Journal of Sports Science and Nutrition

Febriansyah Dwi Cahyoo
Masters Program Sport
Science, Faculty of Health and
Sport Science, Yogyakarta
State University, Yogyakarta,
Indonesia

Yudik Prasetyo
Departement of Sport Science,
Faculty of Health and Sport
Science, Yogyakarta State
University, Yogyakarta,
Indonesia

Cerika Rismayanthi
Departement of Sport Science,
Faculty of Health and Sport
Science, Yogyakarta State
University, Yogyakarta,
Indonesia

Enggista Hendriko Delano
Doctoral Program Sport
Science, Faculty of Health and
Sport Science, Yogyakarta
State University, Yogyakarta,
Indonesia

The effect of water consumption level on dehydration status and archery accuracy in banyumas regency archery athletes

Febriansyah Dwi Cahyo, Yudik Prasetyo, Cerika Rismayanthi and Enggista Hendriko Delano

DOI: https://doi.org/10.33545/27077012.2023.v4.i2a.179

Abstract
This study aimed to determine the effect of water consumption levels on dehydration status and archery accuracy on archery athletes in the Banyumas Regency. This research was based on the observations and experiences of the researchers, who found that there was still a lack of awareness among archery athletes in Banyumas Regency to meet their hydration requirements properly. In addition, there were still many archery athletes in Banyumas Regency who did not carry enough drinking water during practice.
The research design is experimental research using quasi-experimental research methods. The design used in this research was "one group pretest-posttest" design. Furthermore, the instruments used included tests and measurements of water consumption levels using BFNB Quis, dehydration status using the *PURI* (check your own urine) method, and archery accuracy by shooting at a distance of 30 meters with 36 arrows. The population in this study were 35 archery athletes in Banyumas Regency in the standard bow and recurve division, with a sample of 20 people shooting in the standard bow and recurve division. Data analysis technique using paired sample t-test.
The results of the study obtained a t-value for archery accuracy (15.215) > t-table (1.72472) and a p-value (0.00) < 0.05. The results of the t-test on dehydration status showed that the t-count value was greater than the t-table value, and t-count (5.2580) > t-table (1.72472), and the paired sample t-test value sig. 0.00 < 0.05. These concluded that the H0 was rejected and Ha was accepted, meaning there was a significant difference between the pretest and posttest values. This study's results showed that there was an effect of the level of water consumption on dehydration status and archery accuracy in archery athletes in Banyumas Regency.

Keywords: Water consumption, hydration status, accuracy, athlete, archery

Introduction
Indonesia has a tropical climate with two seasons, namely, the dry season and the rainy season. Indonesia is also a country on the equator, and therefore, of course, this affects humidity and air temperature to create a tropical area. The high humidity and air temperature in In Indonesia also make people often feel less thirsty and pay less attention to hydration. On the other hand, body hydration education is still very rarely socialized to the general public, especially to people under the age of 23 because in the age range below 23 years, most people have a higher level of physical activity. This is evidenced by research from Merita (2018) [1] which stated that out of 90 high school youth respondents, only 57.8% were well-hydrated, and the rest were not well hydrated, Body hydration can be fulfilled by consuming fluids like mineral water. For the general public, it is recommended by World Health Organisation (WHO) to consume eight glasses or 2 litres of water per day. Still, the amount of water consumption is different for athletes. Of course, with a level of physical activity that is more than the general public, water consumption for athletes also increases. Ramdhan (2016) [2] also states that the water content in the bodies of athletes is more than that of non-athletes, and the water content in the bodies of young people is more than that of parents. This is because athletes and young people have more muscle mass, so the water content in the body is also more. The level of water consumption, especially in endurance sports athletes, will be higher because the amount of sweat that comes out and the ambient temperature will greatly affect fluid loss from within the body, which can lead to dehydration.

Corresponding Author:
Febriansyah Dwi Cahyoo
Masters Program Sport
Science, Faculty of Health and
Sport Science, Yogyakarta
State University, Yogyakarta,
Indonesia

Therefore, an athlete, especially one who pursues endurance sports, must be aware and sensitive to meeting his hydration requirements to maintain his performance during training or competition.

