

Relationship Between Knowledge and Practice on Hydration Among Perak Shooters

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Received Date: 22 April 2025

Accepted Date: 30 June 2025

Revised Date: 4 July 2025

Published Date: 31 July 2025

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ABSTRACT

Hydration plays an important role in maintaining the performance and cognitive function of athletes. However, there is limited research on the relationship between hydration knowledge and practice among shooters, particularly in the state of Perak. Hence, this study aims to investigate the correlation between hydration knowledge and hydration practices among Perak shooters. Thirty-two shooters (age: 16 ± 2 years) were assessed for hydration levels using Urine Specific Gravity (USG) measurements and were surveyed using the Hydration Knowledge Scale (HyKS) to evaluate their understanding of hydration principles. The selection criteria included active shooters who participated in state-level competitions. The study found a significant moderate negative correlation between total hydration knowledge scores and USG levels ($p < 0.01$). This suggests that individuals with moderate hydration knowledge tend to exhibit better hydration practices. Furthermore, increased knowledge about hydration appears to contribute to improved hydration habits, which may enhance shooting accuracy and overall performance. Future research should use accurate methods to check hydration for small populations such as blood osmolality or wearable devices.

Keywords: athlete performance, hydration knowledge, hydration practices, shooters

INTRODUCTION

Water is necessary for life to exist and for development. Individual hydration requirements can differ depending on factors such as body weight, environmental conditions, and the intensity and duration of physical activity (Stevenson, Zabinsky, & Hedrick, 2019). Hence, lack of water consumption and water replacement will harm the human body, especially the athlete's performance, heart rate, and cognitive (Mendonca, Teixeira, Heffernan, & Fernhall, 2013; Stevenson et al., 2019). Athletes need to be aware of proper hydration practices and attitudes, as they can positively impact their performance. Student-athletes studying sports science have been shown to have better awareness of hydration

knowledge (Abd Rashid, Aznan, & Ismail, 2021) but previous studies indicate that many athletes are unaware of the benefits of staying hydrated for optimal performance (Judge et al., 2021; Scanlon & Norton, 2024). Research shows that adequate water intake can reduce heart rate during and after exercise, positively impacting cardiovascular health and peak performance (Mendonca et al., 2013; Porto et al., 2023). Dehydration, by contrast, thickens the blood and increases heart strain (Rodin, Shapiro, Pinhasov, Kreinin, & Kirby, 2022). Proper hydration also enhances cognitive functions like attention, memory, and executive abilities, which are crucial for sports requiring high psychological stability and focus, such as shooting (Badarin et al., 2023; Monfared, Tenenbaum, & Folstein, 2019; Ortega & Wang, 2018; Shao et al., 2020).

Shooting is a closed-motor skill that requires a high level of mental focus and anti-interference ability. There is a demand for executive and control functions in the shooting movement (Shao et al., 2020). Most studies focus on the psychological effect of shooting (Lu, Li, Wu, Liu, & Wu, 2021; Shao et al., 2020), but there is a lack of studies on the effect of dehydration on shooting sports. Shooting is a skill that demands focus, a high level of confidence, paying attention to the target, and a reduction in anxiety over the outcome of the shot (Alanagh & Atashgahian, 2017). Previous study has examined the impact of dehydration on archery performance, subjective sensations, and heart rate response and the findings indicate that dehydration during a competition leads to reduced concentration, heightened fatigue, and an elevated heart rate (Savvides, D. Giannaki, Vlahoyiannis, S. Stavrinou, & Aphasimis, 2020). Despite its significance, there is limited thorough research on knowledge and practice of dehydration in athletes participating in shooting sports. Hence, the purpose of this study is to address the complex problems related to dehydration in shooting sports and the knowledge and practice among the Perak shooting team.

