

Hydration Knowledge and Fluid Replacement Strategies among Athletic Coaches in Ghana

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Abstract

Adequate hydration is crucial for athletic performance as it affects thermoregulation, cardiovascular function, and endurance. Coaches play a key role in ensuring proper hydration, yet limited data exist on their knowledge and practices in low- and middle-income countries (LMICs). This study assessed hydration knowledge and fluid replacement strategies among athletic coaches in Accra, Ghana. A cross-sectional survey was conducted among 68 coaches from football, basketball, athletics, and volleyball. Data was collected using a structured questionnaire on hydration knowledge, fluid replacement practices, and information sources. Analyses for associations between knowledge scores and demographic variables were conducted using chi-square tests and regression analysis. Only 4.4% of coaches achieved a passing hydration knowledge score ($\geq 80\%$), 67.65% had moderate knowledge and 27.9% had low knowledge. Questions related to indicators of dehydration, appropriate fluid intake, and the impact of climate conditions on hydration needs were frequently answered wrongly by respondents. Despite the importance of hydration, 45.6% of coaches provided no fluids to athletes before training, and 50% did not offer fluids post-training. Social media was the primary source of information on hydration (91.2%), and professional organizations and health professionals were the least consulted sources. Statistical analyses showed no significant associations between knowledge scores and demographic factors such as age, educational level, sports specialty, or coaching experience. Findings highlight substantial knowledge gaps and inadequate hydration practices among the coaches. Targeted educational interventions planned in collaboration with sports nutrition experts are needed to improve hydration strategies and practices among coaches in Ghana.

Keywords: Hydration Knowledge, Fluid Replacement, Athletic Coaches, Dehydration, Sports Nutrition, Dietetic Professionals.

Introduction

Athletic performance is significantly influenced by hydration status. Dehydration impairs physical, cognitive, and cardiac functions by disrupting hemodynamic and thermoregulatory responses (Cheuvront & Kenefick, 2014). Conversely, overhydration can lead to sodium (Na^+) depletion, resulting in hyponatremia (Kalra, 2023). Even a loss of more than 2% of body weight due to dehydration can reduce performance, especially in hot climates (Shirreffs & Sawka, 2011).

Athletic coaches not only train athletes but also provide essential guidance on hydration and nutrition (Belval et al., 2019). Their interactions with athletes play a crucial role in shaping hydration habits (Kobayashi & Yasuda, 2022). Emerging technologies are helping some coaches monitor hydration in real-time (Martin, 2024), allowing for individualized fluid strategies. However, these advancements are unevenly distributed, particularly in LMICs, where resources and training may be limited. Additionally, the rising occurrence of extreme heat events caused by climate change underscores the importance of effective hydration strategies, especially in regions like sub-Saharan Africa where sports are frequently played in high-temperature conditions (Hoegh-Guldberg et al., 2018). Research evidence also suggests potential connections between hydration status and Body Mass Index (BMI). For example, underweight athletes may be at risk of dehydration due to inadequate fluid intake, which could be worsened by low energy availability or disordered eating behaviours (Kutlay & Ergun, 2012). Although extensive research has examined athletes' hydration practices, including studies in low- and middle-income countries (LMICs) (Dube et al., 2022), there is a notable lack of studies evaluating coaches' knowledge and practices. This gap is crucial, as coaches potentially have significant influence on the hydration habits of athletes, particularly young and amateur players who often depend heavily on their guidance. Thus, this study aimed to evaluate coaches' hydration knowledge and the fluid replacement methods they employ during training and competition.

Materials and Methods

Study Design

This cross-sectional study was carried out from April – June 2018 in Accra, Ghana.

Sampling Method

Convenient sampling was employed to recruit all available coaches who were actively coaching sports teams.

Study Site

The study was conducted at the training sites of selected sporting clubs located in suburban areas (East Legon, Madina, Atomic Junction, Haatso, Adenta, Kawukudi) in Accra, Ghana.

Study Participants

Coaches of football, basketball, volleyball, and athletics teams within the study areas were eligible for the study. They were contacted using the snowball approach.

Sample Size

A total enumeration approach was used. Sixty-eight coaches who agreed to participate were recruited for the study, with a breakdown as follows: Football (38), Basketball (10), Athletics (10), and Volleyball (10).

