

Difference of Knowledge Retention between Medical Students with Good and Poor Hydration

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Abstract

Low knowledge retention in medical students is a problem in the health education sector. Retention itself is a reflection of memory ability which can be influenced by an individual's hydration condition. Therefore, this study aims to determine the effect of daily consumption of drinking water on retention in medical students. This research was a descriptive analytical observational study with cross-sectional design. Consisted of 59 medical students from Airlangga University who were divided into two groups: 34 students with water consumption $\geq 2\text{L/day}$ (57.63%) and 25 other students with water consumption $< 2\text{L/day}$ (42.37%). There was score decrease from 1st semester test to 4th semester test in both groups, but it was not significant in students with poor hydration ($p=0.059$). However, average scores both in the 1st and 4th semester were higher in students with good hydration. The findings of this research also showed that students with water consumption $\geq 2\text{L/day}$ had less knowledge retention compared to other groups, but this finding wasn't significant as the p -value was 0.320.

Keywords: Knowledge Retention, Memory, Medical Student, Hydration

1. Introduction

Water is an important component for metabolic processes of the body. When the body is in dehydrated condition, or lack of water, blood flow to the brain is reduced so the intake of oxygen and tissue nutrients is also reduced [1]. Apart from that, it is known that brain volume is shrunk when it's lack of water. This condition of dehydration has a negative effect on cognitive abilities [2][3]. Therefore, the recommended drinking water consumption is 2L/day to prevent dehydration [4].

One of the cognitive abilities studied here is memory [5] in the form of knowledge retention. Memory is an individual's ability to store information. Based on the period, memory is divided into short-term memory or working memory, intermediate memory, and long-term memory [6][7]. Knowledge retention is the result of the consolidation of working memory into long-term memory which will finally be recalled [8]. The hippocampus and thalamus areas are the most crucial parts in the memory processing [9].

According to research by Chakkarapani and Sheng, knowledge retention of medical students is low. In just 2 years, medical students' knowledge decreased by 32.56%. This problem of retention could increase medical errors and risks to patient health in the future when these medical students already become doctors [10].

Therefore, this research was conducted to determine the effect of students' hydration conditions on their knowledge retention.

2. Material and Methods

This research was a cross-sectional descriptive observational analytic study conducted on medical students of Universitas Airlangga, class of 2020. Before started, the research had received ethical clearance number 168/EC/KEPK/FKUA/2023. Data collection used questionnaires and secondary data: tests score recaps. The questionnaire mainly contained respondents' consent, identity, and daily drinking water consumption: more than equal to 2L/day or less than 2L/day. The scores recap taken and used were the 1st semester and 4th semester anatomy test scores. All students who were willing and filled out the questionnaire were included in this research, except for students who had been assistant lecturers, students who won anatomy competitions, and students who repeated courses. Data processing used Microsoft Excel 2019 and SPSS.

3. Result

3.1. General characteristic of research participants

The research participants consisted of 59 medical students of Universitas Airlangga. The participants' age ranged from 20 to 23 years old. Female participants were in a higher percentage (69.5%) than the male (30.5%). These participants were grouped in to two observational groups based on their drinking water consumption each day. Those who drink water more than or equal to 2L per day were categorized in good hydration (57.63%), while participants who drink water less than 2L per day were categorized in poor hydration (42.37%).

Table 1. Knowledge retention in medical students with good hydration

Variables	Total (%)
Sample Size	59 (100%)
Age Distribution	20-23 years old
Sex	
Female	41 (69.5%)
Male	18 (30.5%)
Hydration Status	
Good (Water Consumption $\geq$ 2L/day)	34 (57.63%)
Poor (Water Consumption < 2L/day)	25 (42.37%)

3.2. Knowledge retention in medical students with good hydration

Students with water consumption more than equal to 2L/day had 1st semester and 4th semester average scores of 50.29 and 33.30. The data for those two semesters were known to have normal distribution ($\alpha=0.051$ and $\alpha=0.498$). Using the paired t test, the average scores in the two semesters were significantly different with a decrease in scores from semester 1 to semester 4 of 16.99 ($p=0.000$).

