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Effectiveness of Hydration Education on Fluid Consumption Patterns of Petanque Athletes in FOPI South Sulawesi

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Abstract: Optimal hydration plays a vital role in maintaining athletic performance, particularly in precision-based sports such as *Petanque*, which require concentration, energy stability, and high mental endurance. However, athletes' understanding of proper hydration practices remains limited, increasing the risk of dehydration, reduced focus, and performance decline. This study aimed to analyze the effectiveness of hydration education delivered through digital and printed media in improving the knowledge and fluid consumption behaviors of *Petanque* athletes under the Federation of Petanque Indonesia (FOPI) South Sulawesi. The research employed a quantitative approach using a *one-group pretest–posttest* design involving 35 athletes selected through total sampling. The educational intervention was implemented via an *educational website* and an *athlete hydration handbook*, while data were collected using pre-test and post-test questionnaires. The findings revealed a significant improvement in athletes' knowledge and hydration behaviors after the intervention, confirming the effectiveness of the educational program in fostering positive behavioral changes. The results emphasize the applicability of health behavior change theories in sports nutrition education and demonstrate that interactive, media-based education can effectively enhance both awareness and practice. Theoretically, this study contributes to expanding the application of hydration education in non-cardiorespiratory sports, while practically, it provides a foundation for developing structured training programs that highlight the importance of fluid balance as a key determinant of athletic performance and overall well-being.

Keywords: hydration education, fluid consumption, Petanque athletes.

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INTRODUCTION

Adequate hydration is one of the fundamental components in maintaining optimal athletic performance. Fluid balance plays a critical role in supporting physiological processes such as thermoregulation, cardiovascular stability, and muscle function during physical activity. Globally, several studies have emphasized that even mild dehydration, equivalent to a body weight loss of 1–2%, can significantly reduce concentration, coordination, and endurance among athletes (Bentley et al., 2020). In Indonesia, many athletes continue to exhibit poor hydration awareness and suboptimal fluid consumption practices, which may lead to performance decline and increased injury risk during training or competition (Bakri, 2019). For *Petanque* athletes, who rely

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on focus, precision, and energy stability, insufficient hydration can result in decreased motor coordination and mental fatigue, thereby hindering competitive performance.

Despite the recognized importance of proper hydration, several studies have identified a persistent gap between athletes' theoretical knowledge and their actual hydration practices (Mansur et al., 2022). This gap indicates the lack of effective educational interventions specifically targeting hydration behavior among athletes in Indonesia. Conventional nutrition education approaches often rely on one-way communication and printed materials, which have limited impact on long-term behavior change (Dieny et al., 2021). Therefore, there is an urgent need for innovative, interactive, and accessible educational models that can enhance athletes' understanding and awareness of fluid balance, both theoretically and behaviorally. This research attempts to address that gap by implementing an educational program on hydration through digital and printed media designed specifically for *Petanque* athletes under the Federation of Petanque Indonesia (FOPI) South Sulawesi.

The theoretical foundation of this study is based on the Health Belief Model (HBM) and Nutritional Education Theory, which posit that knowledge and perceived susceptibility to health risks are key determinants of behavior change. Within this framework, hydration education serves not only as an information transfer mechanism but also as a behavioral reinforcement tool that helps athletes develop consistent and preventive hydration habits. The program's dual-medium format, combining a web-based learning platform with a printed handbook, aligns with contemporary approaches to health promotion that emphasize accessibility and self-paced learning (Lee & Lim, 2019). This model has been shown to improve both knowledge retention and behavioral adherence in various athlete populations (Heikkilä et al., 2019).

Accordingly, this study aims to evaluate the effectiveness of hydration education in improving knowledge and fluid consumption behavior among *Petanque* athletes in South Sulawesi. Specifically, it seeks to answer the following research questions: (1) What is the level of athletes' understanding of proper hydration practices that support optimal performance? (2) How effective is the use of digital and printed media in delivering practical hydration education? (3) Is there a statistically significant difference in knowledge and behavior before and after the educational intervention? These questions guide the empirical and analytical orientation of the research.