Inclusion Criteria

Eligible participants included coaches involved in endurance sports such as football, basketball, volleyball, and field athletics.

Exclusion Criteria

Participants who were not actively engaged in coaching sports teams/athletes at the time of the study, as well as those who did not consent to participate in the study, were excluded.

Data Collection Procedure

Study participants were visited at their training sites by researchers. Data was collected using a structured questionnaire adapted from Geijer et al. (2009). The questionnaire was pre-tested among 10 coaches who were not involved in the study. After adjustments, an interviewer-administered approach was employed to collect the data. The questionnaire, shown in Appendix II, comprised three sections as follows: Section 1: Background information; Section 2: Questions on hydration knowledge and practice; and Section 3: Sources of hydration knowledge. Height and weight measurements of participants were measured using a SECA stadiometer and the OMRON Bioelectrical Impedance Analyzer (BIA), respectively.

Data Management Plan

Data from questionnaires were entered and stored on a password-protected personal computer, while physical copies were kept in the archives at the Department of Dietetics, University of Ghana. Access was restricted to authorized personnel only, ensuring confidentiality throughout the study.

Ethical Issues

The study was approved by the Ethics and Protocol Review Committee of the School of Biomedical and Allied Health Sciences, University of Ghana, with ethics clearance number SBAHS- PH/10518333/SA/2017-2018. All participants signed written informed consent before study involvement. Ethical guidelines, including participant confidentiality, data protection, and rights to withdraw, were strictly observed in accordance with the Declaration of Helsinki.

Results

Background Characteristics of Study Participants

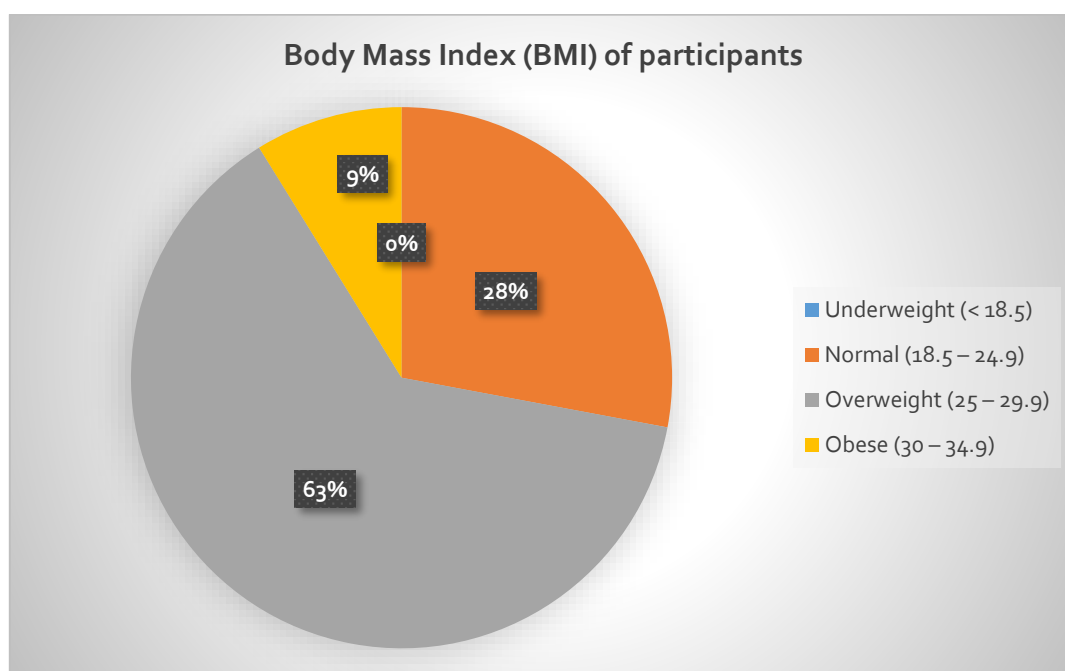
The background characteristics of study participants are presented in table 1. A total of 68 coaches participated in the study, of which 48 (70.6%) were male, and 20 (29.4%) were female. Ages ranged between 22 and 48 years, with a mean age ($\pm$ standard deviation) of 31 ($\pm$ 6.2) years and a mean coaching experience of 5.75 $\pm$ 3.84 years. Six (8.8%) of the participants had received training or attended a training program related to hydration, while 62 (91.2%) had no formal training on hydration. Of the total participants, 28 (41.2%) had a tertiary degree, 36 (52.9%) had a senior secondary school degree, and 4 (5.9%) had

an educational level lower than senior secondary school. The mean Body Mass Index BMI of the participants was 26.34 ± 2.62 . When BMI was classified, 63.24% of participants were overweight, 27.94% were normal weight, and 8.82% were obese, figure 2.

