medical staff). Despite the fact that binaural beats are becoming more widely available, little is known about sports personnel's awareness, usage habits, and behavioural correlations, especially in developing nations like Nigeria.

The main objectives of this research are to assess the level and sources of awareness regarding digital drugs (binaural beats) among Nigerian sports personnel, specifically athletes, coaches, and medical staff. Additionally, the study aims to investigate the relationship between the awareness of these digital drugs and indicators of addictive behaviours among the personnel. Finally, the research seeks to compare awareness levels and knowledge accuracy, such as the ability to correctly define a binaural beat, across the different professional subgroups.

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METHODS

Research Design

This research employed a cross-sectional survey design to investigate awareness and usage patterns of digital drugs (binaural beats) among Nigerian sports personnel.

Study Participants

This study targeted sports personnel in South-West Nigeria affiliated with high-performance sports institutions. The estimated target population was 4,100 individuals, comprising 1,200 elite athletes and 2,900 coaching and medical staff. Using a stratified random sampling technique to ensure proportional representation, a minimum sample size of 351 participants was calculated (95% confidence level, 5% margin of error). A total of 350 participants were successfully recruited across the three strata. However, only 297 completed and correctly returned the instrument, yielding a final sample for analysis. The participants included elite athletes, certified coaches, and registered medical staff (sports physicians, physiotherapists) working within state sports councils and national training centers. The selection criteria required a minimum of 2 years of active involvement in elite sports. A stratified random sampling technique was employed to ensure proportional representation across the three strata of sports personnel: athletes, coaches, and medical staff. Participants were randomly selected from each stratum based on the population proportions derived from state sports council records.

Data Collection

The primary instrument was the validated Awareness and Usage of Digital Drugs Questionnaire (AUDDQ). The AUDDQ consisted of 32 items divided into four sections. Section 1 (Demographics) contained 6 items on age, gender, professional category, and years of experience. Section 2 (Awareness) contained 10 yes/no/don't know items assessing whether participants had heard of terms such as "digital drugs" and "binaural beats." Section 3 (Knowledge) contained 8 true/false/I don't know items testing factual understanding of binaural beats mechanics, including the necessity of headphones and the scientific evidence for their effects (see Table 2 for example items). Section 4 (Addiction-like behaviour) contained 8 items measured on a 5-point Likert scale (1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = always). Example items from this section include: "I feel uneasy if I do not listen to binaural beats for a day," "I have tried to reduce my use of binaural beats but failed," and "I spend increasing amounts of time listening to binaural beats." Higher total scores on this subscale indicated greater addiction-like tendencies. The operational definition of addiction-like behaviour was adopted from existing substance use literature, adapted to the context of digital audio stimuli, comprising three core elements: compulsive use, unsuccessful attempts to reduce use, and emotional reliance.

Following ethical approvals, researchers liaised with state sports councils to obtain participant lists. A stratified random sample was drawn, and invitations were sent directly to selected individuals. Data was collected via self-administered questionnaires distributed in person at training centers during scheduled team meetings to ensure a controlled environment and maximize response rates.

A pilot study was conducted with 30 sports personnel (10 from each subgroup) from a non-participating region. This served to estimate completion time (approx. 15 minutes), confirm clarity, and test psychometric properties. No modifications were required, and pilot data were included in the final analysis. The validity of the AUDDQ was established through several methods. Face and

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content validity were assessed by a panel of five experts in sports psychology, psychiatry, and public health. Construct validity was confirmed via significant item-total correlations ($r = 0.39$ to 0.73, $p < .01$). Internal consistency, measured by Cronbach's alpha from the pilot phase, was 0.93 for the entire instrument and 0.89 for the addiction-like behaviour subscale. Test-retest reliability was assessed by re-administering the questionnaire to the pilot group after a two-week interval, yielding a Pearson correlation of 0.89, confirming temporal stability.

Statistical Analysis

Data analysis was performed using SPSS version 23. Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to summarize demographic variables and answer primary awareness questions (e.g., percentage aware, sources of information). A chi-square test was used to examine associations between personnel category (athlete, coach, medical staff) and source of information. An independent samples t-test was used to compare knowledge scores between reported users and non-users of digital drugs. Pearson Product-Moment Correlation (PPMC) was employed to determine the relationship between awareness levels and indicators of addiction-like behaviour. One-way ANOVA was used to compare awareness scores across the three professional categories. The significance level was set at $\alpha = .05$ for all inferential tests.

