

## THE INFLUENCE OF NUTRITIONAL STATUS ON THE LEVEL OF INTELLIGENCE IN ELEMENTARY-SCHOOL CHILDREN

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### ABSTRACT

**Introduction:** Intelligence level is a person's ability to think and respond to things logically, purposefully, and to control and manage the environment more effectively. Nutritional status and parenting of children affect the level of child's carelessness. Basic Health Research (Riskesdas) 2018 showed the nutritional status of children aged 5-12 years, where 26.8% were anemic (children aged 5-14 years), 23.6% were short, 10.8% were fat, 9.2% were thin, and 9.2% were obese. **Aims:** The researcher hopes to determine how parenting and nutritional status affect elementary school students' Intelligence Quotient (IQ). **Methods:** Purposive sampling strategies are used in this cross-sectional study design. The number of samples in this study is 77 samples. **Results:** The result found the effect of nutritional status on children's intelligence level ( $p=0.006$ ; OR 95% CI 4.17 (1.51-11.52) vs Parenting with intelligence level ( $p=0.343$ ; OR 95% CI 1.35 (0.72-2.54). Nutritional status is something that greatly affects the development of a child's brain so that it can be ensured that good nutritional intake can increase the level of intelligence of children. **Conclusion:** Therefore, it is necessary to increase counseling programs and also continue existing government programs, such as counseling for mothers or parents related to balanced nutrition, providing counseling on making balanced nutritional foods, increasing the budget in providing supplementary feeding that contains high protein, and hence, the Sustainable Development Goals (SDGs) program to reduce the malnutrition rate can be achieved in order to create healthy and intelligent children for the nation's successors.

**Keywords:** Children, Cognitive level, Nutritional Status, Parenting

### INTRODUCTION

The future of the nation and the world is in the hands of the successor generation, namely children. Numerous children do not obtain their rights during their existence, for instance affection, balanced nutrition, and protection that are fundamental to their development. Interrelationship between parents and children is necessarily maintained for an optimal growth and development of the children (Susilaningrum et al., 2020).

Family is the basic and the smallest unit among society, consisting of parents

and children. During every stage of life, family environment and habit are essential for the development and growth of children. Family is also the foundation where children can obtain education and expand many potentials, including social interaction between family members as a provision to deal with society other than family. In other words, family has great influence on children's character, as well as their growth and development. Every parent has a different way of raising and caring for their children. It is widely known as parenting styles or parenting patterns. Appropriate stimulation during early age is

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important to develop social skill, language, motoric, and also intelligence level (Ambariani & Rakimahwati, 2023).

Parenting patterns that are appropriately applied to children will have a positive influence in terms of parental control, clarity of communication, and parental demands. These influences will provide study motivation for children which has an impact to the level of Intelligence Quotient (IQ), Emotional Quotient (EQ), Spiritual Quotient (SQ), and personality (Veryawan et al., 2022). Sahalessy 2020 stated that, in Depok, parenting pattern was dominated by inappropriate parenting styles, i.e., permissive and authoritative patterns that account for 84.9% (Sahalessy, 2020).

Intelligence level is a capability to think and respond to something logically, in a directed manner, also to master and manage environment effectively (Sujana et al., 2020). There are three factors affecting children's intelligence: hereditary, environment, and nutritional status. Intelligence is crucial for learning. Children with low-level intelligence often have a low cognitive level. Children with normal-level intelligence usually require less learning time compared to children with low-level intelligence, and hence, teachers and parents should dedicate more time to children with low-level intelligence. The formation of intelligence among children cannot be separated from parenting patterns, as it has powerful influence on the development and the intelligence level of children (Tjokromihardjo & Indrawati, 2020). Riskesdas (2018) showed the nutritional status of children aged 5 to 12 years old, where 26.8% were anemic (children aged 5-14 years), 23,6% were short, 10,8% were fat, 9,2% were thin, and 9,2% were obese (Kemendikbud, 2020). Elementary school-aged children (6-12 years old) are vulnerable to nutritional issues. Balanced nutritional intake is essential for growth and development (Ahmad et al., 2023).