Table 1. Background characteristics of study participants

Characteristics	Frequency (Percentage) n (%)
Sex (n = 68)	
Male	38 (70.6)
Female	20 (29.4)
Age	
20-30 years	43 (63.2)
31-40 years	20 (29.4)
41-50 years	5 (7.4)
Period of Coaching	
Less than 5 years	34 (50.0)
5-10 years	25 (36.8)
Greater than 10 years	9 (13.2)
Sports Specialty	
Football	38 (55.9)
Basketball	10 (14.7)
Athletics	10 (14.7)
Volleyball	10 (14.7)
Educational Level	
Primary	4 (5.9)
Secondary	36 (52.9)
Tertiary	28 (41.2)

Source: Authors own creation



*BMI Body Mass Index

Source: Authors own creation

Figure 1. Body Mass Index (BMI) of participants

Study Participants' Knowledge Regarding Hydration

The hydration knowledge assessment aspect of the study consisted of 17 questions. A passing score required 14 or more correct responses (i.e., 80% or higher), which aligned with similar studies using comparable knowledge-based tests (Geijer et al., 2009; Ransone & Dunn-Bennett, 2025). The mean score for all respondents was 10.5 ± 1.8 . Only 3 coaches (4.4%) achieved a passing score (14 or more correct responses) on the questionnaire, indicating that majority (95%) of the participants did not meet the passing criteria. Notably, five questions were frequently answered incorrectly by participants, namely, questions 1, 3, 10, 11, and 13. The percentage of correct answers for these questions was below 50%. These are presented in table 2.

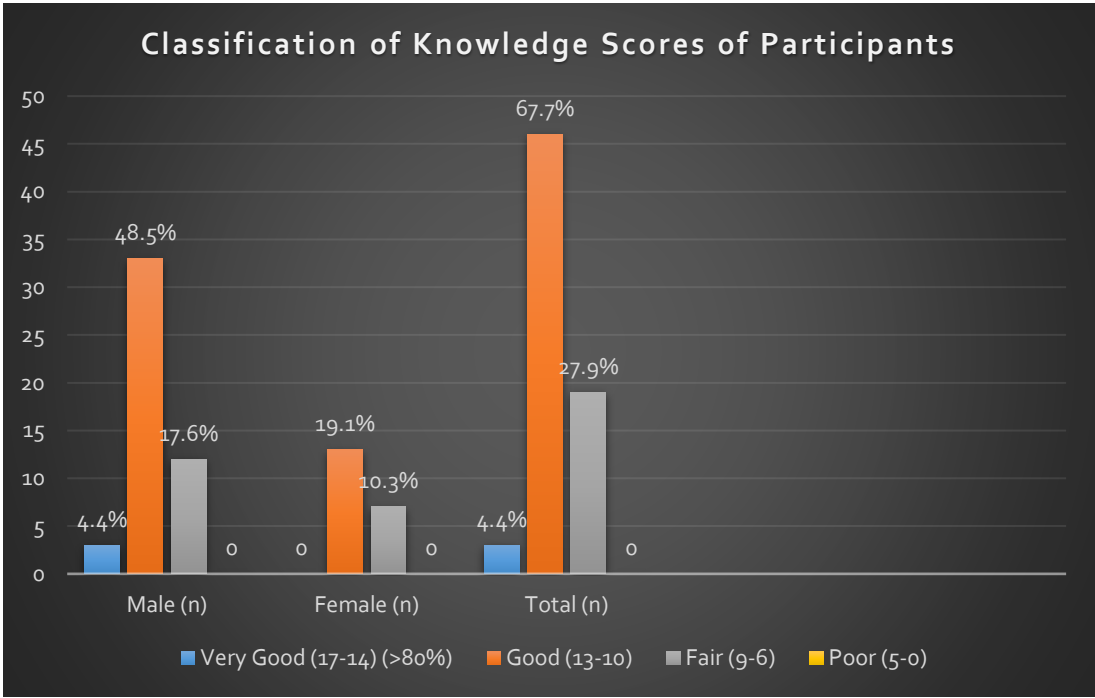
Table 2. Coaches' Knowledge of Hydration – Correct Versus Incorrect Responses ($n = 68$)