Ethical Considerations

Ethical approval was obtained from the Department of Human Kinetics and Health Education at Prince Abubakar Audu University. Written approval was also secured from the relevant state sports councils. All participants provided written informed consent after a full explanation of the study's aims, procedures, risks, and benefits. Confidentiality and anonymity were guaranteed, and participants were informed of their voluntary participation and right to withdraw at any time without penalty.

Training Program

Based on the findings, a targeted psychoeducational training program will be developed. The programmer's objective will be to bridge the identified knowledge gap regarding digital drugs. It will be structured as a 3-module workshop for athletes, coaches, and medical staff, covering: 1) The science and myths of binaural beats, 2) Identification of potential benefits and risks (including addiction-like behaviours), and 3) Ethical guidelines for digital cognitive aids in sports.

RESULT

Table 1. Summary of Descriptive Representation

Item	Variable	N	Percent (%)
Gender	Female	192	64.6
	Male	105	35.4
Age	18-24	132	44.4
	25-34	105	35.4
	35-44	52	17.5
	44 years and above	8	2.7
Category	Athlete	206	69.4
	Coach	29	9.8
	Medical Staff (Doctor, Physiotherapist, Sports Scientist)	62	20.9

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Item	Variable	N	Percent (%)
Heard about Binaural	No	212	71.4
	Yes	85	28.6
Heard about digital drugs	No	147	49.5
	Yes	150	50.5
Used Binaural beats	No	259	87.2
	Yes	38	12.8

The study comprised 297 sports personnel, with a majority being female (64.6%, n = 192) and athletes (69.4%, n = 206). Table 1 also shows that the sample was relatively young, with 44.4% (n = 132) aged 18-24. Baseline awareness data revealed a critical finding: while half of the participants (50.5%, n = 150) had heard the term "digital drugs," familiarity with the more technical term "binaural beats" was substantially lower (28.6%, n = 85). Actual usage was reported by only 12.8% (n = 38) of respondents. This indicates that although the concept of digital drugs has moderate recognition, specific technical knowledge and practical engagement remain limited within the Nigerian sports community.

Table 2. Awareness of Binaural among sports personnel in Nigeria

Item	False	I do not know	True	Mean
Digital drugs involve listening to specific audio files	123	81	93	1.9
Binaural beats can only work if you use headphones.	121 (40.7%)	84 (28.3%)	92 (31%)	1.9
The effects of digital drugs are supported by strong, conclusive scientific evidence.	113 (38.0%)	103 (34.7%)	81 (27.3%)	1.89
Using digital drugs is completely legal in most countries.	122 (41.1%)	91 (30.6%)	84 (28.3%)	1.87
Digital drugs can be used to improve focus and reduce anxiety.	111 (37.4%)	91 (30.6%)	95 (32%)	1.95

Table 2 revealed important misconceptions and knowledge gaps. Just 31.0% (n = 92) of participants correctly identified that headphones are necessary for binaural beats to function, for instance, whereas 40.7% (n = 121) gave an incorrect response, and 28.3% (n = 84) were confused. In addition, there were many misconceptions about the scientific and legal standing of digital pharmaceuticals; only 27.3% (n = 81) properly denied the assertion that there is substantial scientific evidence for their effects, and only 28.3% (n = 84) correctly confirmed their general legality. The populace has a generally inadequate and unclear understanding of the basic mechanics and features of digital pharmaceuticals, as seen by the consistently low mean scores across knowledge items (1.77-8.95 on a 3-point scale).