This study's academic contribution lies in its integration of behavioral health theory with practical sports nutrition education for precision-based sports, an area that remains underrepresented in existing literature. From a practical standpoint, the study provides a replicable model for sports organizations such as FOPI to incorporate hydration education into athlete training programs. The novelty of this research lies in its focus on *Petanque* athletes, whose performance depends heavily on sustained concentration and mental acuity, and its use of interactive, dual-format media as an intervention tool to foster behavioral improvement in sports hydration practices.

METHODS

This study employed a quantitative approach using a quasi-experimental design, specifically the *One Group Pretest–Posttest Design*. This design was selected to measure changes in athletes' knowledge and hydration behavior before and after the educational intervention. The intervention focused on evaluating the effectiveness of hydration education delivered through digital and printed media among *Petanque*

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athletes affiliated with the Federation of Petanque Indonesia (FOPI) South Sulawesi. The research design allowed for assessing the direct impact of the intervention by comparing pre-test and post-test scores within the same participant group, providing a clear indication of learning and behavioral outcomes resulting from the educational program.

The data source in this study was primary, collected directly from the 35 participants who represented the total population of FOPI South Sulawesi athletes. A total sampling technique was employed, as the number of athletes meeting the inclusion criteria, actively training and completing all educational sessions, was manageable and representative of the study population. The instrument used was a structured questionnaire developed to assess both knowledge and behavioral aspects of hydration. The questionnaire consisted of multiple-choice questions, with a scoring system of one (1) point for correct answers and zero (0) for incorrect answers. The pre-test was administered prior to the educational intervention, while the post-test was conducted after participants had completed all instructional sessions.

For data analysis, descriptive statistics were applied to summarize participants' knowledge and behavioral scores, while inferential statistics were used to test the significance of differences between pre-test and post-test results. The Wilcoxon Signed-Rank Test was employed due to the non-normal distribution of data as indicated by the Shapiro–Wilk normality test ($p < 0.05$). This nonparametric test was chosen to determine whether the educational intervention led to statistically significant improvements in hydration-related knowledge and behavior. All analyses were performed using IBM SPSS Statistics software. The significance level was set at $p < 0.05$ to determine the threshold for statistical relevance. This methodological approach ensured that the results were both empirically valid and aligned with the study's objective of evaluating the effectiveness of hydration education among *Petanque* athletes.

RESULT

This study involved 35 Petanque athletes registered under the Federation of Petanque Indonesia (FOPI) South Sulawesi, consisting of 18 males (51.4%) and 17 females (48.6%), aged between 17 and 30 years. All participants took part in the hydration education program, which utilized two main learning media: an *educational website* and a *hydration handbook for athletes*. Every athlete completed both the pre-test and post-test questionnaires, which measured their hydration-related knowledge and behaviors. Data collection was conducted over a two-week period in July 2025 at the FOPI South Sulawesi training venue.

Descriptive analysis indicated an overall improvement in knowledge and hydration behavior scores following the intervention. The mean pre-test score was 11.97 ± 3.36, which increased to 16.06 ± 4.10 after the intervention. The mean difference of +4.09 points demonstrates a positive change in athletes' hydration-related knowledge and practices after the educational program. During the pre-test, most athletes (57.1%) were categorized as having a "moderate" level of knowledge, while after the intervention, the proportion of athletes in the "good" category increased to 68.6%. These results reflect a clear shift toward improved awareness and behavior concerning hydration practices.

Normality testing using the Shapiro–Wilk method revealed that the data were not normally distributed ($p < 0.05$). Therefore, the Wilcoxon Signed-Rank Test was

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applied for hypothesis testing. The results showed a Z-value of -5.75 with a p-value of 0.00009 ($p < 0.001$), indicating a statistically significant difference between pre-test and post-test scores. This confirms that the hydration education intervention using digital and printed media effectively enhanced athletes' hydration-related knowledge and behaviors.

