Hydration status and learning concentration of adolescents during online learning in the era of Covid-19 pandemic

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Abstract

Background: It is necessary to keep the learning concentration level of adolescents during learning online at home.

Objectives: To assess the relationship between breakfast habits and fluid intake with the hydration status and learning concentration of adolescents in learning online during the COVID-19 pandemic.

Method: This was a cohort study. The study population comprised 146 adolescents in a Junior High School, located in Surabaya, chosen using proportional random sampling and simple random sampling techniques. The research instruments were questionnaires, 24 hour food recall surveys, urine colour surveys, and grid concentration tests. The independent variables in this study were breakfast habits and fluid intake, while dependent variables were hydration status and concentration. Data analysis used descriptive analysis and Spearman correlation with $\alpha=0.05$.

Results: When participating in online learning during Covid-19 pandemic, most adolescents had good breakfast habits, adequate fluid intake, good hydration status and good learning concentration levels. Breakfast habits had a positive relationship with learning concentration ($p=<0.001$; $r=0.316$), while fluid intake had a very strong relationship with hydration status ($p=<0.001$; $r=0.952$) and learning concentration ($p=<0.001$; $r=560$).

Conclusions: Adolescents' learning concentration during participation in online learning at home has a relationship with breakfast habits and fluid intake.

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The better the breakfast habits and fluid intake levels of adolescents, the better the learning concentration.

Introduction

Based on the Circular sent by the Ministry of Education and Culture of the Republic of Indonesia No. 4 of 2020, during the COVID-19 pandemic, learning and work are carried out at home through online or distance learning to prevent the spread of the virus[1]. The Circular is the basis for all educational institutions in Indonesia to organise learning and teaching during the COVID-19 pandemic[2]. Adolescents gain vital energy from food or beverages such as having breakfast and drinking water to meet energy needs in the body to support growth and development and various learning activities in school[3]. However, the relationship between the breakfast habits and fluid intake with hydration status and learning concentration levels of adolescents in online learning during the COVID-19 pandemic has not yet been explored.

Results of Basic Health Research in 2013 in Indonesia showed the prevalence of breakfast-skippers to be 16.9%–50% in school-age children and adolescents and around 31.2% in adults. When having breakfast, 26.1% children only drink water, milk, or tea, and 44.6% children consume a low-quality breakfast[4]. Most adolescents (79%) consume fluids from beverages and the rest (21%) from food. Research conducted by the Indonesian Regional Hydration Study (THRIST) showed that 46.1% of people experience mild dehydration. There is a decline in the amount of fluids in the body by 1-2% of body weight[5].

Adolescents are less accustomed to having breakfast, which can have a harmful negative effect because all nutrients derived from dinner have already been converted into energy and circulated throughout the body[6]. In the morning, the brain requires nutrient intake in the form of blood glucose that channels energy for the brain to work optimally. If the level of blood glucose is less than 70mg/dL, it will decrease learning concentration, and a person will feel weak, dizzy, and shaky[7]. Nowadays, adolescents have a low interest in having breakfast

due to several factors such as the family economy, which affects the recommended nutritional adequacy, lack of knowledge regarding the importance of breakfast or fluid fulfillment, the absence of the opportunity of parents to prepare breakfast because they are busy going to work, and an understanding that having too much breakfast can cause drowsiness and obesity[8].

In addition, lack of fluid consumption due to the high physical activity carried out by adolescents and the habit of drinking water when thirsty are characteristics of a dehydrated person. This results in decreased stamina, reduced memory and concentration, and reduced intelligence level[9]. Children who concentrate on the learning process have characteristics such as paying close attention to explanations, actively asking questions, active in the learning process, and doing exercises and evaluations correctly[10].

Objectives
To assess the relationship between breakfast habits and fluid intake with the hydration status and learning concentration of adolescents in learning online during the COVID-19 pandemic.

Method
Design: A correlational analysis research design with a cohort approach was used.

Setting: The study was conducted in a Junior High School in Surabaya, Indonesia, primarily in 10 classes of 7th grade students. Surabaya is a city with a high number of confirmed positive cases of COVID-19.

Participants: The study population comprised 230 students.

Inclusion criteria: 1) Aged 13-15 years. 2) Could participate in the study for four consecutive days.

Exclusion criteria: 1) Adolescents with metabolic disorders, like diabetes mellitus, heart disease, and kidney disease, 2) Adolescent girls who were menstruating.

Sampling technique was proportional random sampling, and sample determination of each class used simple random sampling.

Sample size: Based on the calculation of sample size formulas, the sample obtained was 146 adolescents[11]. Since there were 10 classes, 14-15 students were taken from each class through simple random sampling.

Variables: Independent variables in this study were breakfast habits and fluid intake. Dependent variables were hydration status and learning concentration.

Instruments
Breakfast habits questionnaire: This consisted of 10 questions used in the 4-day observation period. Use of this questionnaire was modified from the research of Lestari[12]. The modified breakfast habits questionnaire was declared reliable with the value of Cronbach alpha = 0.905, and all question items were declared valid. There were three sub scales on the breakfast habits questionnaire: 1) breakfast consumption patterns, 2) factors influencing breakfast habits, and 3) food types. The total score was then divided into four categories: very good = score > 45, good = score 40-44, fair= score 30-39 and poor = score <29.

