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Dietary Determinants of Stunting and Underweight in Under- Five Years Children in Pengasinan Health Center's (Puskesmas) Working Area, Depok, West Java

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Abstract

Stunting and underweight are public health problems, especially in under-five children. This study aims to explore the dietary determinants of stunting and underweight. Participants were 52 under-five children who visited Posyandu in Pengasinan and Bedahan, Depok. Body weight for age z-score (WAZ) and height for age z-score (HAZ) were measured with standardized measurement tools by trained operators. Questionnaires were administered to determine sociodemographic, maternal, and child health history, sanitation, disease history, and exclusive breastfeeding history. Data on food intake was obtained through the semi-quantitative Food Frequency Questionnaire and 24-hour recall. There was a significant correlation between the mother's income with underweight (P=0.01), milk consumption frequency with protein adequacy (P=0.01 r=0.44), and calcium adequacy (P=0.00 r=0.74). There was a tendency of correlation between children's zinc intake (P=0.06) and fat intake (P=0.06) with underweight and milk consumption frequency with HAZ (P=0.05 r=0.28) and WAZ (P=0.07 r=0.25). The frequency of sugar-sweetened condensed milk (SCM) consumption was inversely correlated with HAZ (P=0.01 r=-0.34) and WAZ (P=0.01 r=-0.38). Dietary intake and complimentary beverages affect the nutritional status of a child. SCM consumption did not support the child's growth. Education about children's nutritional status and complimentary beverage consumption is necessary for mothers, mothers' support system, and cadres.

Keywords: stunting, underweight, diet, nutrition, milk

Abstrak

Stunting dan underweight merupakan masalah kesehatan masyarakat, khususnya pada anak di bawah 5 tahun. Penelitian ini bertujuan untuk mengeksplorasi determinan konsumsi makan dengan stunting dan underweight. Partisipan berjumlah 52 balita yang dating ke Posyandu di Pengasinan dan Bedahan, Depok. Berat badan menurut umur (BB/U) dan tinggi menurut umur (TB/U) diukur dengan alat ukur terstandarisasi oleh operator terlatih. Kuesioner disebarkan untuk menentukan sosiodemografi, riwayat Kesehatan ibu dan anak, sanitasi, riwayat penyakit, dan riwayat ASI eksklusif. Data asupan makan didapatkan dari semi kuantitatif Food Frequency Questionnaire dan 24- hour recall. Terdapat hubungan yang signifikan antara pendapatan ibu dengan underweight (P=0.01) dan frekuensi konsumsi susu dengan kecukupan asupan protein (P=0.01 r=0.44) dan kalsium (P=0.00 r=0.74). Terdapat kecenderungan hubungan antara asupan zink (P=0.06) dan lemak (P=0.06) dengan underweight, dan frekuensi konsumsi susu dengan TB/U (P=0.05 r=0.28) dan BB/U (P=0.07 r=0.25). Frekuensi konsumsi SKM berhubungan negative dengan TB/U (P=0.01 r=-0.34) dan BB/U (P=0.01 r=-0.38). Konsumsi makan dan minuman tambahan mempengaruhi status gizi anak. Konsumsi SKM tidak mendukung pertumbuhan anak. Edukasi terkait status gizi anak dan konsumsi minuman tambahan diperlukan untuk ibu dan para pendukungnya, serta kader.

Kata Kunci: stunting, underweight, diet, gizi, susu

Introduction

In Indonesia, 21.6% of children were stunting and 17.1% of children were underweight (1). Even though the number of stunting in Indonesia has decreased, it's still considered a high-level public health problem (20−<30%) (2). Stunting and underweight have short-term and long-term consequences, ranging from health to economic sectors. Stunting and underweight lead to the reduction of cognitive development, increased risk of infectious disease, poor work performance, and productivity (3,4). Malnutrition also leads to the risk of chronic disease in adulthood and even increases morbidity and mortality rates (5,6).

Studies found several determinants of undernutrition, including stunting and underweight, which are socioeconomic, illiterate and lack of knowledge mother, pregnancy at an early age (less than 20 years) and later age (more than 35 years), not exclusive breastfeeding, not properly sanitized environment, infectious disease, and not optimal nutrition intake (7).