Malnourished children are susceptible to infectious diseases that can hinder their growth and development. This occurs due to high calorie needs. Children require high energy for physical activities at school (Papotot et al., 2021). Children's nutritional fulfillment is provided by parents, especially mothers, who have chief role to select and serve food as the nutritional intake of their child. In consequence, parents' knowledge of balanced nutrition will influence the type and the quality of food nutrition. The optimal level of child cognitive is directly linked to the mother's understanding of proper nutrition. As the mother's knowledge improves, so does her child's cognitive development (Rahmaulina & Hastuti, 2008).

Quality of sleep also has a role in maintaining physical and mental health. It is essential for human well-being to escape from fatigue, physically and mentally. During sleep, body performs reconstruction and restores stamina until it is in the optimal state (Larasati, 2017). Healthy sleep as a resting time will help individuals to concentrate more on their activities. Research conducted by the National Sleep Foundation (NFS) in 2018 showed that 60% of children below 18 years old complained of being exhausted during the day and admitted to being sleepy at school (Hirshkowitz, 2020). Based on the data of the Central Bureau of Statistics (BPS, 2021; BPS West Java, 2023; BPS Depok City, 2021), the Human Development Index (HDI) in Indonesia is 72.29, while for Depok City and Bojongsari District is 81.37 and 77.86, respectively. Elementary school is a strong foundation for the development of education in Indonesia (Mulyana et al., 2021). This study is aimed to determine the effect of parenting patterns and nutritional status on the intelligence level of elementary-school children in Depok City.

## METHODS

This research used a cross-sectional

design and an observational-analytic methodology. The study was conducted at 04 Bojong Sari Elementary School, Depok City and the data was obtained through a questionnaire. This study included 77 samples and employed purposive sampling among elementary-school students in grades 4, 5, and 6 based on the following inclusion criteria: students aged 9, 10, and 11, who are able to communicate well and to write independently without any assistance, students are present, and parents are willing to be respondents. The statistical analysis was performed by logistic regression analysis multivariate 2 main independent with significance level of  $<0.05$  and confounding test to determine that the effect of nutritional status and parenting patterns is not influenced by the confounding factors (sex and sleep quantity). This research has been reviewed and approved by the Ethics Committee of Universitas Pembangunan Nasional Veteran Jakarta with ethical clearance number: 343/VII/2024/KEP. In addition, this research has passed the internal research grant of the Institute for Research and Community Service (LPPM) of Universitas Pembangunan Nasional Veteran Jakarta with the Regional Research Research Scheme (RISDA).

The questionnaires used in this study are the Culture Fair Intelligence Test (CFIT) Scale 2 to examine the level of children's intelligence (IQ) and Nutrition Knowledge Questionnaire to measure the level of parental knowledge about balanced nutrition. The CFIT questionnaire was obtained from Eureka Consulting Institute Surabaya. The Nutrition Knowledge Questionnaire is based on the "Guidelines for Balanced Nutrition" by the Ministry of Health of the Republic of Indonesia (2014) which consists of 14 multiple-choice questions. To find out the WHO MT/U Nutrition Status Curve, Parenting Styles and Dimensions Questionnaire (PSDQ) was used (Robinson et al., 2001). The questionnaire consists of 32 question items and has been tested with all  $r$  calculated  $> r$

table and declared valid. The questionnaire got a Cronbach's Alpha score of 0.70 which means reliable (Riany et al., 2018)

Sleep Timing Questionnaires can assess the quantity of sleep with the data of the subjects' sleep time and wake-up time. The value of convergent validity with positive and significant correlation, namely  $r=0.592$  and  $p=0.003$  for sleep time, and  $r=0.769$  and  $p<0.001$  for wake up. This convergent validity was compared to a two-week sleep diary with significantly correlated results. For reliability, it had positive and significant results with  $r=0.705$  and  $p<0.001$  for sleep time, as well as  $r=0.826$  and  $p<0.001$  (Monk et al., 2003).