Survey Question	Correct Response (%)	Incorrect Response (%)
1. Thirst is a timely indicator that an athlete needs to drink fluid	0	100.0
2. Monitoring urine color is an effective way for an athlete to determine if he/she is dehydrated.	95.6	4.6
3. Comparing body weight before and after training/competition is not a useful way to determine how much fluid needs to be consumed.	25.0	75.0
4. Dehydration improves performance in endurance events.	70.6	29.4
5. Dehydration increases the risk of experiencing heat-related illnesses, such as heat cramps, heat exhaustion, etc.	92.6	7.4
6. Exercise or physical activity in hot and humid conditions has no effect on dehydration.	48.5	51.5
7. Athletes should begin each training session or competition well-hydrated.	94.1	5.9
8. 2-3 hours prior to exercise, an athlete should aim to consume: 500-600 ml (1 water sachet to 1 sachet water plus 1/5th water sachet) of fluid.	76.5	23.5
9. 10-20 minutes before competition, an athlete should aim to consume: 200-300 ml (2/5th to 3/5th of water sachet) of fluid.	80.9	19.1
10. Fluid replacement during exercise should, at the very minimum, prevent dehydration of greater than 2% body weight reduction.	83.8	16.2
11. Post-exercise fluid replacement should be approximately 150% of the fluid lost during activity.	17.6	82.4
12. During endurance training or competition that exceeds more than 50 minutes, water is equally as effective as a sports drink containing carbohydrates and electrolytes.	17.6	82.4
13. Sports drinks, if being ingested during exercise, should have a carbohydrate concentration of at least 8%.	17.6	82.4
14. The main form of carbohydrate in a sports drink should be glucose.	97.1	2.9
15. Sodium should be included in fluid replacement beverages if the physical activity lasts 4 or more hours.	76.5	23.5
16. During recovery, athletes should aim to re-hydrate within a 2-hour period after exercise.	80.9	19.1
17. The addition of sodium and carbohydrate to the re-hydration beverage (after exercise) will speed rehydration and replenish glycogen stores, respectively.	80.5	19.5

Source: Authors' own creation, adapted from questionnaire by Geijer et al. (2009)

Classification of Hydration Scores

The classification of hydration scores obtained by participants are presented in figure 2.



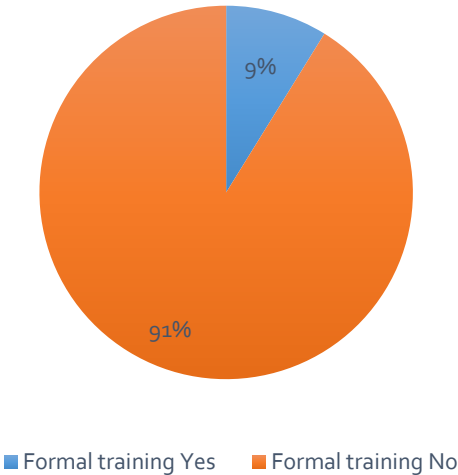
Source: Authors own creation

Figure 2. Classification of Knowledge Scores of Coaches

Figure 2 shows the classification of scores obtained by participants. Only 4.4% participants had a very good score, 67.7% of participants had a good score and 27.9% of participants had a fair pass as shown in figure 2. The mean knowledge score of the respondents was 10.54 ± 1.8 which falls in the category of a good score.

Formal Training of Coaches

The proportion of coaches with formal training is presented in Figure 3.



Source: Authors own creation

Figure 3 – Formal Training of Coaches

Hydration practices of coaches

Out of the 68 respondents, 45.6% gave their athletes nothing at all, 47.1% gave water, while the rest (7.4%) gave sports drinks or both water and sports drinks before practice or training.