Several types of fluids can be consumed to meet the hydration requirements of the body for athletes, namely mineral water, electrolyzed water, isotonic, juice, carbonated water and energy drinks. Of course, each of these types of drinks has its advantages and disadvantages. For athletes who use endurance or endurance energy systems, it is better to consume juice to maintain muscle performance. Research from Fadli (2016) [3] states that the effectiveness of consuming banana juice is better than consuming isotonic drinks on muscle endurance during a 30-minute running activity. This means that consuming to rehydrate the body does not mean only putting water into the body but also includes various other elements such as magnesium, calcium, silica, sodium, potassium, zinc and selenium, which are needed by the body to be able to maintain body performance during training or competition.

Dehydration in endurance athletes can impact cognitive function, performance and ability of the neuromuscular system, such as losing 2-3% of body weight. This is because dehydration can reduce isometric and aerobic endurance performance and its effect, such as decreasing accuracy and concentration, according to Carrasco (2008) [4]. One of the endurance sports, like archery, requires archers to make every shot with concentration and consistent movement to create good accuracy. The dominant movements in archery are isometric movements, carried out without longitudinal movements and shortening of the muscles. To get maximum results in competitions and training, athletes can do these sports for more than 2 hours in an open field. Thus, the risk of archery athletes getting dehydrated will be very large if the athlete does not pay attention to hydration because outdoor sports have high temperatures and water evaporation rates.

Identifying the body's hydration level can be done by using a self-check urine card (PURI), by taking a urine sample in the morning and then matching the colour of the urine with the colour on the PURI card. From there, the dehydration status of the sample can be seen, according to Nur Faridah and Siti in Prayitno's research (2012) [5]. Knowing the level of dehydration directly can raise awareness to fulfil or maintain body hydration. So, before training or racing, the body is well hydrated, and performance during training or racing can stay at its best.

Most archery athletes in Indonesia are, on average, under 30 years old, especially athletes in Banyumas Regency. This agrees with the statement from the Chairman of the Banyumas KONI, who, at the Central Java PORPROV show, said that most Banyumas athletes were junior or young athletes. This statement also coincides with the statement of the Chairman of the KONI on the Banyumas Regency archery branch, which is also dominated by junior athletes in the age range of 17-25 years. In fact, almost 90% of Banyumas Regency archery athletes are junior athletes. Knowledge about body hydration during competition and practice is still lacking because several athletes were not good at managing their hydration during the researchers' observations. One example is that only a few athletes bring drinking water during practice, and the rest only drink during long breaks.

According to this background, the authors conducted a study for archery athletes in Banyumas Regency regarding the effect of water consumption on hydration status and its consequences on archery accuracy entitled "The effect of water consumption level on dehydration status and archery accuracy in banyumas regency archery athletes". With this research, it was expected to know the effect of water consumption on dehydration status and archery accuracy in archery athletes in Banyumas Regency.

Research Methodology
This study applied a quasi-experimental design that aimed to discover the impacts of "something" introduced to a subject, according to Lakens (2022) [6]. This study is included in one group pre-test-post-test design research, which means the experiment was conducted on one group without any comparison group. The setting of the study was in Banyumas Regency, intending to discover the amount of water consumption on dehydration status and archery accuracy of Banyumas Regency Archery athletes.

The researchers wanted to know whether when athletes are fully hydrated (100% water requirement) and reduced by 30% of their water requirements by reducing the drinking water supply will affect their dehydration status and shooting accuracy. During the protest, the athletes were given good hydration by measuring their water requirements using one calorie = 1 milli-litre of water. Therefore, it was expected to have a good hydration effect which marked their *PURI* results (well hydrated). It was also expected that archery accuracy, as measured by an archery test by shooting 36 within a distance of 30 meters, could increase. Whereas when given treatment in the form of reducing the supply of drinking water during the post-test by as much as 30%, hopefully, it would result in an increased dehydration status in PURI and a decrease in archery accuracy as indicated by a decrease in the scores.

