

## THE INFLUENCE OF NUTRITIONAL STATUS ON COGNITIVE DEVELOPMENT PRE-SCHOOL AGE CHILDREN

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### Abstract

Early childhood period is in dire need of good nutrition. Poor nutritional status can cause delays in children's cognitive development. Nutrition report global (2020), stated the whole country experiencing nutritional problems. Globally, the most children with malnutrition problems are in Sub-Saharan Africa. Indonesia is experiencing a triple burden of disease, namely malnutrition, obesity and stunting. The aim of the study was to analyze the effect of nutritional status on the cognitive development of pre-school aged children. This research approach is a retrospective cohort analytic study with a sampling technique using purposive sampling. This study was conducted using data from 79 children aged 5-6 years from early childhood education school students. Nutritional status is determined using anthropometry by measuring body weight and height based on the child's age. Assessing children's cognitive abilities using instruments from the Mini Mental State Examination (MMSE) questionnaire. The results showed that 72.2% of children's nutritional status was normal and 72.2% of children's cognitive development was normal. Data analysis was based on the chi-square test,  $p$ -value = 0.011 ( $p < 0.05$ ), with a relative risk value of 2.591. Shows that nutritional status has an effect of 2.591 times on the cognitive development of pre-school age children.

Keywords : *Nutritional Status, Cognitive Development, Preschool Children*

### 1. INTRODUCTION

According to the global nutrition report (2020), the whole country experiencing nutritional problems. One third of all malnourished children globally live in Sub-Saharan Africa (SSA). According to the World Health Organization, in 2020 around 22.0% or the equivalent of 149.2 million children are stunted and around 6.7% or 45.4 million children are wasted in toddlers (WHO, 2020). Indonesia is experiencing a triple burden of disease, namely malnutrition, obesity and stunting. The percentage of malnutrition (BB/U) in toddlers aged 0-59 months was 3.9%, very thin (BB/TB) 3.5% and very short (TB/U) 11.5%. The prevalence of malnutrition in North Sumatra in children aged 0-59 months was 5.4%, very thin 4.6% and very short 13.2%. This indicates that many Indonesian children are classified as short when they enter school age. (Basic Health Research, 2018)

Nutritional status is a state of balance between nutritional intake from food and the need for nutrients needed for the body's metabolism (Harjatmo et al., 2017). Nutritional status reflects the condition of a person's body as a result of the nutritional intake he gets (Amirullah, 2020). Malnutrition is a form of malnutrition which is characterized by inadequate intake of nutrients in the body. Inadequate nutritional intake can cause several conditions such as low body weight, thin body and very short stature. This can lead to an increased risk of disease and death (Fadillah, 2019). Nutritional problems are influenced by several factors, namely infectious diseases, food consumption, family income level, number of family members, mother's education level, health services, food abstinence culture and nutritional care patterns. (Fitri Kartika et al., 2017). One of the factors that influence cognitive development is nutrition in children. Nutrition plays an important role in cognitive development because it is related to developmental processes in the brain from an

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early age. So that at an early age children need adequate nutrition to meet the growth and development of the brain.(Sholicha & Rona, 2017). Poor nutritional status causes a slowdown in the process of myelination, decreased dendritic production and disruption of synaptic neurotransmitters which can cause delays in children's cognitive abilities(Suhud et al., 2021).

Nutritional status describes the adequacy of nutrition to meet the growth and development of the brain which is very important for the cognitive development of preschoolers. Cognitive development is closely related to the growth and development of the brain which has occurred very rapidly in the third trimester of pregnancy until the age of 2 years. Malnutrition from infancy to 2 years of age can result in reduced brain cells by 15-20%. The results of the study show that malnutrition in early childhood has an impact on low cognitive abilities and IQ (Intelligence Quotient) scores marked by poor learning and academic performance. Stunting can reduce IQ 5-11 points in children(Zhamaroh et al., 2018). Cognitive development is a person's ability to acquire knowledge, be able to understand, know and solve a problem(Marinda, 2020)Cognitive development is an important aspect for humans, because it relates to how humans know something and learn with their minds to survive(Marinda, 2020; Pitriani, 2021). According to Mayer cognitive is a mental activity as a whole regarding the process of thinking, knowing and remembering.

