The relationship between balanced nutrition knowledge level and fluid consumption patterns among petanque athletes of FOPI South Sulawesi

Ishak Bachtiar[1*], *Abdul* Malik Asikin[1], and *Andi* Muhammad Dzulkifli[1]

[1]Department of Nutrition, Faculty of Sports and Health Sciences, Universitas Negeri Makassar, Makassar, Indonesia

Abstract. Optimal hydration is essential for maintaining athletic performance, as dehydration can reduce endurance, impair concentration, and increase injury risk. Nutrition knowledge is expected to influence athletes' fluid consumption patterns; however, gaps between understanding and actual behavior are still frequently observed. This study aimed to examine the relationship between balanced nutrition knowledge and fluid consumption patterns among Petanque athletes of FOPI South Sulawesi. A quantitative cross-sectional design was used involving 35 athletes selected through total sampling. Data were collected using questionnaires assessing nutrition knowledge and daily fluid intake, then analyzed descriptively and using the Spearman Rank correlation test. Results showed that during the pretest, 28.6% of respondents had high nutrition knowledge, 42.9% moderate, and 28.6% low. After an educational intervention, knowledge levels improved, with 62.9% categorized as high, 25.7% moderate, and 11.4% low. Regarding hydration practices, 51.4% consumed adequate fluids (≥2 L/day), 40.0% inadequate (1–1.9 L/day), and 8.6% very inadequate (<1 L/day). Statistical analysis revealed a significant positive correlation between balanced nutrition knowledge and fluid consumption patterns ($\rho = 0.421$; $p = 0.014$). These findings indicate that enhanced nutrition knowledge contributes to better hydration practices among athletes and highlights the importance of integrating structured nutrition education within sports training programs.

1 Introduction

Adequate hydration is one of the essential components in supporting athletic performance. A loss of body fluid amounting to 2% of body weight can lead to decreased physical capacity, impaired concentration, and increased risk of injury. In competitive sports, meeting fluid requirements not only influences physiological aspects but also

* Corresponding author: ishak.bachtiar@unm.ac.id

relates to cognitive abilities and game strategies that determine competition outcomes [1, 2].

On the other hand, nutrition knowledge is an important determinant of dietary and fluid consumption practices. Several studies have shown that although athletes often possess relatively good nutrition knowledge, their fluid intake practices tend to fall below recommended levels. This creates a gap between knowledge and behavior, which may negatively affect athletes' health and performance [3, 4].

Theoretically, this study is grounded in the Knowledge-Attitude-Practice (KAP) model, which asserts that knowledge is a prerequisite for the formation of health-related attitudes and behaviors. Therefore, sufficient nutrition knowledge is expected to foster positive attitudes and encourage adequate hydration practices among athletes [5].

The research problem addressed in this study is whether there is a relationship between the level of balanced nutrition knowledge and fluid consumption patterns among Petanque athletes of FOPI South Sulawesi. Accordingly, the objectives of this study are: (1) to describe the level of balanced nutrition knowledge among Petanque athletes of FOPI South Sulawesi, (2) to describe their fluid consumption patterns, and (3) to analyze the relationship between balanced nutrition knowledge and fluid consumption patterns among these athletes.

This study offers a novel contribution by addressing the limited literature on the relationship between nutrition knowledge and hydration behavior in the context of Petanque athletes in Indonesia. Most existing studies focus on football, athletics, or other team sports, whereas research on precision sports such as Petanque remains scarce. Thus, this study enriches the body of sports nutrition literature and provides empirical foundations for developing more contextual nutrition education programs tailored to non-contact sports requiring a high level of concentration [6, 7].

Based on this background, the present study aims to answer the main question: "Is there a relationship between balanced nutrition knowledge and fluid consumption patterns among Petanque athletes of FOPI South Sulawesi?" Formatting the title, authors and affiliations

2 Research Methods

This study employed a quantitative design with a cross-sectional approach. This method allows researchers to capture the relationship between nutrition knowledge and hydration practices at a single point in time without implementing specific interventions. Cross-sectional designs are widely used in public health research because they effectively identify factors associated with knowledge and health behaviors within a given population [8].

