

Hydration management in rugby: a comparative study on the forward and back positions of the Indonesian national team

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Abstract

Background and Study Aim In the Indonesian national rugby team, there is a lack of awareness among back and forward players about the amount of fluids they lose while playing their respective positions. This is due to the different intensity and roles associated with each position. The aim of this research is to determine the difference in body fluid loss between players in the forward and back positions in the Indonesian national rugby team.

Material and Methods The research method used in this study was an experimental method with a two-group pre-test and post-test design. The data collection process employed purposive sampling with the criterion of selecting 12 individuals from a population of 23 who were willing to participate. The data analysis technique used was the independent t-test.

Results The research results concluded that there was a significant difference in body weight between the initial and final tests for players in the forward position. The t-count of 7.661 exceeded the t-table value of 2.571. Similarly, for players in the back position, there was a significant difference in body weight before and after the match. The t-count of 4.805 exceeded the t-table value of 2.571. Furthermore, when comparing fluid loss between forwards and backs, there was a significant difference. The t-count of 2.443 was greater than the t-table value of 2.222. This demonstrates the difference in fluid loss after competing with the Indonesian national rugby team.

Conclusions The weight of both forward and back players decreased after competing. There are differences in body fluid loss between the two positions, with forwards losing more fluid than backs. This study provides empirical evidence that the position played on the field influences the amount of body fluid lost during the game. This insight is important for developing customized hydration strategies that consider the specific physical demands of each playing position.

Keywords: body fluid, rugby, forwards, backs, hydration management

Introduction

The human body consists mostly of fluids that are distributed inside cells (intracellular) and outside body cells (extracellular). Maintaining the balance of these fluids is crucial, as any imbalance can lead to weakness, lack of focus, and difficulty concentrating.

In adult men, fluids make up 60% of their body composition [1]. These fluids function as regulators of body temperature, blood circulation, and as lubricants and protectors for movement in muscle joints [2]. The fluids in the body are always changing in concentration, quantity, and type [3]. Water is obtained in three ways: drinking, eating, and the oxidation of food in the body [4]. The greatest body fluid loss through the skin occurs in the form of sweat during strenuous activities, reaching up to

5,000 ml/day. If there is an imbalance of fluids in the body, it can lead to weakness, lack of focus, and difficulty concentrating [5, 6].

Dehydration is related to an imbalance between body fluids that enter and exit the body. In the world of sports, dehydration often occurs due to uncontrolled fluid intake, regardless of actual fluid needs. In this case, body fluids can be lost through urine, sweat, and breathing [7]. The impact of dehydration on the body includes reduced cognitive ability or difficulty concentrating, and decreased stamina and work productivity [8, 9]. Dehydration, accompanied by reduced carbohydrate stores, is one of the main factors causing decreased body performance during exercise [10]. Overall, dehydration negatively impacts multiple physiological functions, leading to impaired performance [11].

When participating in sports activities, body fluids are lost with each movement, depending on the intensity and volume performed. In general,

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studies assessing physiological responses and performance typically use dehydration levels of 2% body mass or greater [12, 13]. This ensures sufficient fluid loss to produce measurable changes, as such levels of dehydration are common among athletes. Rugby union players should try to prevent severe dehydration (insufficient fluid intake relative to fluid loss) or hyperhydration (excessive fluid intake relative to fluid loss) during matches and training [14, 15]. When exercising, most of the water lost from the body is through sweat. To avoid a significant decrease in performance, this water must be replaced, both during matches and training [16, 17].

Rugby is starting to be widely played in Indonesia. This is evidenced by the emergence of many rugby tournaments at the national, regional, and inter-school levels [18, 19]. In the sport of rugby, there are two official formats, Rugby 7 and Rugby 15, each with different intensity and volume in each match [20, 21]. The times and number of players vary; specifically, Rugby 15 features 15 players and 8 reserves. In Rugby 15, there are various positions, namely forwards and backs [22]. Different physiques will naturally orient players to certain positions over others [23, 24, 25]. During a 70-minute match, forwards perform approximately three times as much high-intensity work (11.2 ± 0.9 min) as backs (3.6 ± 0.5 min) [26, 27].

In the world of sports, especially rugby, hydration management is a critical aspect that influences athlete performance [28, 29]. Fluid balance in the body is not only important for maintaining peak performance but also for preventing injury and ensuring effective recovery [30, 31]. In the context of the Indonesian national rugby team, hydration management often receives less attention, particularly regarding the specific needs of players in the forward and back positions. Forwards, who are often involved in scrums and rucks, may have different hydration demands compared to backs, who engage in more running and fast movements [32].