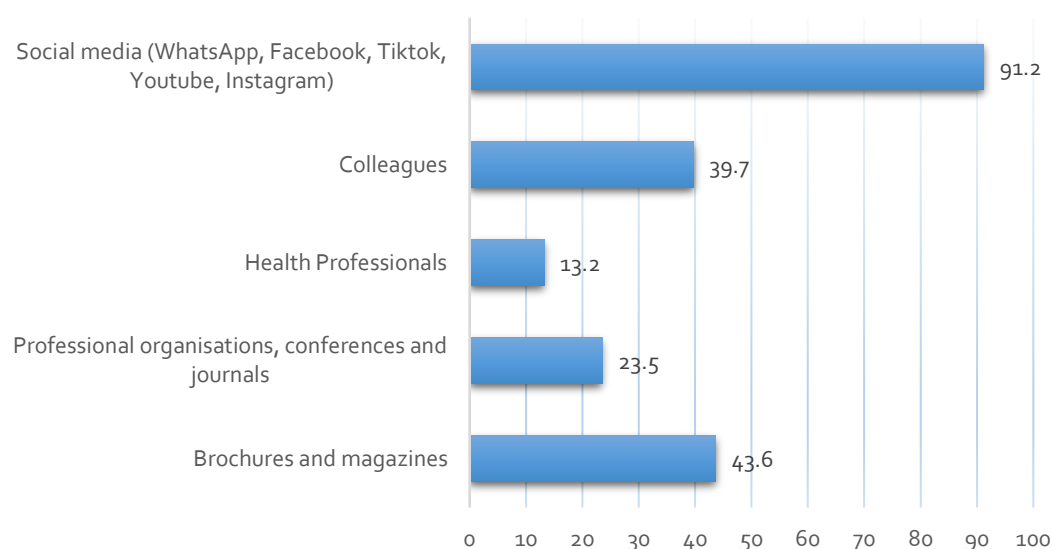
Table 3. Hydration Practices of Coaches Before, During, and After Training/Practice

Hydration Practice	Before (n%)	During (n%)	After (n%)
Nothing	31 (45.6)	22 (32.4)	34 (50.0)
Water	32 (47.1)	45 (66.2)	31 (45.6)
Sports Drinks	4 (5.9)	1 (1.5)	1 (1.5)
Water and Sports Drink	1 (1.5)	0 (0.0)	2 (2.9)
Total	68	68	68

Source: Authors own creation

Sources of hydration information

Sixty-two coaches (91.2% of the respondents) reported social media as one of the sources of information on hydration. Nine coaches (13.2%) identified health professionals as their source of hydration information, making it the least selected option.



Source: Authors own creation

Figure 4: Sources of Hydration Knowledge Among Coaches

Relationship between age, sports specialty, educational level, formal training, body mass index, period of coaching and knowledge score.

The relationship between age, sports specialty, educational level, formal training, body mass index (BMI), and period of coaching with the knowledge score among the coaches was assessed using chi-square tests. The results showed that there were no significant

relationships ($p > 0.05$) between the knowledge score and any of these factors (Supplementary Table 1).

Regression Analysis

A regression analysis was performed to examine the relationship between the knowledge scores of participants (the dependent variable) and several independent variables, including age, sports specialty, educational level, period of coaching, formal training, and BMI. The regression model summary showed an R value of 0.249, with an R-square value of 0.062 and an adjusted R-square of -0.030. The standard error of the estimate was 1.826 (Supplementary Table 2) and $p > 0.05$ for all variables (Supplementary Table 3). These results indicate that the model accounted for only a small proportion of the variance in knowledge scores and did not identify any statistically significant relationships between the knowledge score and the independent variables.

Discussion

In this study, majority of participants were males. This aligns with trends in Africa, where male coaches dominate, particularly in team sports like football. Charway & Strandbu, (2023) in their study provides insights into the cultural and systemic barriers affecting female participation in sports leadership within the Ghanaian context. This highlights the need for targeted efforts to improve female representation in sports coaching in LMICs.

Most participants were aged 20–30 years, suggesting that coaching in Ghana tends to attract younger individuals. This observation agrees with findings by Kubayi et al. (2018) in South Africa, who noted similar trends among coaches in developing regions, where entry into coaching often occurs at younger ages due to fewer barriers to entry. Expertise in sports science, including hydration practices, tends to improve with experience (Couture et al., 2015), thus, the limited duration of coaching observed in this study may partly explain the inadequate hydration knowledge observed.