MATERIAL AND METHOD

Samples

Thirty-two athletes from the Perak shooting team were selected using purposive sampling, involving both male and female participants, based on specific inclusion and exclusion criteria. The inclusion criteria for this study required participants to be active pistol or rifle shooters registered under MSN Perak. Athletes were excluded if they declined to participate, were retired, or had recently undergone a surgical procedure involving anesthesia or received intravenous contrast dye for imaging tests such as CT or MRI scans. The participants, aged between 14 and 21 years old, consisted of both Pistol and Rifle shooters.

Hydration Knowledge Scale (HyKS) KS

The Hydration Knowledge Scale (HyKS) questionnaire assesses participants' understanding of basic hydration, including fluid needs and dehydration signs, with 16 questions on a scale from -2 to 2. Certain answers are scored normally, while others are reverse scored. A perfect score of 32 reflects excellent hydration knowledge, with no external help allowed. The HyKS originally developed and psychometrically validated, where developers used comprehensive item analysis, factor analysis, and assessed internal consistency with reliability measures showing strong item-total correlations ($r = 0.90$) and good construct validity (Veilleux et al., 2020). Additionally, adaptations of the HyKS or similar hydration questionnaires have been employed in athletic contexts including Malaysian athletes to assess hydration knowledge, attitudes, and behaviors (Esa, Saad, Phing, Karppaya, & Sport, 2015).

Table 1: HyKS Score Classification (Ashadi, Mirza, & Siantoro, 2018)

Category of Knowledge	Score
Very Good	25-32
Good	20-24
Fair	13-19
Less	7-12
Poor	0-6
Very Poor	<0

Urine Specific Gravity (USG)

Urine Specific Gravity (USG) was used as testing to check the practice of water consumption among the shooters. USG measures the concentration and water balance of a person's urine. A small amount of urine was placed in a urine refractometer to analyse the hydration status. Urine-specific gravity should be between 1.010 and 1.030. Normal value ranges may differ slightly between laboratories. The urine samples were collected randomly during break times to align with the study's objective of assessing the athletes' hydration practices during typical training or competition routines.

Table 2: USG Reading Classification (Casa et al., 2000)

USG Value	Category
< 1.010	Well Hydrated
1.010 – 1.019	Minimally Hydrated
1.020 – 1.029	Significantly Dehydrated
> 1.030	Severely Dehydrated

Procedure

The data collection was conducted at the Perak Shooting Range. Participants were provided with a consent form to sign the day before the measurements, signifying their agreement to participate in the study and comply with all procedures. They were reminded to refrain from taking any medications that could influence the test results. Testing was carried out between 10:00 a.m. to 12:00 p.m., during break time. Each participant was assigned a label such as “participant 1, participant 2,” and so forth, to maintain confidentiality and facilitate linking questionnaire responses with test results. The testing took place in the doping room at the Perak Shooting Range in Chemor, Perak.

The questionnaire was distributed right after the participant was done with the USG based on the number of participants that had been labeled. The participants answered 16 questions on the HyKS questionnaire based on their knowledge without any help. Data were collected and analyzed after the participants answered all the questions. All research procedures concerning human subjects were accepted by the UiTM Research Ethic Committee with reference number REC-ERC/28/2024.

RESULTS

The mean HyKS score of 14.40 ± 5.17 indicates a fair level of hydration knowledge among the shooters. The wide standard deviation suggests a significant variation in the knowledge levels, with some shooters demonstrating a strong understanding of hydration principles, while others have limited knowledge. The mean USG value of 1.019 ± 0.008 suggests that they were at minimally hydrated. The low standard deviation indicates relatively uniform hydration statuses among the participants, with most shooters gaining similar USG values.

Table 3: Descriptive between HyKS score and USG

	N	Mean	Std. Deviation
HyKS Score	32	14.40	5.17
USG	32	1.019	0.008

The Spearman correlation coefficient between the total HyKS score and USG is -0.650. This indicates a moderate negative correlation between hydration knowledge and USG values. The correlation between HyKS scores and USG yielded a p-value of <0.001, which is below the significance threshold of 0.01. This result indicates that the correlation is statistically significant at the 0.01 level.

