Factors Affecting Nutritional Status of Children with Down Syndrome of 7 to 12 Year-Old in Medan

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ABSTRACT

Background: Despite the increasing prevalence of overnutrition, the increasing number of children with Down syndrome, followed by the higher risk of children with Down syndrome to experience overnutrition, research conducted on factors that influence the nutritional status of children with Down syndrome is still limited in Indonesia. This research was conducted to look at the comparison of factors affecting the nutritional status of children with Down syndrome in the 7-12-year-old age group in Medan.

Subjects dan Method: This research is an analytical cross-sectional study design. This research was conducted by distributing questionnaires to mothers of children with Down syndrome at POTADS Medan. The sampling method used is purposive sampling and data that meets the inclusion and exclusion criteria is selected. The number of samples were 30 children with Down syndrome. The data is then analyzed with Spearman's correlation using SPSS with children's nutritional status as the dependent factor and paternal education, maternal education, total parents' earnings, children's energy intake, children's diet quality, children's physical activity, and maternal nutritional knowledge as the independent factors.

Results: Correlations were found between the nutritional status of the children and paternal education (p= 0.019; r= -0.42), between children's nutritional status and children's energy intake (p= 0.002; r= 0.55), and between children's nutritional status and children's diet quality (p= 0.015; r= -0.44) with confidence interval at 95%.

Conclusion: Strong negative correlation against children's nutritional status was found in paternal education and children's diet quality, while strong positive correlation was found in children's energy intake. Indirect correlations against nutritional status were found in maternal education, parents' total income, and maternal nutritional knowledge score.

Keywords: down syndrome, diet quality, bmi.

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BACKGROUND

Children are one of the most valuable assets of the family and country. Parents need to pay more attention to the growth and development period of the child, especially during the golden period, the first three years of life. During this period, where major development of the brain and physique

occurs. This period impacts how the child develops his or her personality, attitude, and emotional expression. This period will also affect the child's way of interacting with the environment, thus having a big impact in his future. Special attention from the family, especially parents will help optimize the growth and development of the children. However, not all children will grow and develop normally. Some of them require special treatment or care are also called as children with special needs (Adinda & Thristy, 2021). Down syndrome is one of the conditions where a child requires special attention.

Based on the data provided by Riskesdas throughout the year 2010, 2013 and 2018, the proportion of children with Down syndrome aged 24 to 59 months in Indonesia tends to experience an increase. In 2010, the proportion of children aged 24-59 months who suffer from Down syndrome is 0.12 percent and experienced an increase to 0.13% in 2013, and 0.21 percent in 2018. New cases of Down syndrome outpatients in Indonesia based on data from SIRS Online are also increasing feom 1657 patients (768 male, 889 female) in 2015, increased to 4,449 patients (2,438 male and 2,011 female) in 2016, and 4,130 patients (2006 male, 2,124 female) in 2017 (Kemenkes RI, 2019).

An excess of chromosome 21 causes children with Down syndrome to experience intellectual impairment and increases the risk of health problems, especially ones related to nutritional problems. Children with Down syndrome are at risk of experiencing overnutrition A retrospective study conducted by Basil et al. (2016) stated that 47.8% of 303 research subjects (children with Down syndrome) in America were obese, which was significantly higher than the percentage of obesity in the general population of children, which was 12.1%. According to data from the Kemenkes RI (2012), overnutrition is a nutritional problem that threatens public health. In 2007, the prevalence of overnutrition in children was 14.4% and 21.7% in adults in 2010. One of the contributing factors is unbalanced food consumption. Based on data from the Badan Pusat Statistik (2011) as cited in Kemenkes RI (2012), the consumption of oil and fat in Indonesia are above the recommended levels. Whereas, consumption of vegetables or fruit only reached 63.3%, consumption of animal foods reached 62.1%, consumption of nuts reached 54%, and consumption of tubers reached 35.8%.