A previous study reported that 47.2% of children were not achieving the minimum dietary diversity recommendation (8). Related to the aspect of intake, milk is one of the most common liquid consumptions in children, especially in under-5. Milk has been known as one of the nutritious beverages and could provide support for growth (9). Milk consumption is also one of the factors against stunting, wasting, and underweight in children (10). However, in some populations, sugar-sweetened condensed milk (SCM) is often misinterpreted as dairy and given to children as a milk substitute (11,12). Based on the lack of nutritional content and excessive sugar, there are some concerns that the misinterpretation of SCM as dairy may lead to under-5 nutritional problems (12).

Previous research in Depok on the socio-economy and behavior profile of underweight and stunting children is still limited, especially related to the dietary aspects including dairy and SCM consumption. In addition, Pengasinan Ward and Bedahan Ward, which are part of the Pengasinan Health Center's (Puskesmas) working area, are included in the 10 sub-districts with the highest stunting and underweight prevalence in Depok (13). Therefore, this study aims to find out the dietary determinants of stunting and underweight in the working area of the Pengasinan Health Center (Puskesmas). The result of this study can be used as a reference for the government to design the right intervention in order to reduce the prevalence of stunting and underweight in Depok.

Methods

Study Design

The study used a cross-sectional study design. The dependent variables are stunting and/or underweight nutritional status. The independent variables for the current studies are the parent's sociodemographic (level of education, occupation, and income), maternal and child health history (maternal age at childbirth and mother's pregnancy distance), sanitation, disease history, mother's knowledge, exclusive breastfeeding history, children dietary quality and diversity, mother's dietary quality and diversity, milk (whole milk and formula) consumption, and SCM consumption. The dependent variables are stunting and underweight.

Setting

The study was conducted in the working area of Pengasinan Health Center (Puskesmas) in October 2022. There were three Integrated Healthcare Centers

(Posyandu) that were included in this study, which are Melati 2, Flamboyan 3, and Rosella.

Research Subject

The participants were obtained using a convenient sampling technique. Inclusion criteria include children aged 0–59 months who visited Integrated Healthcare Centers, performed anthropometric measurements (body weight and height), completed all the research questionnaires, and were willing to participate in this research. The respondents were mothers or babysitters who visited Integrated Healthcare Centers. There were 67 respondents who participated and filled out the questionnaire. After cleaning the data, 15 were excluded due to incomplete body weight, body height, and food intake data. The total of the included participants was 52 children.

Instruments

This study used primary data which was obtained by anthropometry measurements, self-administered questionnaire and dietary history, semi-quantitative food-frequency questionnaire (SQ-FFQ) and a 24-hour dietary recall interview by enumerators. The self-administered questionnaires consisted of children and respondents' characteristics, parents' sociodemographics, exclusive breastfeeding history, mother's knowledge about stunting, household sanitation, and disease history.

Children and respondents' characteristics included children and mother's date of birth, children's age, children's body weight and height, mother's age during pregnancy, and the gestational gap with the last pregnancy. Body weight and height were measured by cadres and enumerators with the same body scales and microtoise at three different Integrated Healthcare Centers. Parents' sociodemographics included a parent's last formal education, profession, and income. Stunting was defined by a height-for-age z-score (HAZ) of less than -2 standard deviation (SD), and underweight was defined by a weight-for-age- z-score (WAZ) of less than -2 SD based on the World Health Organization (WHO) growth standard charts. Weight-for-length/height-z-score (WHZ) was also measured for additional nutritional status reference.

Exclusive breastfeeding is defined as a feeding practice in which infants only consume breast milk, without any other food and drink within the first 6 months of life (14). The exclusive breastfeeding history questionnaire included 10 questions that showed mothers' attitudes and behaviors toward exclusive breastfeeding for their children. There were two answer options (yes or no). This questionnaire was adapted from (15) and has been tested for validity and reliability. The result was valid and reliable (Alpha Cronbach = 0,746 (> 0.6). The answers were coded as 1 for correct behavior and 0 for incorrect behavior, and then all of the scores were summed up. If all of the answers were accurate, exclusive breastfeeding was determined. If one or more answers were incorrect, non-exclusive breastfeeding was determined.