More than half (52.9%), of participants had secondary school education, suggesting that secondary level education may not adequately prepare coaches with specialized knowledge. Younger and less experienced coaches in particular can benefit from targeted training programs and mentorship opportunities to bridge this knowledge gap. Initiatives like workshops and certification programs tailored to sport-specific hydration strategies could be beneficial.

Football coaches represented the majority (55.9%) of participants, followed by equal representation from basketball, athletics, and volleyball (each at 14.7%). This distribution mirrors the prominence of football in Ghana, a sport that receives substantial media attention, funding, and government support. Studies like Depetris-Chauvin (2020) and Onwumechili (2019) similarly highlight football's dominance in African sports (Depetris-Chauvin et al., 2020; Onwumechili, 2019). However, the equal representation of basketball, athletics, and volleyball coaches indicates increasing diversification in Ghana's sports landscape. Hydration education initiatives could consider the unique physiological

demands and hydration strategies required for different sports to optimize their effectiveness.

The mean BMI was found to be $26.3 \pm 2.6 \text{ kg/m}^2$, placing participants in the overweight category. Males had a slightly lower mean BMI ($26.0 \pm 2.4 \text{ kg/m}^2$) than females ($27.2 \pm 2.9 \text{ kg/m}^2$). The slightly overweight status of coaches in this study may be indicative of sub-optimal dietary or lifestyle practices, that could hinder their ability to model effective hydration and nutrition practices, and underscores the need for holistic education programs that address both personal health and professional knowledge.

Hydration knowledge scores of the participants

In this study only 4.4% of coaches achieved a passing score on the hydration knowledge questionnaire. This is indicative of a critical need for education of coaches in the area of fluid replacement and hydration issues in Ghana. Possible factors contributing to this finding may include limitations, such as inadequate access to targeted educational programs or region-specific training materials. This study's finding is in contrast to findings from a pilot study by Geijer, Pitney & Brandenburg (2009) among Illinois high school coaches, where 54.5% of the participants obtained a passing score on the questionnaire (Geijer et al., 2009). A recent study by Kavouras et al (2020) emphasized that access to region-specific resources and targeted educational initiatives significantly impacts coaches' knowledge and practices regarding hydration (Kavouras et al., 2011).

Most (67.7%) participants obtained hydration scores within the Good category, indicating a moderate level of understanding of hydration practices. Notably, none of the participants obtained score within the Poor category (scores 5–0), indicating that all respondents possessed an awareness of hydration principles. While this is a positive finding, the overall distribution of scores highlights a pressing need for more comprehensive and accessible education to elevate the knowledge levels of coaches across all categories.

Knowledge of coaches regarding the importance of optimum hydration in the context of climate change

Five questions were frequently answered incorrectly in comparison to other questions. These questions addressed: indicator for drinking water (question 1); determination of fluid requirement (question 3); environmental temperature related to dehydration (question 6); ideal percent of total fluids to be replaced (question 11); type of fluid to use when exercise exceeds 50 minutes (question 12) and ideal percent of carbohydrate content of sports drinks (question 13). Knowledge scores obtained for question 6 in particular (51.5% incorrect responses) emphasizes the need to include specific training on hydration issues in the context of climate change resulting in rising temperatures in this part of the world and even globally (World Health Organization, 2024).

Fluid replacement practices of coaches before, during and after training/practice

The inadequate provision of hydration before, during and after training/practice observed in our study may have significant implications for athlete health and performance. Inadequate hydration strategies can increase the risk of dehydration-related injuries and impair athletic output. Improving hydration education for coaches could enhance athletic outcomes. Furthermore, the use of inappropriate hydration methods observed in our study aligns with the incorrect answers given by coaches regarding hydration types and practices, particularly for the question on fluid types for long-duration exercises (table 2, question 12, where 82.4% of coaches responded incorrectly). This indicates that majority of the coaches may have little knowledge about the value and importance of sports drinks in rehydrating athletes involved in sports lasting more than 50 minutes. Belval et al. (2019). Belval et al., (2019) have emphasized that proper hydration practices, such as individualized hydration plans and the use of sports drinks, are essential for optimizing athletic performance and preventing dehydration-related impairments.