Cognitive development of pre-school age children is very important because it can affect aspects of intelligence that can determine their quality in the future. The theory of cognitive development describes the assumptions of individual ways of thinking that change through neurological development and environmental development and occur in a complex manner(Marinda, 2020). Utilization of maternal and child health books in primary care, can be seen as a record of development until children are five years old and pre-school aged children (Ayu MS, 2019). Malnutrition in pre-school aged children can be seen from the results of low nutritional status assessments from an early age(Rahmasari & Muniroh, 2021). Evaluation of nutritional status uses nutritional status assessment clinically, biochemistry and anthropometry. Assessment of children's nutritional status uses the WHO 2006 standard curve, calculated using the index Weight for Age (W/U) with z-score assessment indicators. The results of the assessment are 3 categories including very underweight (<-3 SD), underweight (-3 SD to <-2 SD), normal weight (-2 SD to + 1 SD) and overweight (>+ 1 SD)(Indonesian Nutritionist, 2016).

Cognitive can be assessed by measuring the ability to think according to age and stage of development. The gold standard that is often used to assess cognitive function is the Wechsler Intelligence Scale for Children (WISC) which calculates from Intelligence Quotient (IQ)(Saputra et al., 2020). The pediatric Mini Mental State Examination (MMSE) has been modified and used as a rapid assessment tool that is useful for detecting cognitive impairment in children in the age range of 3 to 14 years. Shows a short implementation within 5-7 minutes with a total of 13 question items.(El-sayeh & El-, 2021). Early childhood period is in dire need of good nutrition. Poor nutritional status can cause delays in children's cognitive development.Globally, the most children with malnutrition problems are in Sub-Saharan Africa.Nutritional problems in Indonesia are still high. Indonesia is experiencing a triple burden of disease, namely malnutrition, obesity and stunting. The aim of the study was to analyze the effect of nutritional status on the cognitive development of pre-school aged children.

## **2. METHOD**

This type of research uses an analytic observational study with a retrospective cohort research design, where the researcher traces back the risks and then measures the effects that occur so that it can be seen how much these risks can affect the effects.(Sastroasmoro & Ismael, 2018). The independent variable is nutritional status, while the dependent variable is cognitive abilities. The study population was all children aged 5-6 years in Medan Amplas District, Medan City, North Sumatra Province, currently attending pre-school age children's education. According to Permenkes No. 25 of 2014 pre-school age children are children aged 60 months to 70 months (5-6 years). The

sampling technique used purposive sampling method. Then data on the history of nutritional status was obtained directly by looking at the results of the recording carried out by the community health center. Cognitive abilities, measurements were carried out directly by researchers using the MMSE questionnaire to respondents. Primary data by means of observation and assessment of cognitive abilities with instruments in the form of structured questionnaires about child development by assessing children's cognitive abilities using instruments from the Mini Mental State Examination (MMSE) questionnaire. The MMSE instrument has 13 questions with 5 cognitive ability subtests in the form of orientation, attention and concentration, registration, memory and language which have a maximum score of 37. Children who have a score below 26 can be considered to have cognitive impairment (abnormal) and a score above or equal to 26 is categorized as normal value. Secondary data collection from maternal and child health books that have a history of the nutritional status of children at the Medan Amplas Health Center. Nutritional status with 2 categories, namely normal and abnormal (undernutrition, obesity and stunting).

Bivariate analysis was carried out to test the effect of nutritional status on children's cognitive development using the Chi Square test. The size of the risk factor will be assessed by analyzing the Relative Risk (RR) value of the history of nutritional status on the cognitive abilities of pre-school children. An RR value  $> 1$  indicates that the variable is a risk factor, whereas if the RR value  $< 1$  indicates that the variable is not a risk factor.

### 3. RESULTS AND DISCUSSION

#### 3.1 RESULTS

**Table 1. The Effect of Nutritional Status on the Cognitive Development of Pre-School Children**

Nutritional status	Cognitive Development		Total	RR (95% CI)	P-values
	No	Normal			
No	11 (13.9%)	11 (13.9%)	22 (27.8%)		
Normal	11 (13.9%)	46 (58.2%)	57 (72.2%)	2,591	0.011
<b>Amount</b>	22 (27.8%)	57 (72.2%)	79 (100%)		

*Primary data, 2022*

Based on table 1. There are 11 children (13.9%) who have abnormal nutritional status in terms of abnormal cognitive development. Normal nutritional status on abnormal cognitive development in 11 people (13.9%). Abnormal nutritional status had normal cognitive development as many as 11 people (13.9%). Normal nutritional status has normal cognitive development as many as 46 people (58.2%). The p value obtained based on the chi-square test was 0.011 ( $p < 0.05$ ). These results indicate that statistically a history of nutritional status significantly influences children's cognitive development. The relative risk value obtained was 2.591 which indicated that children with a history of abnormal nutritional status had 2.591 times the risk of experiencing abnormal cognitive development disorders compared to children who had normal nutritional status.