The population of this study involved 35 archery athletes from the standard bow and recurve bow divisions who lived in Banyumas Regency. The samples were selected by applying purposive sampling, which was sample selection with particular considerations regarding the study samples, as follows:

- Active male or female Banyumas Regency Archery athletes.
- Permanent athletes, junior athletes, or athletes who reside in Banyumas Regency.
- Archery athletes from the standard bow and recurve bow divisions.
- Banyumas Regency athletes who could shoot within a distance of 30 meters.
- Banyumas Regency athletes who were willing to join the research process.
- Athletes who had personal bows.

From the criteria mentioned above, it was concluded that out of the 35 populations, 20 athletes were qualified to be the study samples.

This study was conducted in Beji Purwokerto Field, Village II, Beji, Kedungbanten Sub-District, Banyumas Regency, Central Java, postcode 53152. Furthermore, the study took two days, with the first day for scoring with the condition that the body's hydration was fulfilled in accordance with 1 Kl = 1 ml of water by fulfilling the drinking need as much as 100%. The second day was for scoring with the water need was reduced by 30% by reducing drinking water consumption from the number of basic needs.

Results and Discussion results
Data Analysis
The data analysis was conducted to answer the hypotheses stated in the previous chapter. The analysis tests included normality, homogeneity, and hypothesis tests (t-test). The results of these tests can be seen below:

A. Normality Test
This test aimed to know whether the data obtained by each variable were normally distributed or not. The normality test in this study applied the Kolmogorov-Smirnov test to discover the data distribution. If the sig. > 0.05, the data is declared as normally distributed, and if the sig. < 0.05, then the data is declared otherwise.

Table 1: Normality Test - Kolmogorov-Smirnov

Kolmogorov-Smirnov					
Pre-test - Post Test		**Statistic**	**DF**	**Sig.**	**Category**
PURI	Pre-Test	0.214	0.13	0.05	Normal
	Post-Test	0.195	0.35	0.05	Normal
Archery Accuracy	Pre-Test	0.159	0.175	0.05	Normal
	Post Test	0.151	0.200	0.05	Normal

The table above shows a significant value (p) of all variable which are bigger than 0.05. Therefore, the data were declared normally distributed. With the declared data normally distributed, the analysis could be continued with parametric statistical analysis.

B. Homogeneity Test
The homogeneity test was carried out to test whether there was homogeneity in the samples taken from the study population. The test sample is declared homogeneous if it meets the criteria F count < F table; if F count > F table, then the test is declared not homogeneous. The following are the results of the homogeneity test of this study.

Table 7: Homogeneity Test Results

Test	DF	F Table	F Hit	P	Category
Archery Accuracy	1:40	4.08	0.292	0.592	Homogenic
Dehydration Status	1:40	4.08	1.162	0.287	Homogenic

From the results of the homogeneity test table above, it can be obtained archery accuracy data with a calculated F value (0.292) < F table (4.08). The data were stated to be homogeneous, and the results of the homogeneity test in the dehydration state obtained data on the calculated F value (1.162) < F table (4.08) so that the data were declared to be homogeneous.

C. T-Test
The t-test in this study was conducted to answer the hypotheses previously mentioned. Hypothesis testing was carried out using the t-test (paired sample t-test) at the sig.5% level. The results of the hypothesis test (t-test) can be seen in the table below:

Table 8: Hypothesis Test Results (T-Test)

Pre-test-post-test	DF	T Table	T Count	P	Sig 5%
Dehydration Status	20	1.72472	15.215	0.00	0.05
Archery Accuracy	20	1.72412	5.2580	0.00	0.05

In the analysis of the dehydration status data above, the values of t-count (15.215) > T-Table (1.72472) and the value of p (0.00) < 0.05. The T-Test results on dehydration status show that the calculated t-value is greater than the t-table value. Thus, it can be interpreted that there is an effect of the level of water consumption on the dehydration status of archery athletes in Banyumas Regency.