Sources of hydration knowledge of coaches

The most commonly reported source of hydration knowledge was social media, with platforms such as Facebook, WhatsApp, TikTok, YouTube, Quora, Reddit and Instagram, utilized by 91.2% of participants (figure 4). While social media and informal sources like brochures, colleagues, and magazines are easily accessible, they may not always provide scientifically accurate advice on hydration and fluid replacement strategies. On the other hand, professional organizations, conferences, journals, and health professionals may be more reliable sources of hydration information. Despite this, their utilization was notably low, with only 23.5% of participants reporting using professional organizations, conferences, and journals, and just 13.2% relying on health professionals. The low engagement with professional organizations such as the Ghana Coaches Association may stem from the infrequency of conferences and limited access to professional resources. A potential solution to bridge this gap could involve organizing more frequent and accessible workshops, supported by digital tools such as webinars and online resources, to enhance the availability and appeal of professional materials. The first Ghana Coaches Congress was held in December 2017, with the aim of improving coaches' knowledge and engagement with scientifically sound resources (Ghana Web, 2017). The congress, originally intended to be held biennially, appears to have been discontinued, as we found no records of subsequent events since the inaugural one. We recommend revitalizing the Ghana Coaches Congress to provide regular, structured training to coaches in Ghana. To further enhance coaches' knowledge of hydration and related scientific topics, professional and corporate organizations should be engaged to provide support for and promote such initiatives. Leveraging digital platforms and expert webinars has been highlighted as an effective strategy to improve access to hydration-related professional resources, particularly in remote areas (European Federation of the Association of Dietitians, 2023). Our findings emphasize the need for greater accessibility and utilization of reliable hydration sources,

such as professional journals and medical experts, to enhance coaches' understanding of hydration practices.

Relationship between age, sports specialty, educational level formal training, body mass index, period of coaching and knowledge score

Chi square analysis presented in Supplementary Table S1 showed no significant relationships between age, sports specialty, educational level, period of coaching and Body Mass Index (BMI) and knowledge score among the coaches. A multiple regression analysis similarly did not show any statistically significant findings. The lack of significant relationships observed might be attributed to several factors, such as the limited sample size, which may have reduced the statistical power of the analysis. Additionally, unmeasured confounding variables, such as access to hydration resources or cultural attitudes toward hydration practices, could have influenced the outcomes. These insights suggest the need for future studies to incorporate a larger, more diverse sample and consider additional variables to uncover subtle or context-specific relationships.

Conclusion

The knowledge scores and fluid replacement practices of the respondents revealed significant gaps, with the majority failing to achieve the passing score. Additionally, hydration practices were inadequate, as most respondents provided no fluids before or after practice. While social media was the most frequently reported source of hydration information, its reliability and scientific accuracy remain uncertain. These findings highlight an urgent need for further training and education in fluid replacement and hydration strategies and practices among coaches in the study areas. Collaboration with health professionals, particularly nutritionists and dietitians specializing in sports, for the design and implementation of targeted hydration education programs is urgently needed to aid in improved athletic performance.

Limitations of the Study

Due to funding constraints, recruitment was limited to conveniently selected areas in one region in Ghana, reducing the diversity of perspectives. The use of convenience and snowball sampling methods may have introduced selection bias, as participants who were more accessible or better connected may not represent the broader population of coaches. This limits the generalizability of the findings and should be considered when interpreting the results. Additionally, self-reported data on fluid replacement practices and hydration knowledge sources may have been subject to recall or social desirability bias. Information coaches obtained from social media was not assessed for accuracy or credibility, leaving the quality of these influences unclear. Finally, the small overall sample size may have reduced the statistical power to detect significant relationships, highlighting the need for more extensive and diverse studies in the future.

Strengths of the Study

To the best of our knowledge, this study is the first to examine hydration knowledge and practices among coaches in Ghana, offering unique insights that are seldom explored in low- and middle-income countries. It provides valuable data to support the planning and implementation of hydration training for coaches across various sports disciplines. Additionally, it identifies several gaps in coaches' hydration practices and emphasizes the need for stakeholder engagement to enhance the performance of athletes in Ghana through targeted coach training.

Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics and Protocol Review Committee of the School of Biomedical and Allied Health Sciences, University of Ghana (protocol code SBAHS-PH/10518333/SA/2017-2018).

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The data supporting the findings of this study are not publicly available due to ethical restrictions. However, they can be obtained from the corresponding author upon reasonable request and with approval from the Ethics and Protocol Review Committee of the School of Biomedical and Allied Health Sciences, University of Ghana.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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