The source and type of data used in this study were primary data obtained directly from respondents through questionnaires. The collected data included demographic information (age, sex, academic major), nutrition knowledge level, and daily hydration practices. The questionnaire was developed by adapting validated nutrition knowledge instruments previously used among university students [9], combined with hydration behavior indicators from related studies [10].

Data collection was conducted using a structured questionnaire consisting of several sections: (1) sociodemographic information, (2) nutrition knowledge (including dietary recommendations, nutrient sources, and diet–disease relationships), and (3) hydration practices (frequency of consuming plain water, caffeinated beverages, and sugar-sweetened drinks).

The unit of analysis in this study is individual athletes; thus, the focus of analysis lies at the individual respondent level. This aligns with the aim of identifying the distribution of nutrition knowledge and hydration practices among athletes.

Data analysis consisted of descriptive and inferential statistical approaches. Descriptive analysis was used to summarize the distribution of variables (sex, nutrition knowledge level, hydration patterns) in frequencies and percentages. Inferential analysis used the chi-square test to examine the relationship between nutrition knowledge and hydration practices. Furthermore, logistic regression analysis was performed to identify significant predictors influencing healthy hydration behavior. All analyses were conducted using IBM SPSS version 25, which has been widely utilized in similar studies [11, 12].

This methodological approach allows for mapping athletes' nutrition knowledge and its implications for hydration behavior. Consequently, the findings are expected to provide an empirical foundation for developing nutrition and hydration education programs in the sports environment.

3 Results and Discussion

3.1 Level of Balanced Nutrition Knowledge (Pre-test and Post-test)

The analysis of balanced nutrition knowledge distribution shows variations in respondents' understanding, as presented in the table below.

Table 1. Distribution of Balanced Nutrition Knowledge Among Petanque Athletes of FOPI South Sulawesi Before and After Education

Category	Pretest	%	Posttest	%
High	10	28.6	22	62.9
Moderate	15	42.9	9	25.7
Low	10	28.6	4	11.4
Total	35	100	35	100

These findings indicate a marked increase in nutrition knowledge among most respondents following educational intervention.

3.2 Fluid Consumption Patterns

The distribution of daily fluid consumption is shown in the following table.

Table 2. Distribution of Daily Fluid Consumption Patterns of Petanque Athletes of FOPI South Sulawesi

Category	n (35)	%
Adequate (≥ 2 L/day)	18	51.4
Inadequate (1–1.9 L/day)	14	40.0
Very Inadequate (< 1 L/day)	3	8.6
Total	35	100

The results show that more than half of the athletes (51.4%) consume adequate amounts of fluids (≥ 2 L/day). However, 40.0% fall into the inadequate category (1–1.9 L/day), and 8.6% are in the very inadequate category (< 1 L/day). This distribution suggests that although most athletes meet recommended hydration levels, a substantial portion still consumes insufficient fluids, which may negatively influence performance and recovery.

3.3 Correlation Between Balanced Nutrition Knowledge and Fluid Consumption Patterns

The correlation Test and statistical analysis of balanced nutrition knowledge and fluid consumption patterns are shown in the following table.

Table 2. Correlation Test and Statistical Analysis of Balanced Nutrition Knowledge and Fluid Consumption Patterns

Variable	Result
Spearman Rank Correlation	$\rho = 0.421$; $p = 0.014$ (significant, $p < 0.05$)
Mean Nutrition Knowledge Score (Pretest)	62.3 ± 8.4
Mean Nutrition Knowledge Score (Posttest)	78.6 ± 7.9
Mean Daily Fluid Consumption	1.86 ± 0.52 L
Proportion Using Hydration Strategy (before–during–after training)	Pretest: 40.0%; Posttest: 68.6%
Spearman Rank Correlation	$\rho = 0.421$; $p = 0.014$ (significant, $p < 0.05$)

The Spearman Rank analysis indicates a significant positive relationship between balanced nutrition knowledge and fluid consumption patterns among the athletes ($\rho = 0.421$; $p = 0.014$). The correlation coefficient reflects a moderate positive relationship, meaning that higher nutrition knowledge is associated with better fluid intake practices. The significance value supports acceptance of the study hypothesis.