## RESULTS

The characteristics of the included students and the prevalence of intelligence level are shown in Table 1.

**Table 1.** The Characteristic of the Respondents of Elementary-School Students in Depok City

Characteristics	n	(%)
<b>Parenting</b>		
Authoritative	16	20.8
Permissive	11	14.3
Democratic	50	64.9
<b>Nutritional status</b>		
Normal	51	66.2
Over and Under Nutritional Status	26	33.8
<b>Sex</b>		
Male	37	48.1
Female	40	51.9
<b>Sleep quantity</b>		
Short	40	51.9
Adequate	27	35.1
Long	10	13.0
<b>Intelligence Level</b>		

Characteristics	n	(%)
Borderline	7	9.1
Intellectually Deficient	7	9.1
Below Average	14	18.2
Average	41	53.2
Above Average	6	7.8

Based on Table 1, democratic parenting style was widely used among parents at 04 Bojong Sari Elementary School, Depok City (64.9%/50 subjects), while the least was permissive parenting style (14.3%/11 subjects). Majority of these children had normal nutritional status

(66.2%), while only 33.8% categorized as over and under nutritional status. Based on sex, more than half of the children in this study were female (51.9%/40 children), while the rest were male (48.1%/37 children). It can also be seen that the prevalence of elementary school students with short sleep quantity is 51.9% (40 children), which is the highest compared to adequate sleep 35.1% (27 children) and long sleep 13% (10 children). Based on the level of intelligence, the most frequent level was average, i.e., 53.2% (41 children), followed by borderline level and intellectually deficient, i.e., 9.1% (7 children) each, while the least is above average 7.8% (6 children).

**Table 2.** Effect of nutritional status and parenting patterns on the intelligence level among elementary-school students in Depok City

Variable	Intelligence level				Total		OR	P-Value
	Poor		Good					
	N	%	n	%	n	%		
Nutritional status								
Over and Under Nutritional Status	6	40.0	9	60.0	15	100	3.97 (1.47-10.85)	0.007*
Normal	22	35.5	40	64.5	62	100		
Parenting Patterns								
Authoritative	6	37.5	10	62.5	16	100	1.25 (0.69-2.27)	0.141
Permissive	1	9.1	10	90.9	11	100		
Democratic	21	42.0	29	58.0	50	100		

\*Sig p-value < 0.05

As seen on Table 2, nutritional status had a significant relationship to intelligence level as evidenced by a p-value of 0.007 followed by an OR value of 3.97 (95% CI = 1.47–10.85). Students with over and under nutritional status had a chance to increase the risk of reduced intelligence by 3.97 folds compared to those with normal nutritional status. Children with over and under nutrition status also had low intelligence level accounted for 40% (6 children), while children with normal nutrition status also had low intelligence level accounted for 35.5% (22 children).

The other category, i.e., good level of intelligence, was dominated by children with normal nutrition status at 64.5% (40 children), while children with over and under nutritional status was at 60% (9 children). It can be seen that in addition to the lack of nutritional status, obese children can also have reduced level of intelligence. Table 2 also shows that although there is no significant correlation between parenting patterns and the cognitive level of children, the combined percentage of the low cognitive level of authoritative and permissive parenting groups is still high. In

addition to the percentage, the amount of parenting risk to intelligence level is still pointing in a positive direction, which means that authoritative parenting can increase the risk of decreasing intelligence level by 1.25 (95% CI 0.69-2.27), Despite

this finding, there is no statistically significant correlation ( $p=0.141$ ). Therefore, the findings suggest that further research is needed to prove that parenting is one of the risk factors for decreasing children's intelligence levels.