The role of coaches in educating players in the back and forward positions about fluid loss is still very minimal. This is directly related to the consequences of dehydration or inappropriate hydration patterns in athletes [11, 33]. If this situation continues, athletes may experience impaired body function, resulting in suboptimal performance. The effectiveness of fluid loss management for forwards and backs is not yet well understood, which hinders the Indonesian Rugby 15 National Team coaches from effectively advising athletes on proper fluid consumption. Athletes often do not pay sufficient attention to their fluid loss during play or competition. They typically consume water only when they feel thirsty, focusing solely on quenching their thirst rather than maintaining

proper hydration levels. This approach does not ensure that the fluid intake matches the fluid loss during competition.

Although several studies have investigated hydration management, most previous research tends to generalize the hydration needs of athletes without considering differences in physical demands between positions in rugby. For example, the research by Roberts et al. [34] explains the nutrition protocol for rugby athletes in general. Another study by Scanlon and Norton [35] examined nutritional and body fluid requirements based on age.

However, there is still a lack of specific research focusing on the distinct hydration needs of players in different positions within the same rugby team. This gap highlights the need for targeted studies to develop tailored hydration strategies that consider the unique physical demands of each position.

The aim of this research is to compare the hydration needs of forward and back players on the Indonesian national rugby team.

Materials and Methods

Participants

This research was carried out during the Asia Rugby Championship Division 3 East-South match held at the Rugby Field Complex of Bung Karno Senayan, Jakarta. The population of this research consisted of all Indonesian Rugby 15 athletes. A purposive sampling method was used, with the following sample characteristics:

- 1) participants took a weight test at the beginning of the research;
- 2) participants played during matches;
- 3) participants played until the last round;
- 4) participants took a weight test after competing.

Out of 23 athletes, 11 could not be included in the study due to not meeting the criteria, while 12 athletes met the criteria and were included in the study.

Research Design

This research was designed as a comparative observational study, using a quantitative approach to collect data regarding athletes' weights before and after competition. The "Two Groups Pretest-Posttest" method was used to determine the lost body fluid in the positions of forwards and backs in the Indonesian national Rugby 15 team. This design allows the research to accurately measure and compare the level of dehydration experienced by these two positions before and after the match.

Data Collection

Data collection began by explaining in detail the purpose of the research, the procedures to be followed, the possible benefits, potential risks, and the participants' right to withdraw from the research at any time without consequences. The identities of

respondents and data obtained from the research were kept confidential to meet ethical standards. Data were obtained by weighing the athletes before and after competing to determine body fluid loss in the forward and back positions. The data collection process was as follows:

- 1) Athletes took off their clothes to measure their weight, wearing only shorts and sarongs;
- 2) Athletes relaxed and stood on the scale;
- 3) Each athlete's body weight was measured and the researcher recorded the results;
- 4) Athletes competed in the match;
- 5) After cooling down, the athletes prepared to have their weight measured again;
- 6) Athletes relaxed and stood on the scale;
- 7) Each athlete's weight was measured again and the researcher recorded the results.

Statistical Analysis

After the initial and final test data were collected, the data were processed and analyzed using descriptive analysis and independent t-test techniques. Before carrying out the analysis, the data collected from the initial and final tests were prepared, which included data cleaning such as checking and correcting data entry errors, identifying and resolving missing values, and ensuring that all data were entered correctly and consistently. The first step in the analysis was to apply descriptive analysis, which involved calculating basic statistics to gain a general understanding of the data. These statistics included mean, standard deviation, and minimum and maximum values. After conducting the descriptive analysis, the next step was to use the independent t-test to compare the averages of two independent groups, namely players in the forward and back positions. This t-test was used to determine whether there was a statistically significant difference in body fluid loss between the two positions. Data analysis was carried out with the help of SPSS 24.0.

Results

Description of Fluid Loss in Forward Position

Data on the results of the research regarding body fluid loss in the forward position in the Indonesian national Rugby 15 team can be seen in Table 1. Based on Table 1, there are initial weight data results and final weight data for the forward position. The initial weight test data for players in the forward position (X1) showed the heaviest body weight being 124.3 kg, the lowest body weight being 89.1 kg, with an average of 101.283 kg, a standard deviation (Sx1) of 13.860, and a standard error mean (SEMx1) of 6.215. The final weight test data for players in the forward position (X2) showed the heaviest body weight being 122.8 kg, the lowest weight being 87.0 kg, with an average of 99.0 kg, a standard deviation (Sx2) of 13.880, and a standard

error mean (SEMx2) of 6.224. In the initial and final tests, there was a decrease in body fluids in players in the forward position, with the highest value being a decrease of 3500 ml, the lowest value being 1500 ml, an average of 2283.33 ml, a standard deviation (SDx) of 664.580, and a mean standard error (SEMx) of 298.017.