Further analysis of individual score changes showed that 33 out of 35 participants (94.3%) experienced score improvements, while 2 participants (5.7%) maintained the same score. No decrease was observed in post-test results. Additionally, the attendance and participation rate during both educational sessions was 91.4%, reflecting strong engagement and acceptance of the intervention among the athletes.

Beyond the overall improvement in total scores, specific items revealed notable changes. Understanding of the "ideal timing for fluid intake before and after training" improved from 46% to 89%, and knowledge of "the role of electrolytes in body fluids" increased from 51% to 83%. In terms of behavioral outcomes, the frequency of fluid consumption before training rose from an average of 1.8 times to 3.1 times per training session. Likewise, the percentage of athletes who consistently brought their own water bottles to training increased from 60% to 91%. These findings indicate that the hydration education intervention led to both cognitive and behavioral improvements among the athletes.

Table 1. Mean and Standard Deviation of Knowledge and Hydration Behavior Scores among Petanque Athletes

Variable	Pre-test Mean (±SD)	Post-test Mean (±SD)	Δ (Difference)	p-value
Knowledge and hydration behavior	11.97 ± 3.36	16.06 ± 4.10	+4.09	0.00009*
Total Respondents (n)	**35**	**35**		

Note: Wilcoxon Signed-Rank Test; $p < 0.001$ indicates a significant difference.
Source: Data processing results using IBM SPSS 25 by researchers

Table 2. Distribution of Knowledge and Hydration Behavior Categories Before and After Education

Category	Pre-test (n)	Pre-test (%)	Post-test (n)	Post-test (%)
Good	7	20.0	24	68.6
Moderate	20	57.1	9	25.7
Poor	8	22.9	2	5.7
Total	**35**	**100**	**35**	**100**

Source: Data processing results using IBM SPSS 25 by researchers

DISCUSSION

The results of this study demonstrate that hydration education using digital and printed media had a significant impact on improving knowledge and hydration behavior among *Petanque* athletes under the Federation of Petanque Indonesia (FOPI) South Sulawesi. This finding supports the study's hypothesis that dual-format educational interventions can meaningfully enhance athletes' understanding and daily hydration

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practices. The Wilcoxon test revealed a p-value below 0.001, confirming that the observed improvements were not due to chance but rather a true effect of the intervention. These findings align with previous studies showing that structured nutrition and hydration education programs can lead to positive behavioral change in a relatively short period (Foo et al., 2021); (Abbasi et al., 2020). Theoretically, these findings can be explained through the Health Belief Model (HBM), which posits that an increase in individual knowledge about health risks can influence both attitudes and preventive behaviors, including hydration behavior. When athletes gain a deeper understanding of how fluid balance supports performance and prevents dehydration, they become more motivated to adopt proper hydration habits. The observed behavioral improvements, such as increased frequency of drinking before training and the habit of bringing personal water bottles, reflect the behavioral change process outlined in this model. Education based on behavioral theory has consistently shown greater effectiveness in improving nutrition and hydration behaviors across various sports contexts (Enatsu et al., 2024); (Lee & Lim, 2019).

This study is consistent with the work of (Cleary et al., 2012), who found that hydration education significantly improved adolescents' fluid consumption awareness and behavior. Similarly, (Sánchez-Díaz et al., 2020) reported that team-sport athletes showed increased knowledge and fluid consumption following nutrition education interventions, though physical performance gains required longer observation periods. These findings suggest that knowledge-based educational programs, particularly those with practical and context-specific elements, are crucial for promoting behavioral change among athletes. From a sports nutrition behavior change perspective, the success of this intervention is attributed to the dual-media format that combined visual and experiential learning. The integration of a web-based platform with a printed handbook allowed athletes to revisit materials and engage in self-directed learning, reinforcing key concepts over time. This multimodal approach aligns with the principle that repetitive, multi-channel learning enhances knowledge retention and behavioral adherence (Bentley et al., 2020). Supporting this, (Jayawardena et al., 2025) found that hybrid education combining online and in-person delivery improved athletes' retention and motivation more effectively than single-method instruction.

