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Penulis : Etika Purnama Sari, Laili Veva Nurmaidah, Difran Nobel Bistara, Susanti
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Website : lppm.unusa.ac.id

Email : lppm@unusa.ac.id

Hotline : 0838.5706.3867

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ORIGINAL ARTICLE

Nutritional Status With Short-term Memory in School-aged Children

Etika Purnama Sari¹, Laili Veva Nurmaidah¹, Susanti¹, Difran Nobel Bistara²

¹ STIKES Adi Husada Surabaya, 60141, East Java, Indonesia

² Universitas Nahdlatul Ulama Surabaya, 60237, East Java, Indonesia

ABSTRACT

Introduction: The problem of double nutrition includes undernutrition and overnutrition, often found in elementary school children. Nutritional problems in childhood will cause disturbances in children's cognitive abilities, especially in remembering. The purpose of this study was to analyse the relationship between nutritional status and short-term memory in 5th grade school-aged children at one of the Elementary schools in Surabaya, East Java, Indonesia. **Methods:** This research design is non-experimental with a correlation method and cross-sectional approach. A total of 111 respondents were chosen with simple random sampling. Data collection used observation sheets for nutritional status and questionnaire sheets for short-term memory. **Results:** Chi-square test SPSS statistical test showed that $p < 0.001$ ($\alpha = 0.05$) where H1 was accepted, meaning that there was a significant relationship between nutritional status and short-term memory in school-aged children at one of the Elementary schools in Surabaya, East Java, Indonesia. There were 65 respondents with normal nutritional status and 63 respondents with high short-term memory. Moreover, a good nutritional status of the child and a good neurological function of the child's brain, impact the ability to remember. **Conclusion:** There is a correlation between nutritional status and short-term memory in school-aged children. Most of the respondents have nutritional status and short-term memory in the normal category and high category at the age of elementary school children. In line with the conclusion, the school is expected to periodically monitor nutritional status through UKS (School Health Unit).

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Keywords: Nutritional Status, Short-term memory, School-Aged Children, Malnutrition

Corresponding Author:

Etika Purnama Sari, PhD
Email: etikaps@gmail.com
Tel: +62 31 3721750

INTRODUCTION

Indonesia as a developing country is experiencing multiple nutritional problems. The double nutritional problem is the occurrence of unresolved undernutrition problems and at the same time, there are also overnutrition problems (1). Obesity is a problem that often occurs in adults, but it also occurs in school-age children (2). The better the nutritional status, the better the short-term memory. Malnutrition in early life will affect the formation of neurophysiology and neurochemistry of the formation of the hippocampus. Several studies state that the hippocampus is thought to have a crucial role in determining brainpower in capturing and storing memories (3).

Memory problems are like information that has been captured by the senses, only a few of it becomes a memory. A lot of important information is received in

the learning process, but the new information might disappear (4). Some students are quick to remember any lessons they get. However, many students can only remember lessons by having to repeat them several times, maybe even dozens (5).

Riskesdas (2013) data shows that the nutritional status of children in Indonesia aged 5-12 years (according to BMI/A) is at an underweight prevalence of 11.2%, consisting of 4% extremely underweight and 7.2% underweight (6). In 2017 the results of the percentage of extremely underweight and underweight children aged 5-12 years in the East Java area were 1.9% and 6.0%. East Java province was the second position among 15 other provinces with Surabaya having a prevalence of 8.9% for the incidence of obesity (2). The results of the initial survey conducted by researchers through interviews with homeroom teachers from grades 1-6, especially students in grade 5, have difficulty in remembering lessons, one of which is memorizing mathematics formulas. The results of the initial survey on physical condition by looking at the body shape of one of the 5th graders as many as 35 people found that the body was 51% underweight, 20% obese, and normal 29%. Children experience

fast mental and physical development. Subsequently, it is imperative to guarantee that their development, advancement, and learning potential are optimized through a solid establishment in sustenance to warrant a lifetime of great wellbeing. It is estimated that 50.5 million children were suffered from the negative effect of being underweight (7).

Malnutrition affecting brain function in school-age children. Children with malnutrition experience bad memorizing, productivity, and learning achievement, the better the nutritional status, the better the short-term memory, good memory, the child's academic achievement will also be better, while poor memory will have an impact on children's achievement, causing the child's low self-confidence due to unable to compete with his friends (3). Many students are found to have difficulty in the learning process, one of the causes is bad at memorizing. Various factors cause these difficulties such as genetics, nutritional status, physical trauma or lack of oxygen due to brain injury, loss of biochemicals (such as biochemistry that functions in the central nervous system) biochemical damage to the brain (such as food containing dyes), environmental pollution, social-psychological disorders impact on child development (8,9).