Table 1. Data Description of Fluid Loss in Forward Position

Variable	Initial Weight	Final Weight	Losing Fluid (ml)
Highest Value	124.3	122.8	3500
Lowest Value	89.1	87.0	1500
Average	101.283	99.0	2283.333
Standard Deviation	13.860	13.880	664.580
Error Standard	6.215	6.224	298.017

The detailed results of the athletes' weighing before and after competing in the forward position can be seen in Table 2. The heaviest initial body weight was recorded by "A" at 124.3 kg, and the lowest weight was recorded by "E" at 89.1 kg. Meanwhile, the heaviest final weight was also recorded by "A" at 122.8 kg, and the lowest final weight was recorded by "E" at 87.0 kg. Based on different tests using SPSS, a calculated t-value of 7.661 was obtained. The results were compared with a t-table value at degrees of freedom (df) = n-1 = 6-1 = 5 with a confidence level (α) = 0.05, yielding a critical t-table value of 2.571. Thus, the t-count value was greater than the t-table value (t-count 7.661 > t-table 2.571). The results of the research indicate that for players in the forward position, there is a significant difference in body weight between before and after the match. This difference is attributed to the numerous activities carried out by the forwards during competition.

Table 2. Weight of Players in the Forward Position

No.	Name	Gender	Weight (kg)	
			Initial	Final
1	A	Male	124.3	122.8
2	B	Male	112.3	108.8
3	C	Male	94.1	91.8
4	D	Male	94.9	92.6
5	E	Male	89.1	87.0
6	F	Male	93.0	91.0

Description of Fluid Loss in Backs Position

Data on body fluid loss in the backs position in the Indonesian national Rugby 15 team can be seen in Table 3. Based on Table 3, there are initial and final weight data for players in the backs position. The initial weight test data for players in the backs position (Y1) showed the heaviest body weight being 90.5 kg and the lowest being 70.0 kg, with an average

of 80.6 kg, a standard deviation (Sy1) of 7.976, and a standard error of the mean (SEmy1) of 3.570. The final weight test data for players in the backs position (Y2) showed the heaviest body weight being 87.9 kg and the lowest being 68.9 kg, with an average of 79.3 kg, a standard deviation (Sy2) of 7.272, and a standard error of the mean (SEmy2) of 3.260. In the initial and final examinations, there was a decrease in body fluids in players in the backs position. The highest value for the decrease in body fluids was 2300 ml, and the lowest was 700 ml, with an average of 1300 ml, a standard deviation of 603.324, and a mean standard error (SEMY) of 270.548.

Table 3. Data Description of Fluid Loss in Backs Position

Variable	Initial Weight	Final Weight	Losing Fluid (ml)
Highest Value	90.5	87.9	2300
Lowest Value	70.0	68.9	700
Average	80.6	79.3	1300
Standard Deviation	7.976	7.272	603.324
Error Standard	3.570	3.260	270.548

In detail, the results of athletes' weighing before and after competing for players in the backs position can be seen in Table 4. The heaviest initial body weight was recorded by "G" at 90.5 kg, and the lowest weight was recorded by "L" at 70.0 kg. Meanwhile, the heaviest final weight was recorded by "G" at 89.7 kg, and the lowest final weight was recorded by "L" at 68.9 kg. Based on different tests using SPSS, a calculated t-value of 4.805 was obtained. The results were compared with a t-table value at degrees of freedom ($df = n-1 = 6-1 = 5$) with a confidence level ($\alpha = 0.05$), yielding a critical t-table value of 2.571. Thus, the t-count value was greater than the t-table value (t-count 4.805 > t-table 2.571). The results of the research indicate that for players in the backs position, there is a significant difference in body weight between before and after the match. This difference is attributed to the observation that during the game, the backs performed less work or fewer activities.

Table 4. Weight of Players in the Backs Position

No.	Name	Gender	Weight (kg)	
			Initial	Final
1	G	Male	90.5	89.7
2	H	Male	89.1	87.9
3	I	Male	80.9	78.6
4	J	Male	76.7	75.0
5	K	Male	76.1	75.4
6	L	Male	70.0	68.9

Comparison of the Initial and Final Test on the

Forward and Backs Position

Based on the results of the final test of body fluid loss in rugby players in forward and back positions, a different standard error of the mean (SEmxmy) of 402.499 was obtained. Using SPSS for the different test, a t-count of 2.443 was calculated. This t-count value was compared with the t-table value at a degree of freedom (df) of $(n1 + n2) - 2 = (6 + 6) - 2 = 10$ and a confidence level (α) of 0.05, yielding a critical t-table value of 2.228. Since the t-count of 2.443 is greater than the t-table value of 2.228 (t-count 2.443 > t-table 2.228), the results indicate a significant difference in body fluid loss between players in the forward position and those in the backs position in the Indonesian national Rugby 15 team. This can be understood because the more activity or work done, the more body fluids are excreted, meaning forward players exert more effort than players in the back position.