Referring to CDC (2022), obesity can increase the risk of developing various chronic diseases such as hypertension, dyslipidaemia, type 2 diabetes, coronary heart disease, stroke, gallbladder disease, osteoarthritis, sleep apnoea, cancer, and mental illnesses such as depression which results in decreased quality of life and increased mortality. Children's food intake, children's diet quality, children's physical activity, mother's nutritional knowledge, and parents' demographic characteristics are all factors that can affect the children's nutritional status, including children with special needs such as those with Down syndrome.

There are several theories about the factors that influence nutritional status in a child with Down syndrome. Differences in physiological factors in children with Down syndrome causes an increased risk of obesity, such as the presence of endocrine system abnormalities such as hypothyroidism (Amr, 2018), decreased resting metabolic rate, increased leptin hormone, and dysfunction of the masticatory system. This dysfunction causes a decrease in consumption of vegetables and fruits, while increasing the consumption of high-calorie foods (Tada and Miura, 2018). Besides that, children with Down syndrome also have shorter

bodies, and have lower muscle mass which further triggers a decrease in basal metabolic rate (Artoli, 2017). Main factors that cause overnutrition in children is the consumption of unhealthy foods such as fast food which have high calories, accompanied by low physical activity. These condition results in the number of calories eaten exceeding the number of calories used, otherwise known as calorie surplus. In addition to genetics, family factors also affect children's diet and physical activity (Surudarma, 2017). Hence why, the authors were interested in conducting this research, to be used as a reference for other researchers or other health instances to educate those who are at risk of obesity, in order to be aware of the risk factor and reduce them.

SUBJECTS AND METHOD

1. Study Design
The research was an analytical cross-sectional study with data being collected from August 2022 to November 2022.

2. Population and Sample
The population of this research was children with Down syndrome of the age group for 7-12 in Medan, Indonesia. The sample was then taken from Persatuan Orang Tua Anak dengan Down Syndrome Medan (POTADS) Medan. The sampling method used was purposive sampling with the inclusion criteria consisting of child is healthy during data collection, willing to cooperate to fill questionnaire, and mother's consent to fill the questionnaire.

3. Study Variables
The variables in this research consist of independent and dependent variables. The dependent variable is children's nutritional status, while the independent variables are paternal and maternal education, total parents' earnings, children's energy intake, children's diet quality, children's physical activity, and maternal nutritional knowledge.

4. Operational Definition of Variables
Maternal and paternal education in this research is grouped into 3 categories which consists of:
i) Basic education (elementary and middle school)
ii) Middle education (high school)
iii) Higher education (college/university).

Parents' total income is grouped into 3 categories which consists of:
i) <Rp 3.000.000
ii) Rp 3,000,000 – Rp 4.999.999
iii) ≥ Rp5.000.000

Children's energy intake which is calculated by dividing the total calories consumed on the day by the energy requirements by the age group:
i) 7-9 years old divided by 1800 kcal for both genders
ii) 10-12 years old by 1800 kcal for females and 2050 kcal for males.

The following result will later be grouped into 4 categories which consists of:
i) <60%;
ii) 60%-80%;
iii) 80%-110%;
iv) ≥110%.

Children's diet quality is measured using Diet Quality Index International or DQI-I which is presented only as a score.

Physical Activity is measured with Physical Activity Questionnaire for Older Children or PAQ-C which is presented only as a score.

Maternal nutritional knowledge which is grouped into 3 categories:
i) Good (>80%)
ii) Moderate (60-80%)
iii) Less (<60%).

Children's nutritional status is grouped into 4 categories which are based on Peraturan Menteri Kesehatan Republik Indo-

nesia Nomor 2 Tahun 2020 Tentang Standar Antropometri Anak by the Indonesia's Ministry of Health. The 4 categories are:
i) Thinness (-3 SD s.d. < -2 SD)
ii) Normal (-2 SD s.d. +1 SD)
iii) Overweight (+1 SD s.d. +2 SD)
iv) Obese (> +2 SD).