Table 3. PPMC shows the relationship between awareness and addiction behaviours toward digital drugs

		Addictive behaviour	Awareness
Addictive behaviour	Pearson Correlation	1	-.028
	Sig. (2-tailed)		.627
	N	297	297

Table 4. T-test comparison of knowledge between users and non-users of Binaural Beats

ANOVA					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	.896	1	.896	.237	.627
Within Groups	1115.313	295	3.781		

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Total	1116.209	296

Awareness and addictive behaviours associated with digital medicines do not significantly correlate, according to statistical analyses in Table 3. There was no significant relationship between awareness and addiction-like behaviour, r(295) = -0.028, p = .627. An ANOVA supported this conclusion by demonstrating that there was no discernible difference in knowledge ratings between binaural beats users and non-users ($F_{(1, 295)}$ = 0.237, p =.627, η^2 = 0.018). This implies that compulsive use is probably driven by other factors and that a person's level of knowledge about digital substances is not a predictor of their likelihood of developing addicted consumption behaviours.

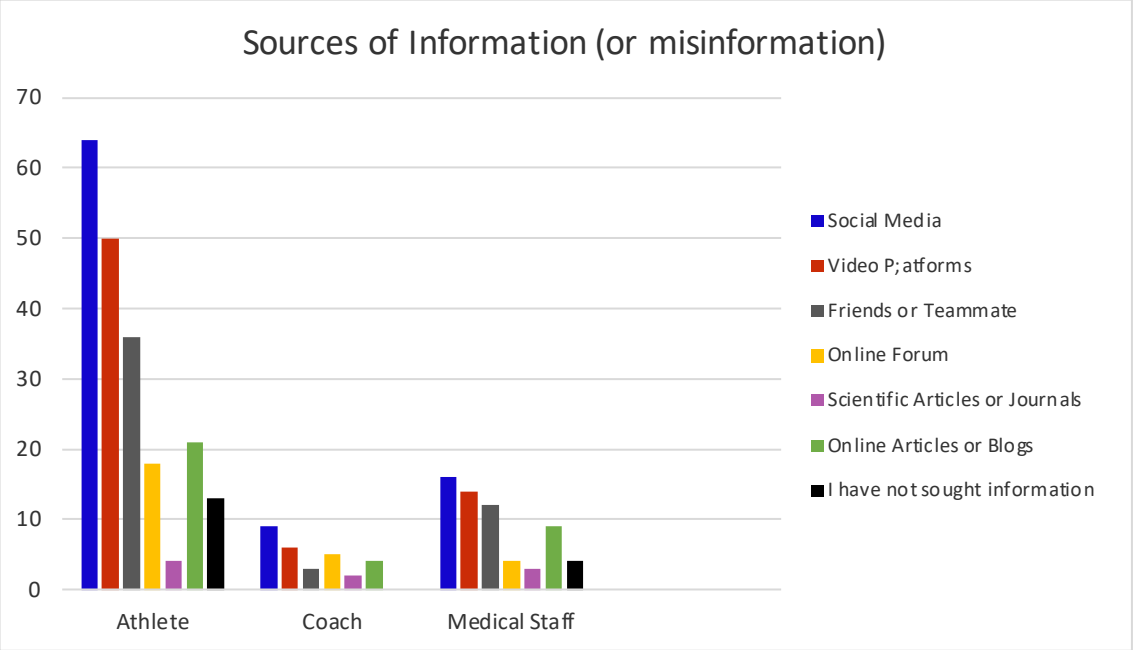

Figure 1. Sources of Information on Digital Drugs/Binaural Beats

The primary sources of information on digital drugs were predominantly informal. Social media (45%) and friends or teammates (30%) were the most cited channels.

Table 5. Association between Category and Source of Information (or misinformation)

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	9.894[a]	12	.625
Likelihood Ratio	10.896	12	.538
Linear-by-Linear Association	1.101	1	.294
N of Valid Cases	297		

a. 7 cells (33.3%) have expected count less than 5. The minimum expected count is .88.

Directional Measures

			Value
Nominal by Interval	Eta	Category Dependent	.107
		Source Of Info Dependent	.062

A Chi-Square Test of Independence correlation between category and information (or misinformation) source is shown in Table 4. χ^2(12, N = 297) = 9.89, p =.625, showed no significant correlation between category (athlete, coach, medical staff) and information source, confirming that these sources were constant across various professional roles. The homogeneity of information channels throughout the sample is further supported by the modest eta values (η <.11). This

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preponderance of unofficial sources reveals a significant dependence on possibly unreliable data and a conspicuous lack of organized, reliable advice on the subject.

