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Association Between Birth Weight and Other Factors with the Intelligence Quotient (IQ) of the Student of SMP Negeri 200 Jakarta in 2013

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Abstract

This study aimed to identify the association between birth weight and other factors with the intelligence quotient (IQ) of the student of SMP Negeri 200 Jakarta. The observed sample in this study was the 7th grader consisting of 131 students. The collected data were IQ score, birth weight, HAZ, energy intake, protein intake, iron intake, mother's education level, and parent's income. These data collected by using a self-administered questionnaire, 2x24 hours recall interview, and height measurement. The result of this study showed that there was a significant correlation between birth weight, mother's education level, parent's income, and IQ ($p < 0.05$).

Keywords: intelligence quotient, IQ, birth weight, mother's education level, parent's income

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1. Introduction

Intelligence is the critical factors of a nation in producing quality human resources. Knowledge can measure by IQ tests. Some studies describe the average IQ scores in some countries, the IQ score of 6-10-year-olds in Germany and Switzerland is 101 points, the IQ score of 9-12-year-olds in Taiwan is 105 points, and the IQ score of 13-year-old teenagers in Singapore is 93 points [1, 2] while the average rating of IQ in Indonesia is 87 points in each child and adolescents aged 5-20 years in Central Java and children aged 6-8 years in North Jakarta [2]. The shows that the average IQ score for Indonesian children is still below other countries.

The measurement of intelligence and learning ability strongly influenced by the nutritional status of a child [3]. Malnutrition is closely related to the structural and functional pathology of the brain [4, 5]. Malnutrition also associated with a low birth weight that will cause growth disorders and brain development [6]. Nutritional status, especially the height-for-age Z-score (HAZ) is an index that describes the nutritional status of the past that may affect someone's IQ [7]. UNICEF report in 1998 said that the average IQ of children who are stunting 11 points lower than children who are not stunting. A higher level of mother's education will also affect the mother's level of knowledge about nutrition as well as mother's parenting pattern to her child [8]. Inadequate economics is

a potent inhibitor limiting IQ to achieve good educational achievement [9]. This research will examine and explain the relationship between IQ with some of these factors.

2. Methods

The design study used in this research is cross-sectional. This research conducted at SMP Negeri 200 Jakarta on April 9-10, 2013. The study population was the seventh-grade students of SMP Negeri 200 Jakarta. Multistage random sampling used for sampling techniques, in which samples were randomized by class. After doing the random class process, the final amount of sample used was 138 students (4 class). The selected samples were students of class VII.A, VII.C, VII.F, and VII.G.

Data collected in this study were primary data consisting of birth weight, height, nutritional intake (energy, protein, iron), mother's education level, and parent's income and secondary data comprising of IQ scores from school. IQ tests conducted on respondents using Raven's Colored Progressive Matrices. This study used anthropometric measurements to measure height by using height gauges and questionnaires to retrieve primary data about respondent characteristics, socioeconomic, and food recall 2x24 hours.

3. Results

The number of respondents in this study was 131 respondents. Seven people were excluded from the research process because they did not take an IQ test that had done before. Respondents consisted of 48.9% male and 51.1% female. Distribution of respondent data by sex and age could see in table 1. The result of the average value of IQ of respondents was 109.24. Table 1 showed that respondents who had superior IQ were 21.4%, high average 25.2%, and ≤ average 53.3%. The average value of the respondent's birth weight was 3.13 kg, and the lowest cost was 2.1 kg. The distribution of HAZ data on the respondents showed the average value at -0.83 SD and the lowest value was at -3.84 SD which include in severely stunted. Table 1 showed that 58.8% of mother's education level was ≤ SMP. The average income of the respondent's parents was IDR 2.150.000 with the lowest salary was IDR 200.000, and the highest was IDR 6.250.000. Based on table 1, the energy intake of respondents showed that respondents who were lacking in the fulfillment of energy needs were 68.7%. The lowest consumption of respondents if calculated using kcal unit was 538.4 kcal, while the highest reached 2841.7 kcal. The average value of protein intake in the respondents was 94.3% with the lowest amount was 1.2 grams, and the highest amount was 31.8 grams. Table 1 showed that only 6.1% of respondents had met adequate iron adequacy. These results were consistent with the results of other studies that had found a high prevalence of anemia and iron deficiency in Indonesian children [10]. The lowest value of respondent's iron intake was 22.4 mg, and the highest was 138.6 mg.

Based on the results of the analysis in table 2, it showed that birth weight and parent's income had a significant relationship with IQ ($p < 0.05$). Based on the results of the

TABLE 1: Data Distribution of Respondents by Sex and Age, IQ, Birth Weight, HAZ, Nutritional Intake (Energy, Protein, and Iron), Mother's Education Level and Parent's Income.