5. Study Instruments
Paternal and maternal education, parents' total income, and children's nutritional status were measured by questionnaire. Children's calorie intake and children's diet quality were measured with 24-hour Food Recall form, Nutrisurvey, and DQI-I. Physical activity was measured by PAQ-C.

6. Data Analysis
Univariate and bivariate analysis were run on this research. The univariate analysis was done to look at the distributions of the data, while a bivariate analysis was done to look whether there is a correlation or not against children's nutritional status. The bivariate analysis used in the research was Spearman's correlation using SPSS with the confidence interval at 95%.

7. Research Ethics
Ethical issues that might arise from informed consent, anonymity, and confidentiality, were addressed with utmost care during the research. The ethical clearance approval letter was obtained from the Ethics Committee of Fakultas Kedokteran USU, North Sumatra, Indonesia, No.878/KEPK/ USU/ 2022.

RESULTS

1. Sample Characteristics
In this research, a total of 31 respondents were willing to participate in the study; out of those 31 respondents, one was excluded due to being sick. Referring to table 1, age for children (Mean= 8.53; SD= 1.66), mother's age at time of data collection (Mean=40.33; SD= 5.37) with the extremes at 29 and 51 years old. Children's Diet Quality score (Mean= 59.15; SD= 5.17) with the extremes at 48.9 and 68.4. Children's Physical activity score (Mean= 2.61; SD= 0.65) with the extremes at 1.56 and 3.99.

Table 1. Sample characteristics of children with Down syndrome in the 7 to 12 year-old age group in Medan city (N= 30)

Variables	Mean	SD	Min.	Max.
Age of the children (year)	8.53	1.66	7	12
Mother's age (at time of data collection)	40.33	5.37	29	51
Children's Diet Quality (DQI-I)	59.15	5.17	48.9	68.4
Children's Physical Activity (PAQ-C)	2.61	0.65	1.56	3.99

Referring to table 2, male represented 19 (63.3%), while female represented 11 (36.7%) of the samples. Children's age was dominated by the 7 and 8 year-old representing a total of 19 (63.3%). Birth order as the first child as much as 13 (43.3%), second child as much as 10 (33.3%), and third child as much as 7 (23.3%). Paternal education was distributed to 3 categories with basic education as much as 2 (6.7%), middle education as much as 10 (33.3%), and higher education as much as 18 (60%). Maternal education was distributed to 3 categories with basic education as much as 1 (3.3%), middle education as much as 9 (30%), and higher education as much as 20 (66.7%). Parents' total income is distributed into 3 categories where for earnings under Rp 3,000,000 as much 7 (23.3%), Rp 3,000,000 to Rp 4,999,999 as much as 12 (40%), and earnings above Rp 5,000,000 as much as 11 (36.7%). Children's energy intake

is distributed into 3 categories with 60%-80% as much as 1 (3.3%), 80%-110% as much as 16 (53.3%), and above 110% as much as 13 (43.3%). Maternal nutritional knowledge score was distributed into 3 categories with <60% as much as 8 (26.7%), 60% to 80% as much as 22 (73.3%), >80% as much as 0 (0%). Lastly, is the children's nutritional status divided into 4 categories with thinness as much as 5 (16.7%), normal as much as 11 (36.7%), overweight as much as 8 (26.7%), and obese as much as 6 (20%).

