

**Fluid Intake and Hydration Status Among Sport Science Students at  
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**Abstract**

Fluid intake is often neglected which has an impact on student productivity and achievement as well as the vulnerability of sports students to dehydration. The purpose of this study was to determine the fluid intake and hydration status of sports science students at Cenderawasih University. This cross-sectional survey with simple random sampling was conducted among 72 sports science students. The data collected were the characteristics of the subjects (age and BMI), fluid intake, hydration status and hydration knowledge. The hydration status was used to measure the urine color chart through the Self-Urine Check (PURI) card. Fluid intake was assessed using the 3x24 hour recall method and the semi-quantitative Food Frequency Form. The subject's hydration knowledge was assessed by using the Hydration Knowledge Scale (HyKS). The results showed that most of sports science students (69.4%) were well hydrated while respectively 18.1%, 6.9% and 5.6% were dehydrated in the light, moderate and severe categories. Total fluid intake was  $2708.99 \pm 416.97$  which was dominantly obtained from the water consumption. Hence, although most of the students were well hydrated, they were still found to be dehydrated. Correlation tests showed a very strong positive relationship between total fluid intake and hydration status. Further research involving physical activity variable in sports science students with a larger sample and sports nutritional education need to be conducted.

**How to Cite**

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## INTRODUCTION

Water is very important for human life. About 65-70% of the human body is composed of water that determines the physiology of the body by channeling nutrients, oxygen and electrolytes needed by cells. However, fluid intake is often overlooked and not many realize the importance of fluid intake (Barley et al, 2018a). Dehydration occurs when the body loses water from the total amount of body water through breathing, urine, feces and skin (Hew-Butler et al. 2018). The fulfillment of water in sports becomes very important to maintain the hydration status of athletes and body temperature due to the expenditure of heat and cooling of the body through sweat (Giriwijoyo & Sidik, 2012). The importance of fluid intake leads to the inclusion of fluid consumption recommendations in the General Guidelines for Balanced Nutrition.

One of the causes of dehydration is a lack of fluid intake and high activity that is affected by environmental temperature. Fluid intake is obtained from food and drink and regulated by thirst and hunger. Dehydration often goes unnoticed, the dense activity causes individuals to forget to drink and only drink when thirst arises. Dehydration occurs before the individual feels thirsty. Exercise and games in the sun lead to an increased need for water and electrolytes due to being lost through sweat (Giriwijoyo & Sidik, 2012).

Dehydration in sports has an impact on the physical and mental condition of the athlete, which determines the performance as well as the athlete's achievements. Dehydration of 1% will interfere with cognition function, movement coordination, and mood (Zhang et al, 2019). Acute dehydration causes impaired muscle strength and endurance and increases fatigue (Barley et al., 2018b). Furthermore, lack of fluid in exercise leads to an increase in excess body heat that triggers injuries and thermoregulation disorders such as fainting and heat gravity (Giriwijoyo & Sidik, 2012). Water loss of 8% of body weight can lead to death (Shaheen et al, 2018).

Sports students are a group at high risk of dehydration due to high outdoor physical activity during the lecture process and there are several who become athletes. This is in contrast to students in general who have more time for theoretical activities and indoor practicum. Previous research results show dehydration determines both exercise and academic achievement. Dehydration decreased performance by 2.4% in 5 Km runners (Jeukendrup, 2017). While research in

students found that dehydration interferes with short-term memory that determines cognitive function in achieving academic performance (Ekpenyong & Akpan, 2017; Wittbrodt & Millard-Stafford, 2018; Nafara et al, 2017). Research in Negeria found 46.4% of students were dehydrated and 59% have a lack of water intake (Ekpenyong & Akpan, 2017). Research in the department of physical education revealed the inaction and unconscious role of nutritional intake including fluids for physical performance (Ozdoğru an & Ozcelik, 2011). How about research in Indonesia? Researchers have not found the topic studied by researchers in Indonesia. In fact, information about how hydration status specifically in sports students is important to know.

By looking at the frequent intake of neglected fluids that have an impact on productivity and achievement and the susceptibility of sports students to dehydration, this study will reveal total fluid intake and hydration status of sports science students at Cenderawasih University.