Improving the nutritional status of the community is part of an effort to improve health status (10). Good nutrition is expected to improve children's growth and development and also improve children's health status (11). These efforts can be carried out through various activities, including schools providing healthy snacks and not buying snacks outside of school, and schools requiring children to bring packed meals so that food hygiene is maintained. The right diet can maintain a healthy body and brain therefore these foods must have a special value for the heart, brain, digestive system, and nervous system. It is recommended to eat fresh food. Avoid canned food. Fresh food contains more nutrients, vitamins, and minerals (12). Moreover, responsiveness of the parents in offering physical assistance appropriate to the age of the child and with consideration to the child's hunger and satiety cues, feeding patiently, offering verbal encouragement to eat, trying different foods, and encouraging the child they refuse to eat, avoiding distractions during meals and talking and making eye contact during feeding may help (13). Memory enhancement can be done in various ways, one of which is by improving nutritional status (14). Increased memories require an optimal brain integration process. Optimizing the use of all brain functions, including nutrition that supports the brain, learning, and playing (15). The purpose of this study was to analyse the correlation between nutritional status and short-term memory in school-age children.

MATERIALS AND METHODS

This study used descriptive-analytic with a cross-sectional study approach which was carried out in February 2020. The population in this study was 5th-grade elementary school students who attended an elementary school in the city of Surabaya, East Java, Indonesia.

The sample in this study was determined using a simple random sampling method and found 111 respondents. Before participating in this study, the respondent's parents had received an explanation of the research mechanism and signed an informed consent indicating their willingness to participate in this study. After obtaining parental consent, the researcher provided a short-term memory questionnaire and measured nutritional status at school.

First, the researchers measured the weight using a stepped scale and measured the respondent's height using a microtoise. This measurement is carried out in the respondent class. After that, researchers measured the respondent's temporary memory with questionnaires. Researchers distribute questionnaire questions about short-term memory to respondents one by one, then respondents are instructed to remember every question that has been given for 3 minutes, after 3 minutes ended the respondent was asked to close the question and put it next to the table, then the researcher distributed the answer sheet to the respondent after the answer sheet had been received by the respondent, then the respondents were asked to write back on the answer sheet about the questions that respondents remembered, after the contents of the questionnaire sheet the questions and answers were collected back to the researcher and the procedure for the distribution and collection of questionnaires was the same for the next test. During the process of doing a memory test questionnaire while respondents are closely monitored so as not to commit fraud and to get maximum results.

Determination measurement tools of the nutritional status of respondents used an observation sheet to determine the respondent's Body Mass Index (BMI) by using BMI-for-age Girls and BMI-for-age Boys that are suitable for children aged 5 to 19 years old (16) and a short-term memory questionnaire by Dominic O'Brien (2013) to identify short-term memory. Nutritional status is categorized based on the WHO's BMI-for-age category, namely severe thinness, thinness, Overweight, Obesity, and normal, while short-term memory is categorized into very low, low, moderate, and high.

Data were analysed using the Chi-square test to identify the relationship between nutritional status and short-term memory with a p-value <0.05 while identifying the demographic characteristics of respondents using descriptive statistics.

This research has been approved by the Ethical

Participant's Characteristics

The most age distribution was 11 years old (65.8%) with most of the female respondents (55.9%). The distribution of the parent's latest education level was high school (73.9%) with most of the parents working as employees (77.5%). Most of the respondents had underweight nutritional levels (58.6%) and high short-term memory

Table I: Characteristics of respondents (n= 111)

Characteristics	n	%
Age		
10 years	14	12,6
11 years	73	65,8
12 years	22	19,8
13 years	2	1,8
Gender	49	44.1
Male	62	55.9
Female		
Parent's education	9	8.1
Elementary School	11	9.9
Junior High School	82	73.9
Senior High School	9	8.1
Higher Education		
Parent's occupation	86	77.5
Employee	18	16.2
Entrepreneur	7	6.3
Unemployed		
Nutritional status	2	1.8
Extremely underweight	10	9.0
Underweight	65	58.6
Normal weight	22	19.8
Overweight	12	10.8
Obesity		
Temporary memory	22	19.8
Very low	24	21.6
Low	2	1.8
Moderate	63	56.8
High		

(56.8%) (Table I).

The correlation between Nutritional Status Support and Short-term memory in School-Aged Children

It shows 63 respondents (96.9%) of the cross-tabulation have "normal" nutritional status with "high" short-term

memory. The nutritional status underweight shows two respondents have very low and low short-term memory. The results of statistical test analysis with the Chi-square test obtained p-value = 0.000 and = 0.05 so that the research hypothesis is accepted p = 0.000 less than = 0.05. From the results of the Chi-square test, the p-value is lower than the research hypothesis is accepted, which means that there is a correlation between the nutritional status variable and short-term memory.

Children with severe thinness nutritional status have a very low short-term memory as many as 2 people, children with Thinnes nutritional status have a very low short-term memory as many as 4 people, children with overweight nutritional status have a very low short-term memory as many as 6 people, children with obesity nutritional status have a very low short-term memory as many as 10 people, Children with obesity nutritional status have a low short-term memory as many as 2 people, children with underweight nutritional status have a low short-term memory as many as 6 people and children with overweight nutritional status have a short-term memory as many as 16 people (Table II).