Mother's knowledge questionnaire was adapted from (16), which consisted of 20 questions with 2 answer options (yes or no). Validity and reliability tests revealed that 15 of the questions were valid and all of them were reliable (Alpha Cronbach = 0.896). The five remaining invalid questions were also included because they are considered important questions about the mother's knowledge. The correct answers were coded as 1, while the incorrect answers were coded as 0, and then all of the scores were summed up. Based on a quartil obtained during the

analysis process, knowledge was classified into four levels. Quartile 1 (Q1) is considered to have high knowledge, while Q4 is considered to have low knowledge.

The household sanitation questionnaire was used to assess the cleanliness of the environment surrounding the children's family, which included drinking clean water, using healthy latrines, and washing hands with soap and running water. This 15-question questionnaire was adapted from (17) which was also adapted from Basic Health Research (Riskesdas) 2013 and 2018. All of the scores from those questions were added up and converted to a percentage. If the score was ≥75%, it was considered good sanitation, and if it was <75%, it was considered poor sanitation.

The disease history questionnaire, adapted from Wulansari et al (18), was used to assess the diseases that children had within the last month, including fever, asthma, difficulty breathing, tuberculosis, diarrhea, and others. FFQ was used to assess children's dietary patterns within the last month. A 24-hour recall was used to assess the dietary intake of children and mothers in a single day, and further used to assess dietary quality and diversity. Dietary quality was assessed based on the adequacy of energy, protein, fat, carbohydrate, vitamin A, vitamin C, Calcium, iron, and zinc consumption. The macro- and micro-nutrient adequacy were measured based on recommended daily intake based on age group by Indonesia's Ministry of Health (19). Dietary diversity for children was based on the WHO infant and young child dietary diversity score (8), with consuming four or more out of eight types of food groups considered as having a diverse diet. Women's Dietary Diversity Score Food and Agriculture Organization – the United Nations (FAO- UN) was used as the standard of dietary diversity for the mothers, and categorized into low-, medium-, or high-diversity diet based on 0–3, 3.01–6 and 6.01–9 food groups consumed for a day (8).

Data Analysis

In this study, researchers conducted univariate and bivariate analyses using SPSS. After checking for the normality of distribution, the current dataset was treated as non-parametric data. The median and interquartile range (IQR) were used for the descriptive presentation of linear data. For bivariate analysis, chi-square and Spearman tests were used to assess the relationship between the independent variable and dependent variables (stunting and underweight) with 95% confidence intervals (CI). It is considered statistically significant if the p-value is <0.05 and there is a tendency if the p-value is <0.10. The correlation analysis is considered strong when the r value is ≥ 0.60, moderate when the r value is between 0.40 and 0.59, and weak when the r value is <0.40.

Results

A total of 52 under-5 children in the Pengasinan & Bedahan Village, Depok were joining the study. The children's age distribution was 24.50 (12.00-36.00) months old. The mother's age distribution was 31.00 (25.25-50.00) years old. Of all participants, eight were stunting (15.40%), and eight were underweight (15.40%). Six of each stunting and underweight children had both conditions (11.50%), and one of them was considered wasting based on the WHZ of less than -2 SD. The distribution of HAZ was -0.95 (-0.19- (-1.53)) and WAZ was -0.73 (0.12 - (-1.64)).

The distribution of variables based on stunting and underweight status is shown in Table 1. The baseline parameters were sociodemographic, maternal and child health history, mother's knowledge, children's

dietary quality and diversity, and mother's dietary quality and diversity. The highest education of participants' parents is mostly high school with 63.50% of fathers and 51.90% of mothers. Furthermore, almost all mothers are unemployed (76.90%), and their income is <1.5 million (90.40%). Nearly all the sanitation is poor quality (98.10%). Almost all of the participants did not get exclusive breastfeeding (82.70%). None of the independent variables is correlated with stunting. Meanwhile, the mother's income was significantly correlated (P=0.01) with underweight. Another variable that showed a correlation with underweight status is children's adequate zinc intake (P=0.00), while fat intake has a tendency to correlate with underweight status(P=0.06). Besides the mother's income and children's adequate fat and zinc intake, the other variables are not significant, including maternal and child health history, the mother's knowledge, and the mother's dietary quality and diversity.