The purpose of this study was to determine the fluid intake and hydration status of sports science students at Cenderawasih University. This study has a continuous impact, the acquisition of information about fluid intake and hydration status of students into the initial data of the next research and the first steps of prevention and treatment of dehydration. Furthermore, it will improve cognition function, optimization of training performance and achievement of student achievement both academically and during competitions.

## METHODS

This research is an observational study with a cross-sectional survey design. The research was conducted at the Faculty of Sports Sciences, Cenderawasih University Jayapura in April-September 2021. The population in this study was sports science students. While the study sample was 72 sports science students in Cenderawasih University, using a simple random sampling technique.

The collected data were the characteristics of the subject (age, weight, height and Body Mass Index (BMI)), fluid intake, hydration status and hydration knowledge. Fluid intake was assessed by performing a 3x24 recall and using semi-quantitative FFQ. Hydration status was known through urine color charts through the Urine Self Check (PURI) card. Urine samples were collected in the morning using a clear bottle, then the hydration status is known by comparing the color

of urine with the graph of urine color on puri cards under the rays of white neon lights. If the comparison results show 1-3 then the subject is well hydrated while 4-8 indicates the subject is dehydrated (Prayitno & Dieny, 2012). The subject's knowledge of hydration was measured using the Hydration Knowledge Scale (HyKS).

Research data was processed using the IBM SPSS program. Univariate analysis was used to describe each variable i.e. subject characteristics, fluid intake, hydration status and hydration knowledge. Spearman's Rho analysis was used to examine the relationship between hydration status and total fluid intake, hydration status and hydration knowledge, BMI and hydration knowledge, and hydration status and BMI. Pearson correlation was used to analyze the relationship between BMI and hydration knowledge.

## RESULTS AND DISCUSSION

The total sample involved in this cross-sectional study was 72 Sports Science students, consisting of 17 female and 55 male students. The description of the results of the collected data is described as follows.

**Tabel 1.** Participants characteristics

Subject Characteristics	(n = 72)		Mean±SD
	Min	Max	
Age	17	27	19.56±1.98
Weight	45	80	60.21±7.55
Height	150	180	164.43±7.70
BMI	17.40	28.50	22.27±2.35

**Tabel 1** shows the average age of respondents, weight, height and BMI were respectively 19.56±1.98, 60.21±7.55, 164.43±7.70, and 22.27±2.35. Respondents in the age range of 17-27 years.

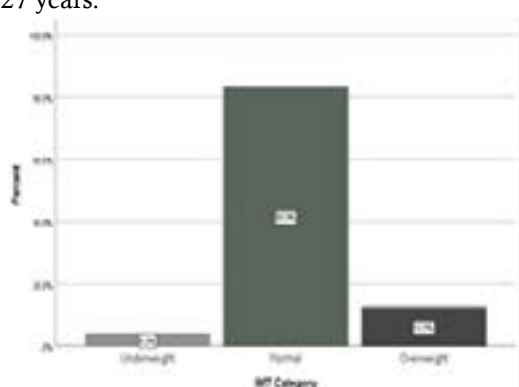


Figure 1. BMI categories of participants

The above chart illustrates the IMT category of sports science students, where most (83.30%) of students had a normal BMI category.

## Fluid Intake

**Tabel 2.** Students water intake

Source	Rerata±SD		Total
	Male	Female	
Total water intake (ml)	2671.31±437.97	2830.88±321.68	2708.99±416.97
Drinking water (ml)	1499.35±339.33	1636.76±269.02	1531.79±327.62
Fluid from food and other beverage (ml)	1171.95±162.94	1194.12±120.01	1177.19±153.38

**Tabel 2** shows the total fluid intake was 2708.99±416.97 ml. It was found that total fluid intake among male students (2671.31±437.97) was lower than that of female students (2830.88±321.68). Meanwhile, the overall mean of fluid intake was 2708.99±416.97. This intake was obtained from the consumption of water, other drinks and water from food.