Table 2. Knowledge retention in medical students with good hydration

Students with Water Consumption $\geq$ 2L/day	N	Mean	$\pm$ SD	α^*	p -value**
1 st Semester Score	34	50.29	$\pm$ 26.91	0.051	0.000

4 th Semester Score	34	33.30	±13.45	0.498
Difference	16.99			

*Shapiro-Wilk test

**paired t test

3.3. Knowledge retention in medical students with poor hydration

The average score for students with water consumption less than 2L/day was 35.6 in the 1st semester and 27.74 in the 4th semester. The data for those two semesters were normally distributed ($\alpha=0.371$ and $\alpha=0.265$), so it was continued with a paired t test. From the results of the paired t test, it was known that the average scores difference of those semesters was not significant though there was 7.86 points decrease ($p=0.059$).

Table 3. Knowledge retention in medical students with poor hydration

Students with Water Consumption < 2L/day	N	Mean	±SD	α^*	$p\text{-value}^{**}$
1 st Semester Score	25	35.6	±18.73	0.371	0.059
4 th Semester Score	25	27.74	±16.21	0.265	
Difference	7.86				

*Shapiro-Wilk test

**paired t test

3.4. Knowledge retention between medical students with good and poor hydration

Knowledge retention was calculated from the percentage comparison between the 4th and 1st semester average score. Students with water consumption more than equal to 2L/day had a lower retention value ($M=83.01\%$) compared to the group of students with water consumption less than 2L/day ($M=92.14\%$). Because the data was normally distributed ($\alpha=0.303$ and $\alpha=0.545$), the mean difference was then tested using an independent t test. The results showed that there was no significant knowledge retention difference between those two groups ($P=0.320$).

Table 4. Knowledge retention between medical students with good and poor hydration

Knowledge Retention	N	Mean	±SD	α^*	$p\text{-value}^{**}$
Student with water consumption $\geq$ 2L/day	34	83.01%	±25.6	0.303	0.320
Student with water consumption < 2L/day	25	92.14%	±19.78	0.545	
Difference	9.13%				

*Shapiro-Wilk test

**independent t test

4. Discussion

Students with water consumption more than equal to 2L/day had higher average grades in both 1st semester and 4th semester than students who drink water less than 2L/day. However, there was a significant score decrease in both groups from 1st semester 1 to 4th semester. This significant decrease is in accordance with research by Chakkarapani and Sheng. In the research, an anatomy test with the same questions was carried out, first test was held in 2016 and second one in 2018. The overall mean score decreased significantly, from 67.9% in 2016 to 37.14% ($p<0.05$) [10].

In this study, the high average score in 1st semester and 4th semester in students with water consumption more than equal to 2L/day did not indicate higher knowledge retention compared to students whose water consumption was less than 2L/day. From this research, it was found that there was no significant difference in knowledge retention between those students with good and poor hydration ($p=0.143$). These results in contradicted with research by Zhang et al. In their study, 64 subjects were asked to fast on water for 12 hours. After that, all subjects were asked to do the pre-Operation Span Test. Next, the subjects were divided into four intervention groups, with each intervention being given drinking water of 500 mL, 200 mL, 100 mL, and not being given water at all. After that, the subject was asked to do the post-Operation Span Test. The results of tests carried out after the intervention showed a significant difference between those four intervention groups ($p=0.047$) [2].

This difference is likely caused by different methods of data collection. Zhang et al.'s research used specific memory tests and there was intervention as well, while this study only used secondary data to assess retention as memory ability and a questionnaire to determine water consumption. The hydration status grouping in Zhang et al.'s study was also more specific, whereas this study only compared two categories, which were water consumption more than equal to 2L/day and less than 2L/day.

5. Conclusion

Score decrease from 1st semester to 4th semester was statistically significant in students whose water consumption was more than equal to 2L/day ($p=0.000$), while it was not significant in students with water consumption less than 2L/day ($p=0.059$). For the knowledge retention difference between these two groups, it is known that there was no significant difference as for the p -value was 0.320.

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