Fluid intake questionnaire: This was obtained using the 24 hour food recall method by writing the type and number of drinks consumed over the past 24 hours. Instrument was modified from other research[13]. The operational measurement results are: 1) ≥ 2,000 ml = Fluids needed by the body are sufficient, and 2) < 2,000 ml = the fluids needed by the body are insufficient.

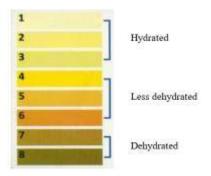***Hydration status questionnaire:*** This is shown in Figure 1.

Figure 1: *Indicator of hydration levels based on urine colour*

Check Your Own Urine is developed by Prof. Armstrong[14], a sports medicine expert from the United States. Examination of urine colour results obtained after urination can describe the signs of dehydration of respondents categorized as follows: 1) hydrated= levels 1-3, 2) less hydrated = levels 4-6, and 3) dehydrated= levels 7-8.

Learning concentration test: A person's concentration level test can be measured using Grid Concentration Test[15]. This is an instrument for measuring concentration from the Grid Concentration Test module adapted from D. Harris and B. Harris (1984)[16]. This test is a 10 x 10 box containing 2 digits of numbers ranging from 00 to 99 in each box. This study used the Grid Concentration Test online through the website. The

following are the steps of conducting an online learning concentration test:

- Respondents went to the website http://concentrationgrids.com/grids.

- As quickly as possible, they found numbers from the smallest to the largest value and directly crossed out from the numbers 00, 01, 02, 03, onwards sequentially without skipping any numbers.

- If there was a skipped number, it would bring up a red colour that meant wrong or a previously skipped number.

- The time given for the test was only one minute, so respondents were asked to take a screenshot on a phone or laptop that must be sent to researchers, as evidence of the results of the tests conducted by respondents.

- The researchers took the assessment from the number of numbers that had been found by respondents.

Learning concentration was classified into five categories: 1) very good=score>21, 2) good=score 16-20, 3) medium = score 11-15, 4) poor = score 6-10, and 5) very poor = 5.

Data collection process:
- On the first day, researchers explained the procedure of filling out a breakfast habit questionnaire performed over the next four days after the online learning was completed. Filling out the questionnaire took approximately 5 minutes, and it was collected online using google form.
- On the second and third day, reseachers contacted respondents of each class to explain the questionnaire online related to fluid intake filled out by respondents for 24 hours. Respondents were asked to remember the consumption of beverages begun since the third day until the fourth day after the online learning.
- On the fourth day, respondents tested concentration levels using the Grid Concentration Test conducted online through the website.
- Then, it was sent to researchers in the form of a screenshot of mobile phones or laptops as evidence that respondents had done the test.

- Then they were asked to fill out a questionnaire of fluid intake that had been consumed on the third day online via the google form.
- Next, respondents filled in the hydration status using the PURI (Check Your Own Urine) method online.
- Respondents filled out an online hydration status questionnaire using the google form.

Ethical clearance:
Written informed consent was obtained from the parents of the adolescents and assent from the adolescents. Ethical approval was obtained from the Health Research Ethics Committee of the Faculty of Nursing, Universitas Airlangga with certificate number 2032-KEPK.

Statistical analysis: The collected data were analysed using descriptive analysis and Spearman rank correlation with a level of α=0.05.

Results
Adolescent's demographic characteristics are shown in Table 1.

Table 1
Adolescent's demographic characteristics (n=146)

Characteristic	n (%)
Gender	
Male	61 (41.8)
Female	85 (58.2)
Age (years)	
13	100 (68.5)
14	46 (31.5)
Got information	
Yes	127 (87.0)
No	19 (13.0)
Resources	
Never got information	19 (13.0)
Electronic media	81 (55.5)
Print media	05 (03.4)
Health workers	41 (28.1)

The majority of respondents were female and most respondents were 13 years old. Most respondents got information about having breakfast, fluid intake, hydration status, and learning concentration through electronic media such as television, social media, and the internet (Table 1).

Levels of breakfast habits, fluid intake, hydration status, and adolescents' learning concentration during learning online are shown in Table 2.