## Hydration Status

**Tabel 3.** Participants hydration status

Hydration Status	(n = 72)	
	Frequency	%
Well Hydrated	50	69.4
Light dehydrated	13	18.1
Moderate dehydrated	5	6.9
Severe dehydrated	4	5.6
Total	72	100

The above **Tabel 3** shows most students (69.4%) were well hydrated. It found 18.1% light dehydrated, 6.9% moderate dehydrated, and 5.6% severe dehydrated.

**Tabel 4.** Hydration status based on gender

Hydration Status	Frequency			
	Men	%	Women	%
Well hydrated	36	65.5	14	82.4
Light dehydrated	11	20.0	2	11.8
Moderate dehydrated	5	9.1	0	0
Severe dehydrated	3	5.5	1	5.9
Total	55	100	17	100

**Tabel 4** shows based on gender it was found that the incidence of dehydration was more common in male students than female students.

#### Hydration Knowledge

Knowledge of fluids was measured by the Hydration Knowledge Scale (HyKS), a knowledge score range of -6 to 25. The average value of knowledge about fluids was obtained  $15.15 \pm 6.85$ . Thus, the higher the HyKS score describes the higher the respondent's knowledge about fluid.

#### Association between total fluid intake, hydration status, BMI and hydration knowledge.

The correlation coefficient of total fluid intake relationship with hydration status was  $r = -0.808$  indicated that there was a significant negative correlation between total fluid intake and hydration with a very strong relationship. Thus, the higher the water intake, the more hydrated the subject. Meanwhile, a moderate significant correlation also found in relationship between total fluid intake and hydration knowledge ( $r=0.729$ ). Tests of the relationship between hydration status and hydration knowledge showed there was a moderate negative correlation with  $r=-0.657$ . The correlation between BMI and hydration status showed a poor negative relationship ( $r = -0.140$ ). Result showed relationship between total fluid intake and BMI was found a fair positive correlation ( $r=0.491$ ). Lastly, correlation between BMI and hydration knowledge was found fair ( $r=0.314$ ).

This cross-sectional study aimed to assess the fluid intake and hydration status of sports science students at Cenderawasih University. Besides, we examined relationships between fluid intake and hydration status, as well as relationships with related variables such as BMI and hydration knowledge.

Results from this study show that most students (69.4%) were well hydrated while the rest were dehydrated at different levels, namely light, moderate dehydrated and severe dehydrated. Total water intake was obtained mostly from drinking water, and was followed by water from other beverages and water from food. The amount of fluid intake in female students was found to be higher than in male students. This section will discuss, compare the results found with the results of previous studies.

The average total fluid intake of students was  $2708.99 \pm 416.97$  ml. This intake is predominantly obtained from the consumption of water of  $1177.19 \pm 153.38$  ml and  $1531.79 \pm 327.62$  ml, respectively. When compared based on gender,

the average total fluid intake was higher in female sports students ( $2830.88 \pm 321.68$ ) than in male students ( $2671.31 \pm 437.97$ ). This amount meets the recommended daily intake of water which is at least 2 liters (2000 ml) or equivalent to 8 glasses of water (240 ml). However, when compared to the recommended daily fluid consumption according to the Institute of Medicine (IOM) (2005) this number is still less, for adult men as much as 3.7 liters and women 2.7 liters. A study conducted by Ekpenyong & Akpan (2017) found as many as 59% experienced a lack of water intake.

Most sports students (69.4%) were well hydrated but still found students who were dehydrated at light, moderate and severe levels. The results of this study are in line with research conducted in Africa with student samples found as many as 46.6% of students were dehydrated (Ekpenyong & Akpan, 2017). This number was not much different from the number found in this study which was 44.7%. Similarly, a study conducted by Penggalih et al (2013) found that more than half of the student sample studied (60.9%) were unconsciously dehydrated. Dehydration in students was influenced by physical activity factors that spend a lot of time sitting and activities in the field and environmental temperature (Penggalih et al, 2013; Giriwijoyo & Sidik, 2012; Ozdoğru & Ozcelik, 2011).