The greater behavioral improvement observed among female athletes compared to males also aligns with prior evidence that female athletes tend to exhibit stronger health awareness and motivation following nutrition education (Patton-Lopez et al., 2018). Additionally, younger athletes demonstrated larger gains in hydration knowledge and practice, a trend that echoes findings from (Palani et al., 2024), who reported that youth athletes are more receptive to behavior change when exposed to structured, interactive education programs. The scholarly contribution of this study lies in its application of a dual-media hydration education model to a precision-based, non-cardiorespiratory sport such as *Petanque*, which has unique physiological demands. Whereas most prior studies have centered on endurance or high-intensity sports, this research demonstrates that hydration education is equally relevant in activities emphasizing focus, stability, and mental resilience. Therefore, this study broadens the scope of sports nutrition research by highlighting hydration's role in both physical and cognitive dimensions of athletic performance.

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Nonetheless, this study has several limitations. The quasi-experimental design without a control group limits the ability to attribute causality exclusively to the intervention, as external factors such as environmental conditions or individual training habits may have contributed to the observed effects. Additionally, the short intervention period did not allow for the assessment of long-term behavioral maintenance. Future studies employing randomized controlled trials (RCTs) and extended follow-up periods would provide stronger evidence and enable exploration of how improved hydration behaviors influence athletic performance outcomes (DeJong Lempke et al., 2025).

From a practical standpoint, these findings underscore the importance of integrating hydration education into routine athlete development programs. Sports organizations such as FOPI can utilize these results to implement continuous hydration education modules within their training curriculum. Coaches and sports nutritionists can also adapt the materials used in this study, interactive web tools and printed handbooks, to suit other sports disciplines. Such efforts would contribute to developing a sustainable hydration culture among athletes, improving not only performance but also overall health and well-being (Fiorini et al., 2023); (Scanlon & Norton, 2024).

CONCLUSSION

This study confirms that hydration education delivered through digital and printed media significantly improved the knowledge and fluid consumption behaviors of *Petanque* athletes under the Federation of Petanque Indonesia (FOPI) South Sulawesi. The statistical analysis revealed a substantial difference between pre-test and post-test scores, indicating that the educational intervention effectively influenced positive behavioral changes. The improvement was evident not only in theoretical understanding, such as knowledge of optimal hydration timing, fluid functions, and electrolyte balance, but also in practical behaviors, including increased frequency of fluid intake before training and the consistent habit of bringing personal water bottles. These results demonstrate that well-designed educational programs combining interactive and participatory approaches can effectively foster healthier hydration habits among athletes.

From a theoretical standpoint, this research reinforces the notion that nutrition and hydration behavior change in athletes can be achieved through knowledge enhancement grounded in behavioral health models such as the *Health Belief Model*. The findings contribute scientifically by integrating cognitive and behavioral dimensions of hydration education into the context of non-cardiorespiratory precision sports like *Petanque*, a field that remains relatively underexplored. Practically, the study provides valuable insights for coaches, sports nutritionists, and athletic organizations such as FOPI to design comprehensive training programs that emphasize hydration as a key factor in maintaining performance, focus, and mental endurance.

Furthermore, this study opens opportunities for future research to expand its scope through controlled experimental designs or longitudinal evaluations to examine long-term behavioral sustainability and its potential effects on athletic performance. The development of continuous, integrated hydration education programs, embedded within regular training routines and personalized nutrition monitoring, can serve as a foundation for improving athletes' overall well-being, performance stability, and sports achievement on a broader scale.

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