Based on the analysis of archery accuracy data, it was obtained T-Count (5.2580) > T-Table (1.72472), and p-value (0.00) < 0.05. These results show that the t-count is greater than the t-table. So, it can be interpreted that there is an effect of the level of water consumption on archery accuracy in archery athletes in the Banyumas Regency. The two T-Test results show that if the T-Count > T-Table, the results of the research hypothesis are accepted, and the results of the hypothesis are stated, "There are effects of the level of water consumption on dehydration status and archery accuracy in archery athletes in Banyumas Regency."

Discussion
Archery sports requires high concentration and consistent level when performing shoots even though it seems otherwise. The truth is, archery needs precision, consistence, good stamina and skills in archery. Archers usually perform their trainings and championships in open spaces, such as field under direct sunlight. This environment provides an obvious risk of dehydration, especially in Indonesia, which is a country located on the equator, so that the temperature and humidity are highly affected the athletes' dehydration levels, including in Purwokerto.

Banyumas Regency, Central Java Province, has a relatively high air temperature compared to areas around Purwokerto, such as Purbalingga, Banjarnegara, Wonosobo, and Kebumen. This results in athletes who want to practice or compete in Purwokerto needing good body hydration preparation to avoid dehydration during training or competition, which can decrease performance and harm athletes. This is like in the research from Huda & Suwandi (2019) [7], which claims that dehydration can result in a lack of fluids which will make the blood thicker than it should be and cause the kidneys and liver to work harder so that damage to these organs can occur.

This study examined "the effect of water consumption on dehydration status and archery accuracy in archery athletes in Banyumas Regency" based on the experience and observations of the researchers at the 2018 PORPROV TC in Purwokerto. At that time, many archery athletes in Banyumas Regency still lacked the awareness to meet their body's hydration requirements, even during the 2018 TC PORPROV, which was taking place intensively, resulting in several athletes experiencing pain when urinating. From this research, it was expected that archery athletes in Banyumas Regency would get references to be more active in paying attention to their body hydration.

Fulfilling the body's hydration, especially during training, will improve performance when training or competing. At times like that, archers need their physical readiness, including the athlete's hydration condition. Meeting the hydration requirements can support the improvement of archer performance in several aspects, i.e., technique, physical, and mental. If these three aspects can be fulfilled because good body hydration conditions support them, then archers will display their archery performance well by

showing high accuracy. Baskara *et al*. [8] stated that dehydration status affected training volume in *pencak silat* athletes. From this study, it can be concluded that there was an influence between a person's dehydration status on their training volume, so if an athlete's training volume decreases, it will affect the training program that has been formed and the goals or peak performance of the program. Maintaining the balance of water in the body is very important because it regulates the body's temperature system or thermoregulator, which is regulated by the hypothalamus. Losing water in the body as much as 1-2% of the total water in the body can result in decreased performance, according to Powers, S. K., & Howley ET (2018) [9]. Increasing loss of body fluids means loss of electrolytes in the body, which can result in decreased performance of nerves that become less responsive, tissues in the body, and decreased performance in muscle fibres. Therefore, it is significant for the human body, especially athletes, to be able to maintain good body hydration.

Fulfilling body hydration is done by consuming water requirements according to or more than the body's water requirements. For people without excessive physical activity (non-athletes), WHO recommends drinking eight glasses of water one day or the equivalent of 2 litters. However, 33% or 1/3 of the water requirement is usually supplied from food, and the rest directly consumes water. Meanwhile, athletes with more muscular body composition and activity levels certainly need more water consumption than recommended by WHO. In this study, the level of water consumption was met by calculating the number of body calories equal to the number of millilitres of water needed.

After finding the amount of water needed in the body, a pre-test was conducted by meeting the water requirements from calorie requirements = millilitres of water requirements. After that, a post-test was conducted with caloric requirements = ml - 30% of drinking water requirements. After the pre-test and post-test were carried out, the t-test results were obtained, which showed t-count> t-table so that the hypothesis was accepted and stated "there is an effect of the level of water consumption on dehydration status and archery accuracy in archery athletes in Banyumas Regency".