Table 2: *Levels of breakfast habits, fluid intake, hydration status, and adolescents' learning concentration during learning online (n=146)*

Indicator	Category	Number (%)
Breakfast habits	Very good	57 (39.0)
	Good	53 (36.3)
	Fair	27 (18.5)
	Poor	09 (06.2)
Types of beverages	Water	146 (100)
	Milk	118 (80.8)
	Tea	119 (81.5)
	Coffee	50 (34.2)
	Juice	88 (60.3)
	Soda	54 (37.0)
	Electrolyte	61 (41.8)
Fluid intake	<2000 ml	69 (47.3)
	≥2000 ml	77 (52.7)
Factors that affect the colour of urine	Consuming vitamin C	0 (0)
	Menstruating	0 (0)
Hydration status	Hydrated	77 (52.7)
	Less hydrated	30 (20.5)
	Dehydrated	39 (26.7)
Learning concentration level	Very good	56 (38.4)
	Good	37 (25.3)
	Medium	26 (17.8)
	Poor	21 (14.4)
	Very poor	06 (04.1)

The majority of respondents had a very well-done breakfast habit. This indicates that most respondents have a level of concern regarding the health of the body to support learning activities. Water is a beverage menu that is always drunk by all adolescents during learning online. The second beverage often drunk by adolescents is tea. Milk is still an option for adolescents to be drunk during online learning. Adolescents had a fluid intake rate that complied with the standard of fluid needs per 24 hours of ≥2000ml (52.7%). But, nearly half of adolescents did not yet drink the appropriate amount of water (47.3%). The adolescents' urine colour test results are not affected by other factors, but the results are only affected by the fluid intake factor for 24 hours. During learning online, adolescents had various levels of learning concentration. The adolescents' concentration level of learning was very good (38.4%). There were still adolescents who had very poor levels of learning concentration (4.1%) (Table 2).

Correlation between variables in adolescents during learning online is shown in Table 3.

Table 3: *Correlation between variables in adolescents during learning online*

Variables	Min-max	Mean	SD	Hydration status		Learning concentration	
				2	r	2	r
Breakfast habits	28-50	42.37	5.205	0.380	0.073	0.000	0.316
Fluid intake	520-2940	1972.64	676.650	0.000	0.952	0.000	0.560
Hydration status	1-8	3.85	2.743				
Learning concentration	3-30	17.23	6.786				

On average, adolescents had a good breakfast habit of 42.37, which was in the 40-44 range of the good category. The amount of fluid consumption in adolescents varied with the average number of fluid intakes that were still below the standard of liquid adequacy rate per 24 hours (mean=1972.64). Adolescents' hydration status varied significantly, starting from the best hydration level (score 1 to worst (score 8). The average hydration status of adolescents was at levels 3 to 4, categorized between hydrated and less hydrated. The adolescents'learning concentration level was in a very good range (score of 30) to very poor (3), but the average was at a good level of learning concentration[17]. Breakfast habits have a direct relationship with learning concentration, but breakfast habits are not related to hydration status. In contrast, fluid intake in adolescents has a very strong relationship with hydration status and learning concentration. The better the breakfast habits applied by adolescents, the better the concentration of learning and hydration status when participating in online learning (Table 3).

Discussion

Having breakfast is essential in supporting the learning process to achieve good learning achievements. Without breakfast, people will feel weak, less fit, sometimes look sleepy, and even experience dizziness[17]. The benefit of breakfast habits is that it can provide carbohydrates ready to be used to increase blood sugar levels. With normal blood sugar levels, spirit and concentration can be better, and nutrients will make a significant contribution needed by the body because malnutrition can affect brain development and decrease the concentration[18].

The balance of fluids in the body plays an essential role in metabolism to determine a person's hydration status. This is to determine whether someone is dehydrated, less hydrated, or well hydrated[19]. The fluid functions as a building block for human cells, especially in the brain. Water is one type of drink that can maintain proper brain function, such as maintaining concentration, thinking faster, and not easily forget. Fluid and oxygen intake flowing to the part of the brain will decrease if there is a lack of fluid. This can make brain cells unable to develop, become less active, and not functioning optimally[20]. Dehydration can affect cognitive function such as a decrease of the ability to concentrate, a decrease of alertness and short-term memory[21].

Learning concentration is one factor that influences one's learning achievement because, with the concentration of learning, students' understanding of the object being studied will increase[22]. Several factors influence adolescent learning concentration when participating in school from home. Another factor that may affect the level of concentration is the adolescents' condition when doing the grid concentration test, such as a disorder condition in adolescents. The negative feelings of adolescents will divide attention so that it interferes with learning concentration. The negative feeling includes doubt about their study ability and a hurry because they have other things that they want to do[23]. Roy's adaptation theory identifies fluid intake as one of the contextual stimuli that individuals can experience both internally and externally which can influence the situation by being observed and measured subjectively. These stimuli will appear simultaneously, which can cause a negative response to the focal stimulus[24]. The application of Roy's adaptation theory can be manifested in four adaptive modes, which become the goal of increasing individual adaptation and contribute to individual health and quality of life to provide adaptive and maladaptive responses[25].

There were some limitations in the study. In relation to the pandemic situation, the researcher cannot directly observe the colour of urine, so that the reports from respondents can be subjective. However, to anticipate deviations in the reading of urine colour, the respondents were given details of urine colour according to the degree of dehydration, so that it can be a reference for respondents when observing urine colour.

Conclusions

When participating in online learning during the Covid-19 pandemic, adolescents had good breakfast habits, fluid intake, hydration status, and learning concentration. Drink most consumed by adolescents was water with the amount of fluid intake >2000ml a day. Adolescents' learning concentration during participating in online learning at home had a relationship with breakfast habits and fluid intake. The better the breakfast habits and fluid intake levels of adolescents, the better the learning concentration.

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