DISCUSSION

The results of this study showed that there was a correlation between nutritional status variables and short-term memory variables with a high and one-way correlation, the better the nutritional status of students, the higher their short-term memory. Children with malnutrition experience limited memory, productivity, and learning achievement, the better the nutritional status, the better the short-term memory, and good memory, the child's academic achievement will also be better, while poor memory will have an impact on child achievement (17). This causes low child's self-confidence to not being able to compete with their friends. The better the nutritional status, the better the short-term memory. Malnutrition in early life will affect the formation of neurophysiology and the neurochemistry of the formation of the hippocampus (18). Several studies state that the hippocampus is thought to have a crucial role in determining brainpower in capturing and storing memories (3). School-age is an age that is entering a period of growth and development. Growth in school-aged children is the second-fastest-growing period after toddlerhood, and at the same time

Table II: The correlation between Nutritional Status Support and Temporary Memory in School-Aged Children

Nutritional Status	Temporary Memory								Total	p
	Very low		Low		Moderate		High			
	n	%	n	%	n	%	n	%		
Severe thinness	2	100	0	0	0	0	0	0	2	0.000
Obesity	10	83.3	2	16.7	0	0	0	0	12	
Thinnes	4	40.0	6	60.0	0	0	0	0	10	
Overweight	6	27.3	16	72.7	0	0	0	0	22	
Normal	0	0	0	0	2	3.1	63	96.9	65	
Total	22	19.8	25	22.5	2	1.8	62	55.9	111	

social, emotional, and cognitive growth such as memory development, critical thinking, creativity, and language also develops. Nutrition is a process of physical growth and development that affects the process of physical growth and development, the nervous system and brain as well as the level of intelligence concerned (19). Proper nutrition is very important to support the growth and development of school children properly and optimally (20). The importance of nutrition in children makes nutrition education should be promoted to children and parents as early as possible to improve knowledge and attitude (7).

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There is a strong correlation between nutritional status and short-term memory in 5th grade school-aged children when a child's nutritional status is good/normal. Children with obesity and malnutrition occur an imbalance glucose in the body that affects their brain function, it affects the nervous system of the brain in the limbic system in the hippocampus, the hippocampus is suspected to have a crucial role in determining brainpower in capturing and storing memories that will affect the ability to remember in children to be high/mod. Although in this study there is a correlation between nutritional status and short-term memory, it is not the only cause of the increasing short-term memory, but experimental research is needed involving other factors such as genetic, motivational, and emotional factors in the next research.

In this study, respondents with normal nutritional status and high short-term memory with a total percentage of 63 respondents (96.9%), this was supported by the good nutritional factors so that the function of the nerves in the children's brain has a good impact on children's memory, the parent's occupation also supports children to meet the food/nutritional needs that the nutrients absorbed by children are fulfilled. In addition, parents' education and children's motivation are very influential on children's cognitive abilities in remembering. The higher the parent's education, the more they understand accompanying their children in learning and teaching children in memorizing techniques. Children's motivation in memorizing is very influential on a lot of material that they learn.

Based on the study, there were respondents with normal nutritional status and moderate short-term memory with a total percentage of 2 respondents (3.1%), this is probably supported by the nutritional factors given to the child so that the function of the nerves in the children's brain and also have a good impact on children's memory, but from the results, it was found that these 2 respondents experienced temporary low memory, possibly due to the sick condition which resulted in the child's being unhealthy and lacking concentration in the process of memorizing questions and resulted in the wrong answer or not answered so that the child gets a low score in the short-term memory category.

In addition to nutritional status, it may be influenced by genetic factors, if parents have high memory skills, parents will pass on high memory genes to children which results in high memory skills, and otherwise if parents have low memory skills, their child's ability to remember is also low. Furthermore, motivational factors affect a child's short-term memory. Less motivation can affect children's enthusiasm for memorizing and result in moderate short-term memory values. From the observations of the short-term memory assessment of the respondents, the respondents answered modestly and even many incorrectly answered the short-term memory questionnaire.

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Improving the ability of short-term memory can be a variety of things one of them with nourishing food and drinks that contain enough sugar for the body. In the brain, sugar serves as a source of energy (glucose) (21). Other nutrients that influence cognitive development and have an impact on memory are omega-3 fatty acids that play a central functional role in brain tissue, vitamin B12, folic acid, choline, zinc, iron, iodine, and multivitamin and mineral supplementation (22).

The limitation in this study was the respondent's characteristic variables have not been tested that might impact the results of the study.

CONCLUSION

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There is a correlation between nutritional status and short-term memory in 5th grade school-aged children. Most of the respondents have nutritional status and short-term memory in the normal category and high category at the age of elementary school children. In line with the conclusion, the school is expected to periodically monitor nutritional status through UKS (School Health Business). Early detection methods for students to prevent changes in nutritional status are by weighing and measuring height and collaborating with PUSKESMAS for nutrition counseling. It is intended that students can maintain good body condition by regulating diet, living a healthy life, exercising regularly, and being more selective in consuming food.

It is expected to conduct more in-depth research on the sub-variables of nutritional status including other factors that can affect short-term memory in children, such as parenting patterns, genetics/heredity, parental care, and nutrition knowledge. Also, the sub-variables of short-term memory include using different research designs such as experimental designs to see the effect of nutritional status on the cognitive development of short-term memory in children.

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