Table 6. One-way ANOVA showing the difference in Awareness Across sports personnel

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	20.677	2	10.339	2.775	.064
Within Groups	1095.531	294	3.726		
Total	1116.209	296			

A one-way ANOVA was conducted to compare the mean awareness scores across athletes, coaches, and medical staff. The test result was not statistically significant, $F_{(2, 294)} = 2.78$, $p = .064$. This indicates that the observed slight variations in knowledge between the groups were likely due to chance. Therefore, the low level of awareness is a uniform issue that permeates all key professional groups within the sampled Nigerian sports institutions, underscoring a systemic rather than role-specific knowledge deficit.

DISCUSSION

This study aimed to investigate the awareness, knowledge, and behavioural correlates of digital drugs among Nigerian sports personnel. The results show that Nigerian athletes have a very poor awareness level and are frequently misinformed. According to the data, just 31.0% of respondents were aware of the basic technical prerequisite for using headphones for binaural beats, a method that Abadin et al. (2021) and Baseanu et al. (2024) has elucidated, and only 27.3% correctly disputed the assertion that digital medications have good scientific proof. Furthermore, a profound conceptual void was confirmed, with only approximately one-third of respondents demonstrating an accurate understanding of binaural beats. This inability to define a technology that operates on a specific psychoacoustic principle, as detailed by previous studies Abadin et al. (2021), Bertaccini et al. (2022), Hamza et al. (2023) and Kim (2023), identifies a gap in psychophysiological education within the sampled population. This deficiency is highlighted by the conceptual gap in the sample; although 50.5% of the participants had heard of "digital drugs," only 28.6% were aware of the term "binaural beats." This discrepancy implies that while the technical term is still unknown, the more sensationalized term "digital drugs" has gained wider traction, probably thanks to popular media and internet subcultures. Theoretically, these findings can be interpreted through brainwave entrainment theory Abadin et al. (2021); Baseanu et al. (2024), which posits that external auditory stimuli at specific frequency differences can influence cortical oscillations. Our finding that only 31.0% of participants understood the headphone requirement necessary for this mechanism to operate reveals a fundamental gap in applied psychophysiological literacy within the Nigerian sports context.

These findings lead to significant conclusions when compared with the literature and reveal their broader implications. The widespread ambiguity and poor awareness indicate an observable gap in the sports ecosystem's knowledge-sharing process. According to Adegbesan et al. (2019), Bertaccini et al. (2022) and Mohammed and Othman (2021), psychological support is frequently undeveloped in this setting, which leaves a gap that is readily filled by the exaggerated claims made in internet marketing. The findings on awareness align with the systematic study from Ingendoh et al. (2023), which found that there is still inconclusive data about the effects of binaural beats on brain entrainment. This knowledge deficit is noteworthy; it indicates that the sports community is potentially vulnerable to a new form of digital dependency, unaware of the risks associated with tools that purport to "hack" the mind for performance.

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Crucially, the analysis revealed no significant relationship between awareness and addictive behaviours ($r(295) = -.028$, $p = .627$), suggesting that familiarity with digital medicines does not serve as a buffer against compulsive usage patterns. This finding confirms the hypothesis of Ingendoh et al. (2023) that consumers may become emotionally dependent due to subjectively felt advantages, independent of their knowledge. It seems that psychosocial considerations, rather than informed choice, may be influential factors behind use in the high-pressure environment of competitive sports. As noted by Bertaccini et al. (2022), Kaplánová (2020), Kim (2023), Olowoleni et al., 2025, and Puce et al. (2023), athletes often face high levels of anxiety and performance pressure, which prompts them to look for quick fixes. From a theoretical standpoint, the absence of a significant relationship between awareness and addiction-like behaviour contradicts rational choice models of health behaviour, which would predict that greater knowledge reduces risky behaviour. Instead, our findings align more closely with the dual-process model of addiction, which distinguishes between cognitive (knowing) and affective (feeling/driving) systems. Within this model, compulsive use is theorized to be driven primarily by the affective system, specifically, the desire to manage performance anxiety, stress, or pressure rather than by the cognitive system's level of factual awareness. This theoretical interpretation explains why individuals with similarly low awareness levels may still be vulnerable to digital drug experimentation and suggests that interventions based solely on information dissemination are theoretically insufficient.