Table 2 shows the correlation between milk and SCM consumption with children's height and weight and protein and calcium adequacy. Protein quantity had a tendency to correlate with HAZ (P=0.07 r=0.27) but not with WAZ (P=0.16 r=0.21). Calcium quantity also did not correlate with HAZ and WAZ (P=0.12 r=0.23 and P=0.13 r=0.22, respectively). Frequency of milk consumption had a tendency to correlate with HAZ (P=0.05 r=0.28) and WAZ (P=0.09 r=0.25). However, frequency of milk consumption also was significantly correlated with protein adequacy with moderate association (P=0.01 r=0.44) and calcium adequacy with a strong correlation (P=0.00 r=0.74). The frequency of consumption of SCM was inversely correlated with children's HAZ (P=0.01 r=-0.34) and WAZ (P=0.01 r=-0.38). Moreover, the frequency of consumption of SCM was not correlated with protein adequacy (P=0.36 r=0.14) and calcium adequacy (P=0.43 r=0.12).

Discussion

In this study, there were 15.40% stunting children and 15.40% underweight children. This study presents associations between a mother's income and children's adequate zinc intake with children's stunting and underweight conditions. Frequency of milk consumption was correlated with the adequacy of protein and calcium for age, while also showing a tendency to positively correlated with HAZ and WAZ. Unlike milk consumption, the frequency of SCM was inversely correlated with HAZ and WAZ. Meanwhile, fat intake has a tendency to correlate with underweight status.

The current stunting and underweight prevalence is lower than in previous studies conducted in Depok, DKI Jakarta, and Jambi (20–23). However, if we compare with data from (13), the prevalence of stunting and underweight in this study was higher than the previously known prevalence in Pengasinan and Bedahan Wards. In Pengasinan Ward, there were 11.09% stunting children and 9.27% underweight children. In Bedahan Ward, there were 9.45% stunting children and 8.28% underweight children. We also find a case of stunting, underweight, and wasting that happens at the same individual, which is an important nutritional concern.

Besides the mother's income and children's adequate fat and zinc intake, the other variables are not significantly associated with stunting and underweight. The lack of association between the previously known determinant for malnutrition and stunting and underweight cases in the current study may happen because of the different populations and characteristics from other studies. Therefore, the associated factors may differ from what has been reported in previous articles.

Table 1. Distribution of variables based on stunting and underweight status (N=52)

Characteristics	N	Stunting		p-value	Underweight		p-value
		Stunting	Not stunting		Underweight	Not underweight	
		n (%)	n (%)		n (%)	n (%)	
Sociodemographic							
Father's level of education							
No School	0 (0.00)	0 (0.00)	0 (0.00)		0 (0.00)	0 (0.00)	
Primary School	5 (9.60)	0 (0.00)	5 (100.00)		0 (0.00)	5 (11.40)	
Middle School	9 (17.30)	3 (33.33)	6 (66.66)	0.26	3 (37.50)	6 (13.60)	0.26
High School	33 (63.50)	5 (62.50)	28 (63.60)		5 (62.50)	28 (63.60)	
Associate Degree/Undergraduate	5 (9.60)	0 (0.00)	5 (11.40)		0 (0.00)	5 (11.40)	
Mother's level of education							
No School	1 (1.90)	0 (0.00)	1 (2.30)		1 (12.50)	0 (0.00)	
Primary School	5 (9.60)	1 (12.50)	4 (9.10)		1 (12.50)	4 (9.10)	
Middle School	14 (26.90)	4 (50.00)	10 (22,70)	0.49	3 (37.50)	11 (25.00)	0.12
High School	27 (51.90)	3 (37.50)	24 (24.50)		3 (37.50)	24 (54.50)	
Associate Degree/Undergraduate	5 (9.60)	0 (0.00)	5 (11.40)		0 (8.00)	5 (11.40)	
Father's Occupation							
Unemployed	3 (5.80)	2 (25.00)	1 (2.30)		1 (12.50)	2 (4.50)	
Service	9 (17.30)	1 (12.50)	8 (18.20)		2 (25.00)	7 (15.90)	
Government employees/ Soldier/Police	1 (1.90)	0 (0.00)	1 (2.30)	0.16	0 (0.00)	1 (2.30)	0.83
Private	24 (46.20)	3(37.50)	21(47.70)		3 (37.50)	21 (47.70)	
Merchant	15 (28.80)	2 (25.00)	13(29.50)		2 (250)	13 (29.50)	
Mother's Occupation							
Unemployed	40 (76.90)	7(87.50)	33 (75.00)		5 (62.50)	35 (79.50)	
Service	1 (1.90)	0 (0.00)	1 (2.30)		1 (12.50)	0 (0.00)	
Government employees/Soldiers/Police	2 (3.80)	0 (00)	2 (4.50)	0.87	0 (0.00)	2 (4.50)	0.08
Private	3 (5.80)	0 (00)	3 (6.80)		0 (0.00)	3 (6.80)	
Merchant	6 (11.50)	1 (12.50)	5 (11.40)		2 (25.00)	4 (9.10)	
Father's Income							
< 1,5 million	9 (17.30)	3 (37.50)	6 (13.60)		3 (37.50)	6 (13.60)	
1,5-2,5 million	10 (19.20)	2 (25.00)	8 (18.20)	0.29	1 (12.50)	8 (18.20)	0.43
2,5-3,5 million	17 (32.70)	1 (12.50)	16(36.40)		2 (25.00)	16 (36.40)	
>3,5 million	16 (30.80)	2 (25.00)	14 (31.80)		2 (25.00)	14 (31.80)	