Table 4: Spearman Correlation

		HyKS score	USG
Total score	Correlation Coefficient	1.000	-.650*
	Sig. (2-tailed)	.	<.001
	N	32	32
USG	Correlation Coefficient	-.650*	1.000
	Sig. (2-tailed)	<.001	.
	N	32	32

*Correlation is significant at the 0.01 level (2-tailed)

DISCUSSION

The objective of this study was to investigate the relationship between hydration knowledge and practices among Perak shooters. The results supported the hypothesis, revealing a moderate negative correlation between knowledge scores and urine-specific gravity (USG) values. Although the correlation between hydration knowledge and USG signifies a meaningful relationship, it remains moderate rather than strong. Several factors are likely to contribute to this outcome. As reported by McDermott et al. (2024), self-reported fluid intake showed a significant negative correlation with USG, whereas hydration knowledge did not, indicating that possessing knowledge about hydration does not necessarily translate into appropriate hydration behavior. Similarly, Jusoh and Salim (2019) found no association between hydration knowledge and USG in Malaysian soccer players ($r = -0.099$, $p = 0.639$). The current study shows moderate correlation may reflect a partial translation of knowledge into practice stronger than those earlier findings, but not absolute. Environmental and sport-specific factors may have contributed to the moderate correlation observed in this study. The participants, who were young shooting athletes, trained under structured schedules with consistent access to fluids. This controlled environment may have minimized behavioral variability, thereby limiting the strength of the correlation. Similar findings have been reported in other athletic settings, such as rugby and soccer, where routine hydration breaks and coaching supervision often result in weaker or non-significant associations between hydration knowledge and actual hydration status (Jusoh & Salim, 2019; Scanlon & Norton, 2024). Additionally, the current study used random break-time USG samples, offering a snapshot of real-world hydration. However, USG fluctuates throughout the day based on recent intake and exercise. Previous study show that 24-hour collections or first-morning voids typically yield stronger biomarker correlations with intake (Perrier et al., 2013). The current study used methodology, while ecologically valid, introduces greater within-subject variability, diluting the potential for a stronger statistical relationship. The overall knowledge scores and the hydration knowledge scale suggest that most athletes lacked sufficient knowledge, indicating a need for educational programmes and routine hydration monitoring to improve practices. These

findings highlight the necessity of educational programmes and regular hydration monitoring to enhance hydration practices. Moreover, water consumption has been linked to a reduction in resting heart rate as well as heart rate during and after exercise, particularly when larger volumes are consumed (Grasser, 2020; Mendonca et al., 2013; Porto et al., 2023). Dehydration can thicken the blood, increasing the workload on your heart, which in turn can raise your heart rate (Rodin et al., 2022). This emphasizes the importance of proper hydration for cardiovascular health and peak performance. In addition, water consumption has been shown to impact cognitive function positively. Adequate hydration is associated with improved cognitive abilities, including attention, memory, learning, and executive functions (García, Ortega, Lorenzo-Mora, & Bermejo, 2022). Shooting sports require high levels of psychological stability and concentration (Shao et al., 2020) which eventually makes cognitive function crucial for these sports (Badarin et al., 2023). This emphasizes why knowledge regarding hydration is important for shooting athletes to enhance their performance. As hydration knowledge increases, the urine-specific gravity (a measure of hydration status) tends to decrease, implying better hydration. The relationship between hydration knowledge and practice is crucial in various contexts. However, previous studies have suggested that while knowledge of hydration is important, it does not always translate into healthier daily habits (McDermott, Zhao, & Veilleux, 2024; Sedek, Mohamad, & Kasim, 2015). A combination of education and practical, science-based strategies can help athletes maintain optimal hydration levels. This can be achieved by organizing workshops and seminars on the importance of hydration and its impact on performance, recovery, and overall health. Inviting nutritionists, sports scientists, and medical professionals to speak to athletes can provide valuable insights and guidance on effective hydration practices. A one-time educational sessions for high school athletes and hydration education programmes for collegiate female indoor-sport athletes have all been shown to enhance hydration status, behaviours, and knowledge (Abbasi, Lopez, Kuo, & Shapiro, 2021).