The implications of these conclusions are further underscored by the sources of information and the systemic nature of the problem. Findings reveal a significant dependence on unofficial sources, with peers and social media serving as the main information sources. This suggests that sports personnel are not receiving filtered or expert-vetted information, leaving them susceptible to unverified claims and potential misinformation. Crucially, $\chi^2(12, N = 297) = 9.89$, $p = .625$, verified that this tendency is consistent across professional categories, suggesting a systemic rather than isolated problem. This is consistent with the worldwide diffusion paths outlined by Al-Sawy and Al-Sawy (2023) and Flore (2021) who point out that informal, internet-based channels are how such occurrences proliferate. Moreover, analysis showed there was no statistically significant difference in the three professional groups' levels of awareness ($F_{(2, 294)} = 2.78$, $p = .064$). This uniformity across professional roles indicates that even medical staff, who are expected to possess specialized health knowledge, are equally uninformed, pointing to a systemic rather than role-specific educational deficit. The findings suggest a widespread lack of structured knowledge dissemination within the sampled sports context. It is notable that medical personnel showed awareness levels on par with athletes and coaches. As noted by Hamza et al. (2023), Olowoleni et al. (2025) and Shirawia et al. (2025), this consistent knowledge gap reflects the larger institutional neglect of psychology education and new developments in digital health.

The practical applications of these results point to a clear need for institutional action and integrated education. There is a need for organized educational interventions aimed at all levels of sports professionals, as the poor awareness seen is not just the result of a lack of knowledge but also of active misinterpretation. The absence of a significant link between awareness and addiction suggests that intervention strategies must extend beyond mere awareness campaigns to address the underlying stressors and promote evidence-based coping mechanisms. This consistent reliance on dubious sources emphasizes how important it is for organizations involved in sports to aggressively spread credible, fact-based information to combat the widespread effect of online disinformation networks. In the absence of specific institutional frameworks and education, as suggested by Cintra et al. (2023), Ingendoh et al. (2023), and Jebabli et al. (2025), digital drugs will continue to be an

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unregulated and misunderstood risk, requiring integrated capacity-building programmes for the entire sports ecosystem.

For future research, several critical directions are indicated. Longitudinal studies are necessary to track the evolution of digital drug use and its long-term psychological impacts. Furthermore, experimental research is needed to conclusively determine the efficacy and specific risks of binaural beats for athletic cognitive conditioning, moving beyond the inconclusive evidence currently available. Additionally, qualitative investigations should explore the psychosocial drivers of use among athletes to better design targeted support interventions that address the root causes, such as anxiety and performance pressure, beyond merely improving awareness.

Several limitations should be considered. First, the cross-sectional design prevents causal inferences. Second, self-reported data may be subject to social desirability bias. Third, the sample was disproportionately composed of athletes (69%), limiting comparisons across roles. Fourth, the addiction-like behaviour subscale, while internally consistent (α = .89), has not been validated in other populations. Additionally, the "addiction-like behaviour" construct was measured using a newly developed subscale that, while internally consistent (α = .89), has not been validated against clinical criteria for substance use disorders. Respondents may also have interpreted the term "addiction" differently, introducing potential measurement bias. Finally, findings are limited to South-West Nigeria and may not generalize to other regions.

CONCLUSION

Based on the findings of this study, it can be concluded that Nigerian sports personnel demonstrate a crucially low awareness of binaural beats, with only a small portion familiar with the term or understanding the basic technical requirement of headphone use. This knowledge deficit is universal across the sampled sports ecosystem, as no significant differences in awareness exist among various professional categories. Furthermore, a systemic knowledge dissemination failure is evident, given that information sources are predominantly informal (such as social media and peers), and this pattern remains consistent across athletes, coaches, and medical staff. Finally, there is no significant relationship between the awareness of digital drugs and addiction-like behaviour, indicating that compulsive use is driven by factors other than knowledge.

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CONFLICT OF INTEREST

The authors have nothing to declare.

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