Table 2. Sample characteristics of children with Down syndrome in the 7 to 12 year-old age group in Medan city (Categorical Data) (N=30)

Characteristics	Category	Frequency	Percentage
Children's gender	Male	19	63.3%
	Female	11	36.6%
Children's age	7 years old	10	33.3%
	8 years old	9	30%
	9 years old	4	13.3%
	10 years old	2	6.6%
	11 years old	2	6.6%
	12 years old	3	10%
Birth order	1	13	43.3%
	2	10	33.3%
	3	7	23.3%
Paternal education	Basic education	2	6.6%
	Middle education	10	33.3%
	Higher education	18	60%
Maternal education	Basic education	1	3.3%
	Middle education	9	30%
	Higher education	20	66.6%
Parents' total income	< Rp 3,000,000	7	23.3%
	Rp 3,000,000 - Rp 4,999,999	12	40%
	≥ Rp 5,000,000	11	36.6%
Children's energy intake (% of RDA)	60% to 80%	1	3.3%
	80% to 110%	16	53.3%
	>110%	13	43.3%
Maternal nutritional knowledge score	< 60%	8	26.7%
	60% to 80%	22	73.3%
	> 80%	0	0%
Children's nutritional status	Thinness	5	16.6%
	Normal	11	36.6%
	Overweight	8	26.6%
	Obese	6	20%

2. Bivariate Analysis

Referring to table 3, it was found that there were no significant correlation between maternal education, parents' total income, children's physical activity, and maternal knowledge score. Strong negative correlations were found in paternal education (p= 0.019; r= -0.42) and children's diet quality

(p= 0.015; r= -0.44), while strong positive correlation was found in children's energy intake (p= 0.002; r= 0.55).

Referring to table 3, 4, and 5, it was found that maternal education had a strong positive correlation against paternal education (p= 0.008; r= 0.47) and a moderate negative correlation against children's energy intake (p= 0.046; r= -0.36), both of which are correlated to children's nutritional status.

Referring to table 3 and 4, it was found that while parents' total income did not have a direct and significant correlation against children's nutritional status, there was a moderate and positive correlation against paternal education (p= 0.035; r= 0.38) which makes it indirectly correlated with children's nutritional status.

Referring to table 3, 4, and 6, while there was no direct significant correlation between maternal knowledge score and children's nutritional status, it was found that it had a strong positive correlation against paternal education (p= 0.007; r= 0.48), and moderate positive correlation against children's diet quality (p= 0.050; r= 0.36). Both of which have a direct correlation against children's nutritional status.

Table 3. Spearman's correlation against nutritional status

Variables	r	p
Paternal education	-0.42	0.019*
Maternal education	-0.29	0.113
Parents' total income	0.00	0.996
Children's energy intake (% of RDA)	0.55	0.002*
Children's diet quality (DQI-I)	-0.44	0.015*
Children's physical activity (PAQ-C)	0.24	0.196
Maternal nutritional knowledge score	-0.28	0.126

*. Correlation is significant at the 0.05 level (2-tailed).

Table 4. Spearman's correlation against paternal education

Variables	r	p
Maternal education	0.47	0.008
Parents' total income	0.38	0.035
Maternal nutritional knowledge score	0.48	0.007

Table 5. Spearman's correlation against children's energy intake

Variables	r	p
Maternal education	-0.36	0.046

Table 6. Spearman's correlation against children's diet quality

Variables	r	p
Maternal nutritional knowledge score	0.36	0.050

DISCUSSION

1. Paternal education

The result of the Spearman's correlation shows that there was indeed a significant correlation between paternal education and children's nutritional status. This is consistent with the research done by Hermann et al. (2011) where a negative association between BMI with a lower education. Another research done by Muthuri et al.

(2016) also found that excess body weight in parents are also associated with excess body weight found in their children.

2. Maternal education

The result of the Spearman's correlation found no significant correlation between maternal education and children's nutritional status. However, it must be noted that there were indirect correlations stemming out of paternal education and children's energy intake, which had direct correlation with children's nutritional status. The lack of direct correlation makes this not consistent with the two research mentioned above by Hermann et al. (2011) and Muthuri et al. (2016).

3. Parents' total income

The result of the Spearman's correlation found no significant correlation between parents' total income and children's nutritional status. However, it also must be noted that there were indirect correlation stemming out of paternal education, which had a direct correlation against children's nutritional status. The result is consistent with the meta-analysis done by Kim and von dem Knesebeck (2018) where there were found an association between lower income and obesity, however the significance of the association was lost after adjusting for publication bias.