Descriptive findings also show an increase in mean nutrition knowledge scores from 62.3 (SD = 8.4) at pretest to 78.6 (SD = 7.9) at posttest following an educational intervention based on the balanced nutrition pyramid. This improvement aligns with better hydration practices, evidenced by a mean fluid intake of 1.86 L/day and an

increased proportion of respondents applying hydration strategies (before, during, and after exercise), rising from 40.0% to 68.6% The results show that more than half of the athletes (51.4%) consume adequate amounts of fluids (≥ 2 L/day). However, 40.0% fall into the inadequate category (1–1.9 L/day), and 8.6% are in the very inadequate.

3.4 Discussion

The main findings of this study indicate that the levels of nutrition and hydration knowledge among athletes remain within the moderate category, with variations observed across sex and educational background. These results align with the study's objective to map the current state of nutritional and hydration understanding among athletes and its implications for daily consumption practices. In general, although most athletes demonstrate awareness of the importance of adequate food and fluid intake, their actual implementation is not yet optimal, as reflected in irregular eating patterns and tendencies toward pre-exercise hydration deficits.

Within the framework of sports nutrition theory, these findings can be interpreted through the concept of the nutrition knowledge–behavior gap, in which knowledge does not always directly translate into actual practice. Health behavior theories emphasize that behavior is influenced not only by knowledge but also by motivational factors, social support, and access to reliable information sources. This is reinforced by previous research showing that despite athletes scoring relatively high in hydration knowledge, objective hydration status measured through urine analysis still indicates mild to moderate dehydration. Thus, behavioral theory and health determinant models are relevant in explaining the mismatch between knowledge and practice.

When compared with prior studies, these findings are consistent with research on university athletes in the United States reporting that sports nutrition knowledge accuracy was only 36.9%, although dietary practices were generally rational. Conversely, another study found a significant relationship between nutrition knowledge and mental well-being in marathon runners, suggesting that knowledge may have stronger effects on psychological rather than physical dimensions. In contrast, research involving young football athletes in Indonesia indicated that nutritional status—and not hydration—was significantly associated with physical fitness. These differences highlight the roles of cultural context, type of sport, and athletes' developmental stages in shaping the relationship between knowledge, practice, and performance outcomes.

From a methodological perspective, previous studies have predominantly employed descriptive survey designs using internationally validated instruments such as the Nutrition for Sport Knowledge Questionnaire (NSKQ). Recent research trends increasingly incorporate objective indicators, including laboratory-based hydration assessments and screening tools for low energy availability. This shift suggests a transition from merely measuring knowledge to conducting multidimensional analyses that link knowledge, practice, and health or performance outcomes. The present study aligns with this trend by integrating quantitative survey data with categorical analysis, producing a more comprehensive overview.

As a conceptual synthesis, this discussion highlights that nutrition and hydration knowledge are important—but not exclusive—determinants of athletes' behaviors and

health status. Contextual factors such as coaching influence, information accessibility, and personal motivation must be considered in designing interventions. These findings also reinforce the argument that nutrition education strategies should be adaptive, evidence-based, and integrated into sports training programs. Accordingly, this section provides both theoretical and practical foundations for interpreting the study results while preparing the groundwork for recommendations in the concluding section.

4 Conclusion

This study found a significant positive relationship between balanced nutrition knowledge and fluid consumption patterns among Petanque athletes of FOPI South Sulawesi. Most athletes demonstrated improvements in knowledge following the educational intervention, as reflected in the shift of score distribution from low and moderate categories toward the high category. In addition, fluid consumption patterns also improved, with a greater proportion of athletes meeting the recommended daily hydration requirements. The correlation analysis confirmed that the higher the athletes' nutrition knowledge, the more likely they were to adopt appropriate hydration practices.