CONCLUSION

This study highlights the importance of hydration knowledge and practice in optimizing performance among Perak shooters. Findings indicate a gap between athletes' knowledge of hydration and their actual practices, a significant moderate negative correlation between total hydration knowledge scores and USG levels. This suggests that individuals with moderate hydration knowledge tend to exhibit better hydration practices. The moderate correlation suggests that while athletes may understand the significance of hydration, translating this knowledge into consistent behaviours remains a challenge. Bridging this gap through education and practical interventions could help shooters maintain optimal hydration, supporting both cognitive and physical performance (McDermott et al., 2024; Sedek et al., 2015). Future studies could enhance accuracy in hydration assessment with advanced methods like blood osmolality testing or wearable hydration sensors, especially for targeted athlete populations.

ACKNOWLEDGEMENTS

The authors would like to thank the Faculty of Sports Science and Recreation, UiTM Perlis Branch and Perak State Sport Council for their encouragement, assistance and fantastic effort in completing this manuscript.

FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

AUTHORS' CONTRIBUTION

Abu Bakar, A. H. conceptualized and designed the experiments. Hazni, M. A. N. H. conducted the experiments, prepared the data, planned and executed the simulations, contributed to interpreting the results, and wrote the manuscript. All authors offered essential feedback, assisting in refining the research, analysis, and manuscript.

CONFLICT OF INTEREST DECLARATION

We certify that the article is the author's and co-author's original work. The article was not published before and is not being considered for publication elsewhere. This research has not been submitted for publication, nor has it been published in its entirety or in part elsewhere. We attest that all authors made significant contributions to the work, validity, and legitimacy of the data, as well as its interpretation for submission to Jurnal Intelek.

REFERENCES

- Abbasi, I. S., Lopez, R. M., Kuo, Y.-T., & Shapiro, B. S. (2021). Efficacy of an educational intervention for improving the hydration status of female collegiate indoor-sport athletes. *Journal of Athletic Training*, 56(8), 829-835.
- Abd Rashid, F. N., Aznan, E. A. M., & Ismail, A. D. (2021). The awareness of hydration knowledge on gender differences among UiTM Perlis athletes. *Jurnal Sains Sukan dan Pendidikan Jasmani*, 10(1), 39-44.
- Alanagh, H. N., & Atashgahian, R. (2017). The effect of motivational and cognitive imagery on flow and shooting performance. *Journal of Research in Humanities Social Science*, 5(5), 35-44.
- Ashadi, K., Mirza, D., & Siantoro, G. (2018). *Hydration status in adolescent runners: Pre and post training*. Paper presented at the IOP Conference Series: Materials Science and Engineering.
- Badarin, A., Antipov, V., Grubov, V., Grigorev, N., Savosenkov, A., Udoratina, A., . . . Hramov, A. (2023). Psychophysiological parameters predict the performance of naive subjects in sport shooting training. *Sensors*, 23(6), 3160.
- Casa, D. J., Armstrong, L. E., Hillman, S. K., Montain, S. J., Reiff, R. V., Rich, B. S., . . . Stone, J. A. (2000). National athletic trainers' association position statement: fluid replacement for athletes. *Journal of Athletic Training*, 35(2), 212.
- Esa, N. H., Saad, H. A., Phing, C. H., Karpaya, H. (2015). Knowledge, attitudes and behaviours regarding hydration and hydration status of Malaysian national weight category sports athletes. *Journal of Physical Education and Sport*, 15(3), 452. DOI:10.7752/jpes.2015.03068;
- García, R. M. M., Ortega, A. I. J., Lorenzo-Mora, A. M., & Bermejo, L. M. (2022). Importance of hydration in cardiovascular health and cognitive function. *Nutricion Hospitalaria*, 39(Spec No3), 17-20.
- Grasser, E. K. (2020). Dose-dependent heart rate responses to drinking water: A randomized crossover study in young, non-obese males. *Clinical Autonomic Research*, 30, 567-570.
- Judge, L. W., Bellar, D. M., Popp, J. K., Craig, B. W., Schoeff, M. A., Hoover, D. L., . . . Al-Nawaiseh, A. M. (2021). Hydration to maximize performance and recovery: Knowledge, attitudes, and behaviors among collegiate track and field throwers. *Journal of Human Kinetics*, 79, 111.
- Jusoh, N., & Salim, S. (2019). Association between hydration status, hydration knowledge and fluid consumption during training among soccer players. 23(1), 23-29.
- Lu, Q., Li, P., Wu, Q., Liu, X., & Wu, Y. (2021). Efficiency and enhancement in attention networks of elite shooting and archery athletes. *Frontiers in Psychology*, 12, 638822.