The purpose of fulfilling body hydration in archery athletes in Banyumas Regency is to improve performance and appearance when training or competing, which is characterized by good accuracy. Athletes are expected to get the correct peak performance during competition. Maximum body condition can be in excellent condition because when the condition of the body is ready, the appearance of motion (technique) and the accuracy of archery athletes increases. The importance of fulfilling body hydration for archery athletes is maintaining their performance. This is because archery in competitions and training is long and requires good endurance. This needs to be done to overcome tiring conditions but is still required to give the best performance by showing good accuracy. So if the body's condition is not ready, one of which is due to dehydration, the body's condition and performance will decrease, which is detrimental to archery athletes. This is because accuracy will also decrease, and thus it is necessary to prepare and maintain proper body hydration, one of which is by consuming healthy water, juices, and energy drinks.

The study found that there was an effect of the level of water consumption on dehydration status and archery accuracy in archery athletes in the Banyumas Regency. This is linear with research from Wittbrodt *et al*. (2020) [10], which found that a lack of fluids of 2% of body weight can result in decreased performance in cognitive function. Decreased cognitive function results in decreased accuracy, reflexes, and the ability of the nerves that regulate body control and movement in archery or sports decreases. In addition, research from Pratiwi (2019) [11], also states that giving fluids in the form of coconut water, as much as 500 ml, to PBSI Medan athletes had a significant effect on the athlete's dehydration status, which is indicated by the clearer urine colour after being given 500 ml of coconut water.

The effect of dehydration on athletes is substantial, including archery athletes. Savvides *et al*. (2020) [12] state that the effect of dehydration on archery accuracy did not occur directly but through a decreased psychological and physiological impact resulting in a decrease in concentration, an increase in fatigue, and an increase in heart rate frequency which resulted in a decrease in the results of the archery score. With a decrease in concentration, the archer's response and reflexes will decrease and reduce the performance in archery. Meanwhile, the effect of dehydration on increasing fatigue will result in neuromuscular performance or muscle work function not taking place optimally. Nybo *et al*. (2014) [13] explain that dehydration could be more severe in hot and humid environmental conditions, potentially increasing tension, affecting the nervous system and brain blood flow and increasing mental fatigue. So, this will affect the level of accuracy in archery. On the other hand, dehydration can also affect the maximum work of the deep muscles. Jones *et al*. (2008) [14] stated that dehydration can reduce the maximum strength of the upper body muscles and reduce the maximum anaerobic performance during the test.

Meanwhile, for archery athletes, the physiological effects that occur when they are dehydrated, according to Jones *et al*. (2008) [14], the ability of upper body muscle contractions can decrease by as much as 15% of maximum strength. Furthermore, from a neurological point of view, the ability to get fast reflexes will also decrease, resulting in reduced coordination and automation of the athlete's movements and causing a decrease in scores. Moreover, vice versa if the athlete is hydrated, his body can maintain good muscle contraction strength, and the performance of the nervous system will also be maintained. In addition, the blood viscosity level will be maintained because fluids are supplied optimally, so the blood and oxygen supply to the brain will also be better. This is very important for archers because they get consistent shooting and a higher score than when the body is dehydrated.

With the inclusion of archery in the category of strength-endurance sports, it is very necessary to meet the hydration and nutrition requirements of archery athletes. Archery is also a measured sport and requires high concentration. This, of course, requires careful preparation of hydration and nutrition so that when competing or practising, athletes are not affected by the side effects of excessive or insufficient hydration and nutrition that can affect the focus of the archer. One source of energy is carbohydrates. Jeukendrup (2014) [15] states that *"The recommended carbohydrate intake can be achieved by consuming drinks, gels, or low fat, low-protein, and low fibre solid foods (bars), and selection should be determined by personal* preference'' to

fulfil carbs requirement for athletes who perform for more than two hours (Djoko Pekik Irianto. 2006: 56) [16].

Conclusion

The research results on archery accuracy obtained a p-value $(0.00) < 0.05$, which indicated that the t-count value was greater than the t-table. The results of the research on dehydration status obtained a value of P $(0.00) < 0.05$, which showed that the t-count value was greater than the t-table so that in this study, it could be concluded that H0 was accepted, which means that there was an effect on the level of water consumption on dehydration status and archery accuracy in archery athletes in Banyumas Regency.