**Table 3.** Covariate Factors with Intelligence Levels in Elementary School Student in Depok City

Variable	Intelligence level				Total		OR	<i>p-value</i>
	Poor		Good					
	n	%	n	%	n	%		
<b>Sex</b>								
Male	13	35.1	24	64.9	37	100	1.10 (0.44-2.81)	0.231
Female	15	37.5	25	62.5	40	100		
<b>Sleep quantity</b>								
Short	16	40.0	24	60.0	40	100	0.67 (0.16-2.68)	0.513
Adequate	7	25.9	20	74.1	27	100	2.39 (0.49-11.63)	0.109
Long	5	50.0	5	50.0	10	100	Reff	Reff

Table 3 showed that sex and sleep quantity do not have a significant relationship with the cognitive level in elementary school student in Depok city ( $p$ -value=0.231). Although there is no significant relationship, low intelligence level is quite high in males (35.1%), despite the fact that females still dominate this category (37.5%) ( $p$ -value=0.231), which

means that sex was not significantly associated to the level of intelligence. Based on the quantity of sleep, short sleep (40%) was higher than adequate (25.9%) and long sleep in students who had low intelligence levels. This study showed that sleep quantity was not statistically significant when compared to the level of intelligence ( $p=0.513$ )

**Table 4.** The Influence of Nutritional Status and Parenting Patterns on Intelligence Levels in Elementary School Children in Depok City

Variable	B	P-Value	OR (95%CI)
Nutritional status	1.428	0.006 <sup>a</sup>	4.17 (1.51-11.52)
Parenting Patterns	0.308	0.343 <sup>a</sup>	1.35 (0.72-2.54)

\*Sig  $p$ -value < 0,05; <sup>a</sup> after controlling for gender and sleep quantity.

In Table 4, it can be observed that nutritional status still affects the level of children's intelligence as evidenced by the  $p$ -value of 0.006 followed by an OR of 4.17 (95%CI=1.51-11.52) and coefficient of 1.428. Elementary school students with under or over nutritional status can increase their level of intelligence after controlling the sex and sleep quantity compared to those with normal nutritional status. Furthermore, poor parenting patterns

(authoritative and permissive) are not statistically related, but the OR value obtained is 1.35 (95%CI=0.72-2.54), which means that it is 1.35 folds higher to increase children's intelligence after controlling the sex and sleep quantity.

## DISCUSSION

Based on research that has been conducted, it was proven that poor

nutritional status directly affects children's intelligence levels. A child with poor nutritional status has a 4.17 folds greater risk of decreased intelligence compared to those with good nutritional status. Optimal nutritional status refers to a condition where the body receives sufficient nutrients and uses them efficiently (Sumiaty, 2018). Malnutrition is the term used to describe a specific condition related to nutritional disorders. Malnutrition is defined as a condition in which the deficiency of one or more nutrients adversely affects cells, tissues, organs, and the body overall, leading to impaired functioning and unfavorable changes in the overall clinical presentation (Kobylińska et al., 2021). Malnutrition in children is often mistakenly equated with a low body mass index (BMI). However, recent research has revealed that children with high BMI (obesity) are also associated with poor nutritional status (Bradley et al., 2023). Malnutrition was defined as a condition that encompassed both undernutrition and overnutrition. Undernutrition includes wasting, stunting, and underweight, whereas overnutrition was recognized by the World Health Organization (WHO) as a significant part of malnutrition. WHO further categorized malnutrition into three major types, i.e., micronutrient-related malnutrition, referring to deficiencies or excesses of vitamins and minerals; overweight and obesity; and diet-related noncommunicable diseases. (World Health Organization, 2024).

The numbers of malnutrition in the world are still high and is a concern. Based on the data, it was found that one-eighth of the people worldwide have poor nutritional status. Malnutrition is mostly found in countries with low economies and low levels of community life (Usnia et al., 2023). In the United States, low-nutrient, sugary foods account for 27–30% of daily caloric intake for both adults and children. Despite having a high caloric intake, these calories contain lower-quality nutrients, increasing the risk of malnutrition (Bradley

et al., 2023). The 2023 Indonesian Health Survey reported that in children aged 5-12 years, 7.5% have a low BMI, 11.9% are overweight, and 7.8% are obese (Badan Kebijakan Pembangunan Kesehatan, 2023).