Characteristics	N	Stunting		p-value	Underweight		p-value
		Stunting	Not stunting		Underweight	Not underweight	
		n (%)	n (%)		n (%)	n (%)	
Mother's Income							
< 1,5 million	47 (90.40)	7 (87.50)	40 (90.90)	0.49	6 (75.00)	41 (93.20)	0.01*
1,5-2,5 million	2 (3.80)	0 (0.00)	2 (4.50)		0 (0.00)	2 (4.50)	
2,5-3,5 million	2 (3.80)	1 (12.50)	1 (2.30)		2 (25.00)	0 (0.00)	
>3,5 million	1 (1.90)	0 (0.00)	1 (2.30)		0 (0.00)	1 (2.30)	
Sanitation							
Poor Quality	52 (98.1)	8 (100.00)	43 (97.70)	0.67	0 (0.05)	1 (2.30)	0.67
Good Quality	1 (1.90)	0 (0.00)	1 (2.30)		8 (100.00)	43 (97.70)	
Maternal and child health history							
Maternal age at childbirth							
<20 years	3 (5.80)	0 (0.00)	3 (6.80)	0.71	0 (0.00)	3 (6.80)	0.28
20-35 years	41 (78.80)	7 (87.50)	34 (77.30)		8 (100.00)	33 (75.00)	
>35 years	8 (15.40)	1 (12.50)	7 (15.90)		0 (0,00)	8 (18.20)	
Mother's Pregnancy Distance							
First Child	18 (34.60)	1 (12.50)	17 (38.60)	0.18	1 (12.50)	17 (38.60)	0.26
<2 years	2 (3.80)	1 (12.50)	1 (2.30)		0 (0.00)	2 (4.50)	
>2 years	32 (61.50)	6 (75.00)	26 (59.10)		7 (87.50)	25 (56.80)	
Exclusive Breastfeeding							
No Exclusive Breastfeeding	43 (82.70)	8 (100)	35 (79.50)	0.16	0 (0.00)	9 (20.50)	0.16
Exclusive Breastfeeding	9 (17.30)	0 (0,00)	9 (20.50)		8 (100.00)	35 (79.50)	
Child Disease History							
Had illness in the last 1 month	35 (67.30)	6 (75.00)	29 (65.90)	0.61	1 (12.50)	16 (36.40)	0.19
Had no illness in the last 1 month	17 (32.70)	2 (25.00)	15 (34.10)		7 (87.50)	28 (63.60)	
Mother's Knowledge							
Quartile 1 (>14)	11 (21.20)	2 (25.00)	9 (20.50)	0.68	1 (12.50)	9 (20.50)	0.81
Quartile 2 (12,5-14)	15 (29.80)	1 (12.50)	14 (31.80)		2 (25.00)	14 (31.80)	
Quartile 3 (10,25-12,45)	13 (25.00)	2 (25.00)	11 (25.00)		2 (25.00)	11 (25.00)	
Quartile 4 (<10,25)	13 (25.00)	3 (37.50)	10 (22.70)		3 (37.50)	10 (22.70)	