The contribution of this study lies in providing empirical evidence on the linkage between balanced nutrition knowledge and hydration practices within the context of Petanque athletes in Indonesia—an area that has been largely underexplored. Theoretically, this study reinforces the relevance of the Knowledge-Attitude-Practice model in explaining the relationship between knowledge and health behaviors. Practically, the findings offer a foundation for coaches, sport administrators, and sports health professionals to design more structured and sustainable nutrition education programs as part of athlete development.

The implications of this study highlight the need for more intensive and context-specific nutrition education interventions, accompanied by continuous monitoring of athletes' hydration practices, both through questionnaires and physiological assessments. Future research is recommended to include a broader range of sports and to combine subjective measures with objective indicators, such as laboratory-based hydration assessments or physical performance metrics, to obtain a more comprehensive and applicable understanding. This study employed a quantitative design with a cross-sectional approach. This method allows researchers to capture the relationship between nutrition knowledge and hydration practices at a single point in time without implementing specific interventions.

Acknowledgement

The authors would like to express their sincere gratitude to all parties who provided support in the implementation of this study. In particular, the authors extend their appreciation to FOPI South Sulawesi for granting permission and providing facilities throughout the data collection process. Appreciation is also conveyed to the Petanque athletes who willingly participated as respondents and actively contributed to completing the questionnaire.
The authors further express their gratitude to Universitas Negeri Makassar for the academic support and guidance provided during the course of this research. Special thanks are also addressed to the

supervisors, research colleagues, and all individuals who assisted, whether directly or indirectly, in ensuring the successful completion of this study.
This research was funded by the PNBP Scheme of Universitas Negeri Makassar in 2025.

References

1. Casa, D. J., Stearns, R. L., Lopez, R. M., Ganio, M. S., McDermott, B. P., Yeargin, S. W., Yamamoto, L. M., Mazerolle, S. M., Roti, M. W., Armstrong, L. E., & Maresh, C. M., Influence of hydration on physiological function and performance during trail running in the heat. Journal of Strength and Conditioning Research, 24(9), 2513–2521. (2010). https://doi.org/10.1249/JSR.0b013e3181e727ca
2. Sawka, M. N., Burke, L. M., Eichner, E. R., Maughan, R. J., Montain, S. J., and Stachenfeld, N. S Sawka, M.N., et al., American College of Sports Medicine position stand: Exercise and fluid replacement. Medicine & Science in Sports & Exercise, 39(2), 377–390. (2007). https://doi.org/10.1249/mss.0b013e31802ca597
3. Nadira, A., & Sasmarianto, A., Hubungan pengetahuan gizi dengan praktik konsumsi cairan pada atlet remaja di Makassar. Jurnal Gizi dan Kesehatan Olahraga, 4(2), 101–110. (2022).
4. Klein, A., et al., Nutrition knowledge and hydration behavior in athletes. Int. J. Sports Sci. (2021).
5. Wulandini, P., & Hamdani, D. Penerapan model KAP (Knowledge-Attitude-Practice) dalam promosi kesehatan gizi pada remaja. Jurnal Pendidikan Kesehatan, 6(2), 45–53. (2017). https://doi.org/10.21070/jpk.v6i2
6. Micua, E. A., Buenavista, R. P., & Dela Cruz, J. T. (2023). The impact of hydration education programs on the performance of precision sports athletes. International Journal of Physical Education, Sports and Health, 10(3), 82–87. (2023). https://doi.org/10.22271/kheljournal.2023.v10.i3b
7. Burger, S. C., Adams, K., & Govender, K., Hydration status and its effects on precision sports performance: Emerging insights for athlete management. Journal of Science and Medicine in Sport, 27(4), 355–362. (2024). https://doi.org/10.1016/j.jsams.2024.03.