Nutritional status can be influenced by direct factors such as food intake or infection. In addition, there are also indirect factors, such as food availability, maternal or parental care, healthcare services, and the environment. Another study stated that malnutrition arises from a lack of food supply brought on by environmental, political, and economical issues; it is especially prevalent in low- and middle-income nations. Poor nutrition during pregnancy, intrauterine growth restriction, low birth weight, inadequate supplemental feeding and nursing, a high prevalence of infectious illnesses, contaminated water, poor cleanliness, and household food insufficiency are all contributing causes (Dipasquale et al., 2020). If nutritional needs are not met, it will trigger response from adrenal cortex, resulting in an increase of plasma cortisol that will inhibit the hormone response. That will cause a disruption in brain development that correlated with anatomical changes like a smaller brain size, which resulting in intelligence disorder leading to below-average intelligence scores (Rahmi H.G, 2017).

BMI was found to have a negative correlation with prefrontal lobe gray matter volume and matrix reasoning ability (figural reasoning) in both the baseline and 2-year follow-up groups of children between the ages of 9 and 10 in another study conducted in the United States. These results imply that there is a connection between childhood obesity and a decrease in gray matter volume in regions related to cognitive abilities, executive processes, and reward processing (Jiang et al., 2022). Long-term effects of severe malnutrition at an early age can include delayed brain development, delayed head circumference growth, and decreased academic attitude and achievement. These effects are

substantially correlated. Malnutrition has a multifaceted effect on how the brain and intelligence develop, and it intensifies adverse effects, particularly if those variables continue throughout a person's lifetime. Early-life starvation can cause irreparable brain damage (Ivanovic et al., 2004). Based on WHO, children that have poor, insufficient nutritional status, and stunting face a risk of losing intelligence or Intelligence Quotient (IQ) by 105 points. Measurement of weight for age (W/A) also insufficient or poor nutritional status, which means they are thin or very thin is often assessed through measurements of height for age (H/A). Intellectual intelligence is defined as the ability to apply formal rules, such as calculations or grammar. Children's intelligence indicators include numeric, figurative, and verbal abilities (Said & Rahmawati, 2018).

One factor directly influencing a person's nutritional status is their food intake. Low nutritional intake and an unbalanced diet can affect children's growth and increase the risk of malnutrition status (Ruswati et al., 2021). Children in school may become less intelligent as a result of their dietary state. Elementary school age children are a vulnerable group to nutritional adequacy, so they must always be monitored to avoid malnutrition that has an impact on decreasing the level of children's intelligence. Children of elementary school age are relatively older and need adequate nutrition for growth, because at this time growth will be faster, especially the increase in height. Nutritional needs based on sex are also different, i.e., boys do more physical activities, so they need more protein and iron (Apriluana & Fikawati, 2018).

Food in school-age children is the same as food consumed by adults. One of the growth processes needs, especially in school-age children, is the nutritional factor. Children's energy needs are based on energy needs for basal metabolism, growth rate, and physical activity. Indonesia employs two food guides: 1) The "Tumpeng

Gizi Seimbang," a rounded, pyramid-like structure representing balanced nutrition principles, including diverse foods, food safety, physical activity recommendation, and weight monitoring, along with five food groups and their suggested portions; and 2) The "Piring Makanku" a plate guide depicting the recommended proportions of food groups for each meal, while emphasizing the importance of hydration and maintaining hygiene before and after eating (The Ministry of Health of The Republic of Indonesia, 2014). It emphasizes the importance of meeting nutritional needs, including macronutrients (carbohydrates, protein, and fat) as well as micronutrients (minerals and vitamins).