#### 3.2 DISCUSSION

The results of the cross-tabulation test between the history of nutritional status and cognitive development showed that there was an effect of nutritional status on the cognitive development of pre-school-age children, obtained a p value of 0.011 ( $p < 0.05$ ). History of nutritional status is at

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risk for the cognitive development of pre-school children (relative risk 2.591). This shows that a history of nutritional status affects cognitive abilities with a 2.591 times greater risk. As many as 57 respondents (72.2%) in this study had normal cognitive abilities and as many as 22 respondents (27.8%) had abnormal cognitive abilities.

The dominant results of the study were that 46 children (58.2%) with a history of normal nutritional status had normal cognitive abilities as well. This is due to the fulfillment of nutritional needs during the first 1,000 days of life which can be seen from the history of nutritional status. The first 1000 days of life refers to a child's life from the womb to the age of 2 years where in this period rapid brain development occurs so that it requires nutrition for optimal cognitive growth and development (Princess et al., 2021; Roberts et al., 2022). Growth and development in the brain occurs very rapidly from the end of the third trimester of pregnancy until the age of 2 years (Soetjiningsih & Ranuh, 2013). This period is also called the critical and vulnerable period so that if there is a disturbance in that period it will result in a disturbance in the number of brain cells that cannot be pursued again in the next period. (Soetjiningsih & Ranuh, 2013; Suwito et al., 2014).

Children aged 2 years experience very rapid brain development and growth. The group of children who have a history of malnutrition can cause delays in the process of cognitive development and permanent cognitive impairment. This is caused by malnutrition because inadequate nutritional intake can cause disruption of brain function and structure, tissue damage, growth retardation, impaired cell differentiation, decreased synaptic and neurotransmitter formation, delayed myelination thus disrupting the formation of neural circuits. (Handryastuti et al., 2022). The level of intelligence is one aspect that is influenced cognitively. Children aged less than 2 years are influenced by food intake, whereas children aged 5-6 years are influenced by cognitive aspects and environmental stimuli on the level of intelligence. Cognitive development is not only influenced by nutritional factors but also other factors such as heredity, environment, maturity, formation, interests and talents and freedom. Cognitive development of preschool-aged children is the ability of children related to how to think, process information, understand and solve problems by using their minds and minds to survive by learning from their environment (Fadillah, 2019). Formation factors are external aspects that affect cognitive divided into intentional and unintentional formation. One of the intentional formations is the existence of formal schools such as early childhood education (Marinda, 2020) Nasution (2022).

Early childhood education can have an effect on improving children's cognitive abilities. One that influences cognitive abilities is the formation factor. Inadequate nutrition so that there is a delay in the process of brain growth and development. Malnutrition can be corrected if it gets comprehensive treatment. At the time of the study, cognitive measurements were carried out on children who had received Early Childhood Education (PAUD). So that the results obtained by children with normal cognitive abilities are more. This can also be seen in the results of the study showing that there were 11 children (13.9%) with a history of abnormal nutritional status who had normal cognitive abilities.

#### **4. CONCLUSIONS AND SUGGESTIONS**

It was concluded that there is an effect of nutritional status on the cognitive development of pre-school age children. Nutritional status poses a risk to the cognitive abilities of pre-school-age children. Parents must have knowledge about nutrition and routinely bring their children to the community health center to get measurements of nutritional status and immunizations every month. Changes in nutritional status cannot be monitored continuously by health services so changes can occur that cannot be known. It is hoped that parents will pay more attention to their child's upbringing so that the need for nutritional intake in children can support growth and cognitive development in children. Normal nutritional status is based on parents' ability to meet children's food intake needs.

Community health centers are more active in providing counseling on the importance of child nutrition to parents and improving performance in child nutrition data collection. Organizers of early childhood education should pay more attention to aspects of development in children and be able to provide or increase developmental stimulations that can help children's cognitive development.

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