Variable	n	%	Mean ± SD	Min – Max
Sex				
Man	64	48.9		
Women	67	51.1		
Age				
12 years old	51	38.9		
13 - 15 years old	80	61.1		
IQ (score)			109.24 ± 11.17	86 – 133
Superior	28	21.4		
High Average	33	25.2		
≤ Average	70	53.4		
Birth Weight (kg)			3.13± 0.45l	2.1 – 4.8
HAZ			-0.83 ± 1.02	-3.84 – 1.34
Normal	110	84		
Stunted	21	16		
Energy Intake (% AKG)			71.42 ± 21.55	22.4 – 138.6
Adequate (≥ 80%)	41	31.3		
Less (< 80%)	90	68.7		
Protein Intake (%AKG)			94.3 ± 36.65	22.5 – 240.6
Adequate (≥ 80%)	78	59.5		
Less (< 80%)	53	40.5		
Iron Intake (%AKG)			38.65 ± 25.44	6.3 – 159
Adequate (≥ 80%)	8	6.1		
Less (50-79%)	17	13		
Insufficient (< 50%)	106	80.9		
Mother's Education Level				
≤ SMP	77	58.8		
≥ SMA	54	41.2		
Parent's Income (Million Rp)			2.15 ± 1.41	0.2 – 6.25

analysis in table 3, it could see that there was a substantial difference between the education level of mothers ≥ SMA and ≤ SMP with IQ ($p < 0.05$).

4. Discussion

Intelligence Quotient (IQ) in respondents measured using Raven's Colored Progressive Matrices test showed that the highest percentage of IQ was less than equal to average (53.4%). Meanwhile, the mean value of IQ in the respondents was 109.24. The average

Table 2: Results of Bivariate Analysis using Correlation Test.

Variable	n	r	p-value
Birth Weight	131	0.226	0.009*
HAZ	131	0.042	0.633
Parent's Income	131	0.296	0.001*
Energy Intake	131	0.003	0.971
Protein Intake	131	-0.046	0.603
Iron Intake	131	-0.02	0.822

Table 3: Results of Bivariate Analysis using Independent T-Test.

Variable	n	Mean ± SD	p-value
Mother's Education Level			
≤ SMP	77	107.36 ± 10.29	0.021*
≥ SMA	54	111.93 ± 11.9	

cost of the IQwas still included in the average category. Several other studies showed results that were not much different. Research conducted in Surakarta on elementary school students grades 1 - 5 showed the average IQ of 105.9 (8). Other studies were done on children aged 11-18 years got an average value of IQ of 100.15 [11] while the survey of the respondents aged 18-44 years got an average IQ of 111.5 [12].

Birth weight is one of the factors that affect a child's IQ. Birth weight can describe how the condition of the baby while still conceived. Based on this research, the results showed that there was a significant relationship between birth weight and IQ ($p < 0.05$). This study was in line with several other studies [13, 14]. Children who have low birth weight have brain cell deficiency because when in the womb have a lack of nutrient intake, while the nutrient intake needed in the process of growing brain development during fetal [15]. If the growth and development of the brain disrupted, it will affect its IQ later.

IQ is also affected by height. However, the results of this study showed that there was no significant relationship between height-for-age (z-score) and IQ ($p > 0.05$). This study was in line with other studies [16], but it was different with some recent research saying there was a significant relationship between HAZ and IQ [7, 17-20]. Small brain size can be caused by a smaller body size so that the number of cells in the brain is reduced and not by the standard [8]. Also, immaturity and neurotransmitter imperfections occur in mind.

Nutrient intake needed by the human body. The energy required for the formation of new body tissues. Protein plays a role in the process of growth and development of body tissues. Iron is one of the nutrients needed in thyroid hormone synthesis, and the mechanism of enzymes is also much affected by thyroid hormones in the development of brain function [21]. However, the results obtained in this study indicate that there is no significant relationship between nutritional intake (energy, protein, iron) with IQ ($p > 0.05$). Unrelated research results in this study may be due to dietary intake when the study conducted, not directly related to IQ. However, it may be the fetal nutritional intake

that directly affects the IQ of the child. The results are in line with the results of other studies [22]. The may be due to the similar characteristics of respondents that cause the consumption pattern of the respondents to be the same. However, other studies found a significant relationship between nutritional intake and IQ [19, 23].

Mother's education level dramatically affects the IQ of a child [24]. As in this study, the results showed that there was a significant difference between a mother's education level ≥ SMA and ≤ SMP with IQ ($p < 0.05$). The mean value of IQ at mother's education level ≥ SMA was greater than ≤ SMP. The results of other studies also showed that the higher the level of the mother's education, the higher the mean value of IQ in the respondents studied [11, 25]. The can attribute to a more top mother's education level that will affect the mother's knowledge of nutrition as well as mother's parenting pattern to her child.

Furthermore, the mother's knowledge and good parenting will also affect the ability of children intelligence that will produce high information. Also, more top mother's education level will shape the character of parents so that they have more expertise in guiding the child in learning [8]. The cognitive skills of children in all aspects (verbal and non-verbal) will be higher when living with adults who have higher levels of education [26].

Fulfilling the need for nutrient consumption, learning and play facilities will all affect the IQ of a child. This study confirmed the statement with the results showed that there is a significant relationship between a parent's income with IQ ($p < 0.05$). Recent studies have also shown similar results [17, 25]. Low income leads to a lack of food supply for children that will impact on the development of children's intelligence [22]. The shows the tendency that children from high-economic families have more food and a better life. Inadequate economics is a potent inhibitor limiting IQ to achieve good educational achievement [9]. The financial ability of parents to provide adequate needs and facilities is an essential key to the development of children's intelligence.

5. Conclusion

The mean value of IQ in this study was 109.24 points with the lowest IQ score of 86 points and the highest IQ score of 133 points. Most of the respondents in this study were in the category of IQ ≤ average (53.4%). Birth weight, mother's education level, and parent's income have a significant relationship with IQ in students of SMP Negeri 200 Jakarta.

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Competing Interest

Authors declare that there is no competing interest.

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