Children's protein needs are related to the maintenance of tissues in the body, changes in body composition, and the formation of new tissues. The most important function for a child's growth is protein. High protein can help the process of tissue formation and maintenance properly. Protein deficiency can inhibit children's growth, which has an impact on the nutritional status and intelligence level of children. Additionally, compared to their classmates who are not stunted, stunted children have lower levels of amino acids. Research has shown that providing protein supports growth in stunting cases (Endrinikapoulos et al., 2023).

In addition to protein, fat also functions as a source of energy, absorption of several vitamins, and provides good taste and satisfaction with food. Fat also has a role in growth, especially in the components of cell membranes and brain cells. Fats that are essential for the growth of children are called alpha linolenic acid (ALA) and linoleic acid (LA). Vitamins and minerals are also no less important in the process of helping children's growth, although the body only needs a small amount of protein, fat and carbohydrates but is very essential for the body (G. Puspita et al., 2021).

The need for micronutrients and macronutrients can be fulfilled through adequate food consumption, one of which is



through breakfast. The importance of breakfast in elementary school children can meet one third of the nutritional needs per day. Breakfast has benefits in the learning process. Children have better memory (cognitive), learning and concentration skills, calculation (mathematics) and similar ability scores (language and logic), as well as optimal child stamina so that children are not susceptible to disease. Among students aged 13 years, breakfast has a beneficial impact on academic achievement and classroom behavior (Adolphus et al., 2013).

Food intake is related to the needs of the child's body, especially school children who are experiencing physical and intellectual growth and development. The brain's natural function may be compromised if food intake is inadequate in key nutrients and this shortfall lasts for a long time. This might cause changes in the metabolism of the brain. In even worse cases, this condition will lead to malnutrition. Malnutrition can cause impaired weight growth, such as a small body followed by a smaller brain size. This will have an impact on the number of cells in the brain decreasing and immaturity and imperfection of brain biochemistry (Mahyiddin et al., 2019).

Inherited factors, maturity, formation and interests are values that influence intelligence (Mulyana et al., 2021). In addition, parental background is highly related with parenting models that also affect the level of children's intelligence. Parenting has an influence on the development of children which will later have an influence on the intellectual intelligence of children (Sunain, 2017). Another study proved that parents who had authoritative parenting were 13.4 times more likely to increase the child's intelligence level compared to democratic parenting (T. Puspita et al., 2021). A study about parenting patterns and intelligence level of early childhood children in RA. An Najah, Tasikmalaya obtained  $p=0.008$ , which indicated that there is a relationship

between maternal parenting patterns and the level of intelligence (IQ) of children in early childhood (Sulastri, 2021).

The findings of the current research differ from those of other studies that revealed no connection between children's IQs and parental practices. A study on a preschool child in Banda Aceh found a correlation between different parenting styles and intelligence, particularly in social skills (Rizka & Bacotang, 2019). Although it is not in line with statistics, the amount of risk obtained is 1.35, which means that there is a risk, but it is not significant. It has also been found that the prevalence of authoritative parenting styles and suboptimal intelligence levels was relatively high at 37.5%. The findings indicate the need for further research to confirm that parenting may be a risk factor contributing to a decline in children's intelligence levels.

In addition to nutritional status, parenting patterns also affect the level of children's intelligence. Although there is a previous study showing that parents who had authoritative parenting were more likely to increase the child's intelligence level compared to democratic parenting, it is contrary to the result obtained in this study. Our findings showed that nutritional status had a greater impact than parenting practices, highlighting the importance of adequate dietary intake to support children's concentration and enhance cognitive performance.

Differences between parents in parenting and educating children are common, but parents must be good at choosing and sorting out which parenting style is appropriate and suitable for their children with the existing situation and conditions. In parenting, the most important thing that parents must pay attention to is those who are able to foster confidence in children, make children independent, and parenting should be done according to the parents' inherent skills, abilities, and potential, so that they can successfully develop talents and potential that exist in



children. So that in the future children will be able to face all situations and conditions that exist in every phase of their lives (Ambariani & Rakimahwati, 2023).