Reference

1. Merita M, Aisah A, Aulia S. Status Gizi dan Aktivitas Fisik dengan Status Hidrasi Pada Remaja di SMA Negeri 5 Kota Jambi. J Ilmu Kesehat Masy. 2018;9(3):207-15.
2. Ramdhan RI, Rismayanthi C. Hubungan Antara Status Hidrasi Serta Konsumsi Cairan Pada Atlet Bola Basket. Med J Ilm Kesehat Olahraga. 2016;15(1):53-67.
3. Mardian F, Marijo, Ayu Indraswari D. Perbandingan Efektivitas Pemberian Minuman Isotonik Dan Jus Pisang Terhadap Daya Tahan Otot Selama Aktivitas Lari 30 Menit [Internet]. 2016 [Cited 2023 Jun 25]. Available from: https://ejournal3.undip.ac.id/index.php/medico/article/view/14424
4. Carrasco AJ. Effects of exercise-induced dehydration on cognitive ability, muscular endurance and surfing performance: a thesis presented in partial fulfilment of the requirements for the degree of Master of Science in Sport and Exercise Science, Massey University, Auckland, New Zealand [Internet] [Thesis]. Massey University; 2008 [Cited 2023 Jun 25]. Available from: https://mro.massey.ac.nz/handle/10179/759
5. Perbedaan Konsumsi Cairan Dan Status Hidrasi Pada Remaja Obesitas Dan Non Obesitas [Internet]. [cited 2023 Jun 25]. Available from: https://ejournal3.undip.ac.id/index.php/jnc/article/view/739
6. Lakens D. Sample Size Justification. Collabra Psychol [Internet]. 2022 [cited 2023 Jun 25];1(Methodology and Research Practice). Available from: https://online.ucpress.edu/collabra/article/8/1/33267/120491/Sample-Size-Justification
7. Huda AI, Suwandi T. Hubungan Beban Kerja Dan Konsumsi Air Minum Dengan Dehidrasi Pada Pekerja Pabrik Tahu. Indones J Occup Saf Heal. 2018;7(3):310-20.
8. Baskoro RA. Pengaruh Bow Training Terhadap Daya Tahan Otot Lengan Dan Akurasi Memanah Anggota UKM Panahan UNY. J Pendidik Jasm Kesehat Dan Rekreasi. 2018;7:9.
9. Pritchett K, Broad E, Scaramella J, Baumann S. Hydration and cooling strategies for paralympic athletes: Applied focus: Challenges athletes may face at the upcoming Tokyo paralympics. Curr Nutr Rep. 2020;9:137-46.
10. Wiitbrodt M, Barnes K. Hydration and Cognition in the General Population. Sports Sci. Exch; c2020. p. 209.
11. Pratiwi PM. Pengaruh Pemberian Air Kelapa Muda Terhadap Status Hidrasi Atlet Badminton Pbsi Medan [Internet], [Undergraduate]. UNIMED; c2019 [cited 2023 Jun 25]. Available from: http://digilib.unimed.ac.id/36537/
12. Savvides A, Giannaki DC, Vlahoyiannis A, Stavrinou SP, Aphamis G. Effects of dehydration on archery performance, subjective feelings and heart rate during a competition simulation. J Funct Morphol Kinesiol. 2020;5(3):67.
13. Nybo L, Flouris AD, Racinais S, Mohr M. Football facing a future with global warming: Perspectives for players health and performance. Br J Sports Med. 2021;55(6):297-8.
14. Jones AM, Wilkerson DP, DiMenna F, Fulford J, Poole DC. Muscle metabolic responses to exercise above and below the critical power assessed using 31P-MRS. Am J Physiol-Regul Integr Comp Physiol. 2008;294(2):R585-93.
15. Jeukendrup A. A step towards personalized sports nutrition: carbohydrate intake during exercise. Sports Med. 2014;44(Suppl 1):25-33.
16. Irianto DP. Pedoman praktis berolahraga untuk kebugaran dan kesehatan. Yogyak Andi Offset; c2004.