4. Children's energy intake

The result of the Spearman's correlation shows that there was indeed a significant correlation between children's and children's nutritional status. This is consistent with the theory where if calorie intake were to surpass the needs of the body otherwise known as calorie surplus, where if it were to happen for quite some time, it will cause weight gain causing overnutrition (CDC, 2022). Winerungan et al. (2018) found that there was a correlation between energy intake and nutritional status of adolescents in Manado city.

5. Children's diet quality

The result of the Spearman's correlation shows that there was indeed a significant correlation between children's diet quality and children's nutritional status. Pratama (2018) found a significant correlation was found between the DQI-I score and nutritional status at the Down syndrome group. This however is not consistent with Cheung et al. (2018) where there was no significant correlation found between the DQI-I score and nutritional status. However, when measured by AHEI-2010 on Cheung et al. (2018) there was indeed a correlation.

6. Children's physical activity

The result of the Spearman's correlation found no significant correlation between children's physical activity and children's nutritional status. This is not consistent with the research done by Philips and Holland (2011) as cited in Pratama (2018), in the research, it was found that there was an association between low physical activity and overnutrition. This however is consistent with the research done by Effendy et al. (2018) where there were no significant association between physical activity and obesity incidence. This is also consistent with a study by Yousif et al. (2019) where no significant association was found between physical activity and BMI. Damayanti et al. (2019) found that there was no significant relationship between physical activity and children's nutritional status. This might be caused by the 2022 lockdown in Indonesia where it causes physical activity of children at time of data collection be not representative of their daily physical activity of that year as it takes a long time for physical activity to be impactful towards nutritional status. Another opinion while it might be anecdotal, is that increasing physical activity causes the person to eat more than what someone else who does not do much physical activity eats. More research however, is needed to deter-

mine the definite cause of why physical activity not being correlated with children's nutritional status.

7. Maternal nutritional knowledge

The result of the Spearman's correlation found no significant correlation between maternal nutritional knowledge and children's nutritional status. However, it must be noted that there was a correlation with paternal knowledge and children's diet quality which have direct correlation with child nutritional status. A study by Pratama (2018) stated that there was no significant correlation was found between maternal nutritional knowledge and children's nutritional status. This is also consistent with the research done by Rahmawati (2016) as cited is Pratama (2018), where not significant association was found between maternal nutritional knowledge and children's nutritional status.

In summary, it was found that there were direct and meaningful correlation between paternal education, children's energy intake, and children's diet quality. It was found that there were indirect correlations between maternal education, parents' total income, and maternal nutritional knowledge. Correlations were not found between children's physical activity and the children's nutritional status. Limitations found during the research was due to the lockdown in Indonesia due to COVID-19, most students were forced to study from home, and due to the lockdown, many of the children's nutritional status were impacted. Thus, causing the nutritional status to not be representative of the normal times. As nutritional status in this research was reported from parents, there might be some under reporting or overreporting for height and weight, causing data to not be very accurate. Thirdly, as correlations were found in paternal education, children's energy intake, and children's diet quality, we hope that parents take on further studies, pay more attention on reducing the children's energy intake, and improving the children's diet quality remembering that the prevalence of obesity in children's with Down syndrome had reached 46.67% as obesity can cause many problems in the long term, for example, hypertension, coronary artery disease, type 2 diabetes mellitus, osteoarthritis, and many others.

AUTHOR CONTRIBUTION

Reynard Andrew who selected topic, collected data, analyzed data, and arranged the article. Nenni Dwi Aprianti Lubis who suggested topics, played a role in data collection, advisory, and reviewed the article. Fitriyani Nasution who played a role in data review, article review, and advisory. Deryne Anggia Paramita who played a role in article review, and advisory.

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CONFLICT OF INTEREST

There are no conflicts of interest.

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