Parenting styles in educating children also vary. There are several factors that affect parenting styles, i.e., the environment, work, education, parental personality, beliefs, and similarities in the parenting received. These few things can influence and determine parental parenting styles, both authoritative, democratic, and permissive (Nur Utami & Raharjo, 2021).

Parenting style refers to the combination of parents' attitudes and actions toward children, as well as the emotional environment in which these behaviors are demonstrated (Bi et al., 2018). Families differ substantially from one another, and cultural backgrounds have a correlation impact on how families interact and raise their children. Stewart and Koch stated that parenting styles can be categorized into three main tendencies: a) Authoritative, characterized by strict, inflexible, and punitive approaches with lack of affection or empathy. Parents enforce their values by controlling children's behavior, suppressing their desires, and discouraging independence. Praise is rarely given, and there are little chances for independence; b) Democratic parenting, where parents use democratic and supportive methods. This style emphasizes self-confidence, encourages independent decision-making, and promotes responsible and autonomous behavior; c) Permissive parenting, characterized by a lack of control and giving kids too much freedom. Parents impose minimal responsibilities on their children, resulting in limited accountability for their actions (Esti, 2023).

This authoritative parenting style is characterized by strict parental behavior and critical assessment of children's behavior, low acceptance, physical punishment, uncompromising attitude to children, being harsh, prone to emotions and being defiant. Have little in talking, and

lack warmth to children. This parenting style is very high in demanding, but low in responding, causing children to lack initiative, tend to be hesitant, nervous, withdraw from association and are dissatisfied and distrustful of others. According to a different study, teenagers who experience dominant authoritative parenting are more likely to suffer from mental and emotional illnesses, including depression, as evidenced by the five signs of depression (King et al., 2016). The advantage of this authoritative parenting style is that children will be disciplined, obey the rules, even though children tend to be disciplined in front of their parents only. (Ambariani & Rakimahwati, 2023)

Using a democratic parenting style instead of an authoritative one allows parents to establish clear boundaries for their connection with their teenagers by finding and maintaining the ideal balance between control and support. Teenagers who experience democratic parenting may also exhibit autonomy, but they must still adhere to social norms and value each child's uniqueness. Teenagers will take greater responsibility for their actions when they are able to make decisions on their own ('Ibad et al., 2023). Previous research revealed that permissive parenting is linked to lower cognitive development in children within the Chinese population (Wang et al., 2022).

According to this study, parents' roles in providing for their children's nutritional needs are crucial for raising their IQ. Children who have poor nutritional adequacy can increase the risk of decreasing intelligence levels, and hence, there is a need for nutritional fulfillment in school-age children. Efforts must be made for children so that their cognitive level is good at school age. It is necessary for sufficient nutrition fulfilment, especially in the first 1000 days until the child enters school. (Mahyiddin et al., 2019)

This research has several disadvantages, i.e., it is carried out at school during class hours, and the school only gave

a few hours. In addition, many parents were unable to come to the school during the time provided by the school as it was within their working hours. Therefore, it is difficult to obtain the data as the parenting-related questionnaire need to be completed by the parents. However, despite the disadvantages, there is also the advantage in this study, i.e. engaging a third-party consultant for IQ analysis, so the examination of the intelligence level in this respondent can be declared valid.

## CONCLUSIONS

According to this study, there was a statistically significant correlation between primary school-aged children's IQ and their nutritional status. However, in Depok City's 04 Bojong Sari Elementary School, parenting styles did not statistically correlate with children's IQ. However, parenting and nutritional status in children need to be considered. Especially the low nutritional status and those who are obese must be controlled, because it causes the cognitive level in children to be poor.

Based on these study findings, it is necessary to increase programs to improve the nutritional status of children from an early age. These efforts are essential to achieving the SDG goals of reducing malnutrition rates and nurturing healthy, intelligent future generations. It is hoped that future studies can investigate the relationship between internal factors of the children themselves and their level of intelligence, to see what the most significant internal influence is.

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