Discussion

The results of this study show that there is a significant difference in body fluid loss between players in the forward and back positions in the Indonesian national Rugby 15 team, with forward players experiencing greater fluid loss compared to back players. These findings are consistent with previous studies indicating that rugby players who engage in more intense physical activity and more frequent physical contact tend to lose more body fluid during the game [36, 37]. This highlights the importance of effective hydration management in rugby, especially for players in forward positions who are at greater risk of dehydration.

Forward players are usually involved in many activities such as scrums and rucks, which require great physical effort and result in increased heat production and fluid loss through sweat [38]. These activities lead to significant heat production and excessive sweating, causing substantial loss of body fluids [23, 24]. In contrast, backs engage in more sprinting and long-distance running, which also requires high effort but involves less duration and frequency of contact compared to forwards, resulting in lower fluid losses [39]. This study confirmed these findings, with the average player in the forward position losing 2283.333 ml of fluid, while players in the back position lost an average of 1300 ml.

When players compete, especially for long durations or at high intensity, the body produces sweat as a cooling mechanism. This process causes fluid loss from the body, which directly affects body weight. This research shows that weight loss occurs before and after the match in both forward and back players. Significant fluid loss without adequate replacement can lead to dehydration, which has been shown to affect physical and cognitive performance [40, 41]. Dehydration of 2% of body weight can reduce aerobic capacity, strength, and stamina,

which are crucial in high-intensity sports such as rugby [12, 13]. In addition to reduced physical performance, dehydration can also lead to decreased ability to concentrate and maintain alertness, which are important factors in making quick and accurate decisions on the field [11, 42]. This means that players who are not sufficiently hydrated may have difficulty following game strategy and responding effectively to match situations. Furthermore, dehydration can affect the body's thermal homeostasis, increasing core temperature and potentially leading to adverse health effects such as heat exhaustion or even heat stroke in extreme conditions [43]. The cardiovascular system is also affected, with dehydration resulting in increased blood viscosity, which can raise the risk of thrombosis and overwork the heart as it strives to maintain adequate blood flow to muscles and other vital organs [44].

From a hydration management perspective, these results underscore the importance of differentiated hydration strategies based on players' positions during the match [41, 45]. Coaches and medical teams should design more specific and targeted hydration protocols for forward players to optimize performance and reduce their higher risk of dehydration. Efforts to increase awareness of the importance of proper and effective hydration should be intensified, especially among forward players who are prone to dehydration. It is also important to consider the health consequences of significant body fluid loss [46]. Dehydration can cause a variety of health problems, including decreased physical and cognitive performance. In high-intensity sports such as rugby, where physical performance and endurance are critical, effective hydration management can be a determining factor in team success [47, 48].

Conclusions

This research reveals that there is a significant difference in fluid loss between forward and back players on the Indonesian national rugby team, with forward players losing more fluid than back players. Weight loss measured after competition indicates a reduction in body mass that can be directly attributed to dehydration occurring during intense

physical activity. These findings have important practical implications for players, coaches, and medical staff of rugby teams. Understanding the differences in fluid loss between positions helps in developing more targeted hydration strategies. Coaches can use this information to design more effective training and match preparation programs, specifically considering hydration needs based on the intensity and nature of each position's physical tasks. Thus, implementing a more dynamic and customized hydration strategy will support players' optimal performance and reduce the risk of dehydration-related disorders.

This study makes an important contribution to the sports literature by identifying and documenting specific differences in fluid loss between player positions in rugby. However, this study has several limitations, including a limited sample size and a focus on only one national team. Additionally, this study did not directly measure electrolyte levels or other physiological parameters that may be affected by dehydration, which could provide a more complete picture of the physiological effects of fluid loss. Future research could target larger sample sizes and diverse teams to validate these findings and expand their generalizability. Additionally, it would be beneficial to include measurements of electrolytes and other physiological variables to better understand the impact of dehydration on rugby players. Future researchers could also consider evaluating the effectiveness of different hydration strategies to determine which are most effective for players in various positions.

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Conflict of Interest

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