The Relationship Between Sociodemography and Nutritional Status with the Cognitive Level of Elementary School Children in Padang Timur Based on Cognitive Test Battery for Individuals with or without Intellectual Disabilities (CIID)

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ABSTRACT

Background: Poor cognitive performance in children has been associated with several risk factors associated with low socioeconomic status, such as the level of parental education and particularly low maternal education, malnutrition, micronutrient deficiencies and a less stimulating environment for children. The CIID has the same principles as other nonverbal IQ tests, correlates well with the WISC and has excellent psychometric qualities.

Aim: to investigate the relationship between sociodemography and nutritional status with cognitive level of elementary school children in Padang Timur District using CIID.

Methods: Analytical research with a cross sectional study design from February to May 2022 on elementary school children in Padang Timur, Padang city.

Results: There is a relationship between the cognitive level of elementary school children with nutritional status, mother's education, family income and father's education.

Conclusion: The most important factor in influencing a child's cognitive level is nutritional status.

Keywords: cognitive, sociodemographic, nutritional status

INTRODUCTION

Cognition is the ability to process information through the senses.[1] Cognitive related to the level of intelligence. Cognitive is more passive and refers to the ability to understand something, while intelligence is more active and refers to behavior that shows that potential. IQ test (Intelligence Quotients) is used to measure a person's level of intelligence. In 2013 as many as 88 children (6.9%) of 1,284 children aged 6 to 12 years in Indonesia reported having a low IQ.[2]

The correlation between socioeconomic level, nutritional status, and cognitive function has been regularly demonstrated in studies from both industrialized and developing nations. Good nutrition is useful in supporting the development of the brain and nervous system.[3] Malnutrition in children is known to have long-term side effects on cognitive function, school completion and productivity during adulthood.[4,5]

Standard measurement for assessing cognitive levels in children is the *Wechsler intelligence scale for children* (WISC).[6] However, WISC has limitations in that experienced psychologists must assess it. This can be a problem in developing countries, such as Indonesia, because the number of child psychologists is limited and they are not evenly distributed throughout the country. Moreover, WISC takes about

45-60 minutes of inspection and is considered expensive.[7]

Cognitive Test Battery for Individuals with or without Intellectual Disabilities (CIID) is a psychometric test that attempts to measure intelligence by comparing the test taker's performance with standardized scores. The CIID shares the same principles as other nonverbal IQ tests, correlates well with the WISC, and has excellent psychometric qualities. This test can be performed on children aged over five years, can be used daily by general practitioners and pediatricians, does not require a long time, and is easy and inexpensive. [8] Padang Timur sub-district is one of the sub-districts in the city of Padang, which has the highest density and percentage of population compared to other sub-districts in the city of Padang. This research aims to investigate the relationship between sociodemography and nutritional status with cognitive level of elementary school children in Padang Timur District using CIID.

METHODS

Analytical research with a cross-sectional study design was conducted from February to May 2022 on elementary school children in Padang Timur, Padang city. The inclusion criteria included students in grades 1, 2 and 3, where parents were willing to sign the informed consent. Exclusion criteria included children with attention-deficit/hyperactivity disorder (ADHD), intellectual disability (including Down's syndrome) as well as children with marked edema (fluid retention), ascites and hydrocephalus that would affect body weight.

The sample was selected by stratified random sampling. The dependent variable is cognitive level, while the independent factors are family income, the mother's education, the father's education, and nutritional status. Before conducting the research, an application for approval from the Health Research Ethics Committee, Faculty of Medicine, Andalas University, Padang was submitted for approval. All patients who participated as respondents in this study will be given an explanation of the procedures, objectives and benefits of the study. Then written consent is asked to participate in the study and sign an informed consent form prepared by the researcher.