The results of the correlation test showed a very strong positive relationship between total water intake and hydration status. Hydration status is affected by the amount of fluid consumed from beverages and food and high activity (Giriwijoyo & Sidik, 2012). Students in particular sports students have high activities with field practice courses and there are students who are also athletes causing a lot of water that comes out through sweat during training and competing (Giriwijoyo & Sidik, 2012; Ozdoğru & Ozcelik, 2011). In addition, Barley et al. (2018a) stated that fluid intake is often ignored and not many realize the importance of fluid intake.

The process of losing body water is known as the definition of dehydration, however, it is frequently used inappropriately to explain hypohydration. Human body water is lost in several ways, such as through respiratory system, the kidneys, gastrointestinal system and skin (i.e. sweating). Excessive sweating during exercise or diarrhoea can have life threatening outcomes may cause severe hypohydration (Barley et al., 2020).

The finding from the current study showed there was a poor negative correlation between BMI and hydration status, indicating that although the correlation is poor but it showed a negative correlation. This finding is consistent with a study conducted in 2017 (Sari & Nindya, 2017)

which found a weak negative relationship between nutritional status and hydration status. Furthermore, a study conducted among teenager with obesity found that dehydration is more common among teenager with obesity compared to those without obesity (Prayitno & Dieny, 2012). This is because people with obesity has more fluid in their adipose cell is less than fluid in muscle cell (Yuniastuti, 2008). In other words, more water is found in muscle cells compared to in adipose cell. Hence, the greater the BMI the better hydration status.

Results from this study did show that there was a moderate negative relationship between hydration status and hydration knowledge ( $r = -0.657$ ). Similarly, a high number of dehydration was found among athlete due to poor knowledge about nutrition and fluid, therefore it is important to educate athletes about hydration knowledge especially how to meet their needs by individualised hydration strategies (Magee et al., 2017). Additionally, as Veilleux et al. (2020) states that although fluids intake behaviour is more likely affected by hydration attitudes but it is important to increase people with inaccurate information about hydration. Thus, a good hydration knowledge is more likely to have and meet ones' hydration status.

The results showed a very weak relationship between BMI and the hydration status of sports students. The average BMI of sports students was in the normal category (83.3%) with 69.4% of students well hydrated. Maffeis et al. (2015) found that subjects with BMI category obese were not well hydrated compared to those with normal BMI. This is due to lack of fluid intake (Maffeis et al., 2015). While research with a sample of futsal club members conducted by Turyandari (2017) found that subjects with normal category BMI had good hydration status. Another study found obese teens were more prone to dehydration caused by lack of fluid consumption (Prayitno & Dieny, 2012).

This study found that there was a sufficient relationship between hydration knowledge and hydration status. The average hydration knowledge score in sports students was  $15.15 \pm 6.85$  which is relatively low when compared to the maximum score of hydration knowledge according to HyKS (32). This result is in line with a study in China that found about 71.6% of students did not know the recommended daily water intake (Zhang et al, 2019). Water consumption is determined by knowledge of nutrition, especially fluid intake (Dubose et al, 2013). Shaheen et al (2018) found that participants with good knowledge of dehydration reported adequate water intake and meet

the requirement for water intake recommendation. Although a study among female indoor-sport athletes found no correlation between hydration knowledge and fluid intake, hydration status among athletes might be improved by providing educational intervention (Lopez et al, 2021).

This study found a fair correlation between BMI and fluid knowledge. This result is consistent with a study in Malaysia that found sufficiently hydrated children has parents with a good knowledge about fluid consumption. BMI also found has relationship with hydration status, children with overweight were insufficiently dehydrated (Kaur et al., 2017). Referring to study limitations, the COVID-19 pandemic made it difficult to reach potential participants, leading to relatively small sample size. Therefore, further studies include larger sample size are required to be conducted to look closer and explain the association deeper.

## CONCLUSION

Thus, although most sports science students were well hydrated, dehydration were still found in college students. Correlation tests showed a very strong positive relationship between total fluid intake and hydration status. With the discovery of dehydrated sports students, it is necessary to educate sports nutrition about the importance of fluid intake. Additionally, further research involving physical activity variable with a larger sample number needs to be done.

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