- McDermott, B. P., Zhao, X., & Veilleux, J. C. (2024). Association of knowledge and health habits with physiological hydration status. *Nutrients*, 16(11), 1541.
- Mendonca, G. V., Teixeira, M. S., Heffernan, K. S., & Fernhall, B. (2013). Chronotropic and pressor effects of water ingestion at rest and in response to incremental dynamic exercise. *Experimental Physiology*, 98(6), 1133-1143.
- Monfared, S. S., Tenenbaum, G., & Folstein, J. R. (2019). Anticipation in sharp shooting: Cognitive structures in detecting performance errors. *Psychology of Sport Exercise*, 45, 101555.
- Ortega, E., & Wang, J. C. K. (2018). Effectiveness of an integrated mental skills and biofeedback training program on sport shooters. *International Journal of Sport Psychology*, 49(1), 35-54.
- Perrier, E., Rondeau, P., Poupin, M., Le Bellego, L., Armstrong, L. E., Lang, F., . . . Klein, A. (2013). Relation between urinary hydration biomarkers and total fluid intake in healthy adults. *European Journal of Clinical Nutrition*, 67(9), 939-943. doi:10.1038/ejcn.2013.93
- Porto, A. A., Benjamim, C. J. R., da Silva Sobrinho, A. C., Gomes, R. L., Gonzaga, L. A., da Silva Rodrigues, G., . . . Valenti, V. E. (2023). Influence of fluid ingestion on heart rate, cardiac autonomic modulation and blood pressure in response to physical exercise: A systematic review with meta-analysis and meta-regression. *Nutrients*, 15(21), 4534.
- Rodin, D., Shapiro, Y., Pinhasov, A., Kreinin, A., & Kirby, M. (2022). An accurate wearable hydration sensor: Real-world evaluation of practical use. *PLoS One*, 17(8), e0272646.
- Savvides, A., D. Giannaki, C., Vlahoyiannis, A., S. Stavrinou, P., & Aphas, G. (2020). Effects of dehydration on archery performance, subjective feelings and heart rate during a competition simulation. *Journal of functional morphology kinesiology*, 5(3), 67.
- Scanlon, S., & Norton, C. (2024). Investigating nutrition and hydration knowledge and practice among a cohort of age-grade rugby union players. *Nutrients*, 16(4), 533.
- Sedek, R., Mohamad, M. M., & Kasim, Z. M. (2015). Knowledge, attitudes and practices on hydration and fluid replacement among endurance sports athletes in National University of Malaysia (UKM). *Pakistan Journal of Nutrition*, 14(10), 658.
- Shao, M., Lai, Y., Gong, A., Yang, Y., Chen, T., & Jiang, C. (2020). Effect of shooting experience on executive function: Differences between experts and novices. *PeerJ*, 8, e9802.
- Stevenson, W., Zabinsky, J. S., & Hedrick, V. E. (2019). Effects of dehydration on cognitive and physical performance in female golfers: A randomized crossover pilot study. *J Appl Physiol* (1985), 2(4), 32.
- Veilleux, J. C., Caldwell, A. R., Johnson, E. C., Kavouras, S., McDermott, B. P., & Ganio, M. S. (2020). Examining the links between hydration knowledge, attitudes and behavior. *European Journal of Nutrition*, 59, 991-1000.