The study was conducted for children who met the inclusion criteria. All children who met the inclusion criteria underwent anthropometric measurements, determining their nutritional status using the CDC growth chart for children over the age of five years. The scales and meters have been calibrated previously. Anthropometric measurements were carried out three times in a row, where the average number for the child's weight and height was taken. Furthermore, the CIID test was carried out to see the child's cognitive level. The researcher will take a random sample of 2 public elementary schools from 34 public elementary schools and one private elementary school from 16 private elementary schools in Padang Timur District. Then, random and stratified sampling is carried out from grade 1 to grade 3 elementary school. The CIID test is carried out by a doctor who has attended a CIID examination workshop. The CIID test examination is carried out by a maximum of 10 people for one examiner.

After processing the data, the processed data will be analyzed using univariate, bivariate and multivariate analysis. Univariate analysis is an analysis carried out on each research variable. Bivariate analysis was conducted to see the relationship between the two variables. The type of statistical test used in this study is the chi-square test with a 95% confidence interval (CI) and $\alpha = 0.05$. The test results conclude that if $p \leq 0.05$, Ho is rejected, meaning that there is a significant relationship between the independent and dependent variables. Multivariate analysis in this study used logistic regression, where at the beginning of the analysis, a bivariate test was assessed,

and the P value <0.05 was continued into multivariate modeling.

RESULTS

The study was conducted on pediatric patients who met the inclusion criteria, as many as 123 children. The results showed that most of the respondents were male (52.8%), well-nourished (55.3%), with the mother's education and father's education mostly high education (80.5%) and parental income enough (71.5%).

Subject Characteristics	N (%) (N = 123)
Sex	
• Male	65 (52,8%)
• Female	58 (47,2%)
Nutritional Status	
• Underweight	22 (17,9%)
• Wellnourished	68 (55,3%)
• Overweight	33 (26,8%)
Mother's Education	
• Low	24 (19,5%)
• High	99 (80,5%)
Father's Education	
• Low	24 (19,5%)
• High	99 (80,5%)
Parental Income	
• Low	35 (28,5%)
• Enough	88 (71,5%)

Table 1 Distribution of Subjects by Subject Characteristics

Most of the children with an average cognitive level (61%), followed by high average (24%) and low average (15%).
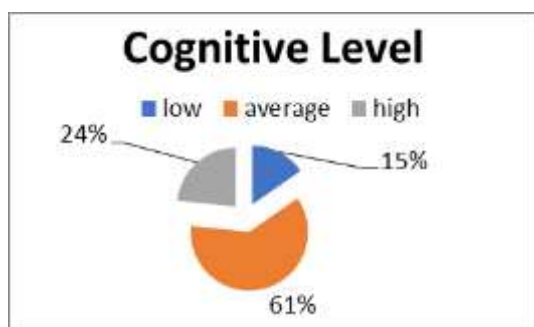
Picture 1 Cognitive Level

Bivariate analysis shows a relationship between the cognitive level of elementary school children with nutritional status, mother's education, father's education and parental income.

Independen Variable	Cognitive Level			f(%)	P value
	Low Average f(%)	Average f(%)	High Average f(%)		
Nutritional Status					
Undernourished	0 (0%)	3 (13,6%)	19 (86,4%)	22 (100%)	0.001
Wellnourished	4 (5,9%)	64 (94,1%)	0 (0%)	68 (100%)	
Overweight	15 (45,5%)	8 (24,2%)	10 (30,3%)	33 (100%)	
Mother's Education					
Low	0 (0%)	7 (29,2%)	17 (70,8%)	24 (100%)	0.001
High	19 (19,2%)	68 (68,7%)	12 (12,1%)	99 (100%)	
Father's Education					
Low	9 (37,5%)	11 (45,8%)	4 (16,7%)	24 (100%)	0.004
High	10 (10,1%)	64 (64,6%)	25 (25,3%)	99 (100%)	
Parental Income					
Low	18 (20,5%)	52 (59%)	18 (20,5%)	88 (100%)	0.039
Enough	1 (2,9%)	23 (65,7%)	11 (31,4%)	35 (100%)	

Table 2 Bivariate Analysis

Multivariate analysis showed that the most crucial factor influencing children's cognitive level was nutritional status, followed by the mother's education and parental income.

Variable	Model log likelihood	Change in -2 log likelihood	P value
Nutritional Status	-37.425	20.003	0.001
Mother's Education	-35.026	15.205	0.001
Father's Education	-29.174	3.500	0.061
Parental Income	-29.553	4.258	0.039

Table 3 Multivariate Analysis

DISCUSSION

Nutritional problems are serious problems that can impact cognitive and motor development and academic achievement, especially at school age. Nutrition is one of the essential factors in the development of children's intelligence. The problem of malnutrition that occurs can have an impact on the nutritional status and health conditions of individuals as well as aspects of development including the function of children's intelligence, academic success, and the opportunity to earn a decent living in the future.[9]

Sociodemography is related to social and economic status. Socio-economic is a multidimensional construction consisting of education, income and employment.[4,10] It is essential to examine socioeconomic factors such as education and income separately, as these correlated factors represent different resources that may have different roles in children's development. Income affects the

material resources available to children, whereas parental education may be more critical in shaping parent-child interactions.[11]

Children who are cared for by mothers who only have education up to elementary school have a three times greater risk of experiencing growth retardation than children who are cared for by mothers with higher education. Other research states that mothers who have formal education for more than five years will respond more verbally and emotionally to their children, are better able to organize the environment, provide enough play and game material, have greater involvement with children and the stimulation they provide is also more varied. Children aged 3-6 years who have fathers with less than six years of education have a 3.57 times more risk of experiencing lower cognitive development than children whose fathers have more than six years of education. [12]

Parents with a better level of education will earn more income so that they are able to provide a better place to live, provide more educational opportunities for their children and will have a better socioeconomic status.[12,13]

Kimberly's research in New York on children aged 3-20 also showed a relationship between parental education level and family income and children's cognitive level related to language, executive and memory functions. The study explains that parental education is linearly associated with children's total brain surface area, implying any increase in parental education, whether an additional year of high school or college.[13]

The results showed that the most important factor influencing children's cognitive level was nutritional status. Research conducted by Sandjaja et al in Indonesia, Malaysia, Thailand and Vietnam in 2012 showed that nutritional quality had a strong relationship with children's cognitive levels.[2] According to Mohd Nasir that although the contribution seems small, the findings suggest that both long-term and short-term nutritional status contribute to cognitive performance. Since nutrition is the most volatile factor, many sectors may play a role towards its improvement.[2]

Communication between one brain cell and another occurs through neurotransmitters, which are chemical compounds consisting of amino acids (monomers that make up proteins). The production of neurotransmitters requires a protein that must be obtained from food intake. Protein intake that is rich in protein will improve children's learning abilities.[15]

This study is the first to examine the relationship between sociodemographic and nutritional status and the cognitive level of elementary school children using the CIID test in Padang. However, this research still has shortcomings. This study only assessed the sociodemographic relationship and the nutritional status of children. In contrast, the cognitive level of children was influenced by many factors, such as prenatal factors (maternal nutrition during pregnancy, infection, radiation and maternal psychology), childbirth factors (head trauma and asphyxia), postnatal factors affecting others such as psychosocial (stimulation), parenting patterns and parental personality.[14]

This research is a cross-sectional study which means that data collection is only done at one time but can directly describe the characteristics of the research subjects and the associations between the variables studied. In this study, the nutritional status assessed is the current nutritional status of children, while the nutritional status of children during the golden period is unknown. Myelination progresses rapidly from mid-pregnancy to the first two years of life. At the age of 2 years, the size of the child's brain reaches 80% of the size of the adult brain. Furthermore, the brain will continue to develop after the age of 2 years with slower development.[14,16]

CONCLUSION

The most important factor influencing children's cognitive level was nutritional status, followed by the mother's education and family income.

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