Characteristics	N	Stunting		p-value	Underweight		p-value
		Stunting	Not stunting		Underweight	Not underweight	
		n (%)	n (%)		n (%)	n (%)	
Children's Dietary Quality and Diversity							
Energy							
Inadequate	39 (75,00)	6 (75.00)	33 (75.00)	1.00	6 (75.00)	33 (75.00)	1.00
Adequate	13 (25,00)	2 (25.00)	11 (25.00)		2 (25.00)	11 (25.00)	
Protein							
Inadequate	17 (32.70)	3 (37.50)	14 (31.80)	0.75	1 (12.50)	16 (36.40)	0.19
Adequate	35 (67.30)	5 (62.50)	30 (68.20)		7 (87.50)	28 (63.60)	
Fat							
Inadequate	29 (55.80)	4 (50.00)	25 (56,80)	0.72	2 (25.00)	27 (61.40)	0.06+
Adequate	23 (44.20)	4 (50.00)	19 (43.20)		6 (75.00)	17 (38.60)	
Carbohydrate							
Inadequate	41 (78.80)	7 (87.50)	34 (77.30)	0.51	7 (87.50)	34 (77.30)	0.51
Adequate	11 (21.20)	1 (12.50)	10 (22.70)		1 (12.50)	10 (22.70)	
Vitamin A							
Inadequate	43 (82.70)	6 (75.00)	37 (84.10)	0.91	5 (62.50)	38 (86.40)	0.10
Adequate	9 (17.30)	2 (25.00)	7 (15.90)		3 (37.50)	6 (13.60)	
Vitamin C							
Inadequate	43 (82.70)	7 (87.50)	36 (81.80)	1.00	7 (87.50)	36 (81.80)	0.69
Adequate	9 (17.30)	1 (12.50)	8 (18.20)		1 (12.50)	8 (18.20)	
Calcium							
Inadequate	48 (92.30)	8 (100.00)	40 (90.90)	0.86	8 (100.00)	40 (90.90)	0.37
Adequate	4 (7.70)	0 (0.00)	4 (9.10)		0 (0.00)	4 (9.10)	
Iron							
Inadequate	42 (80.80)	5 (62.50)	37 (84.10)	0.34	5 (62.50)	37 (84.10)	0.15
Adequate	10 (19.20)	3 (37.50)	7 (15.90)		3 (37.50)	7 (15.90)	
Zinc							
Inadequate	40 (76.90)	5 (61.50)	35 (79.50)	0.55	4 (50.00)	36 (81.80)	0.00*
Adequate	12 (23.10)	3 (37.50)	9 (20.50)		4 (50.00)	8 (18.20)	
Diversity of Children's Intake							
Not diverse	15 (28.80)	1 (14,30)	14 (35.00)	0.28	6 (75.00)	26 (66.70)	0.64
Diverse	32 (61.50)	6 (85.70)	26 (65.00)		2 (25.00)	13 (33.30)	

Characteristics	N	Stunting		p-value	Underweight		p-value
		Stunting	Not stunting		Underweight	Not underweight	
		n (%)	n (%)		n (%)	n (%)	
Mother's Dietary Quality and Diversity							
Energy							
Inadequate	43 (82.70)	5 (62.50)	38 (86.40)	0.10	6 (75.00)	37 (84.10)	0.53
Adequate	9 (17.30)	3 (37.50)	6 (13.60)		2 (25.00)	7 (15.90)	
Protein							
Inadequate	44 (84.60)	6 (75.00)	38 (86.40)	0.41	7 (87.50)	37 (84.10)	0.81
Adequate	8 (15.40)	2 (25.00)	6 (13.60)		1 (12.50)	7 (15.90)	
Fat							
Inadequate	35 (67.30)	6 (75.00)	29 (65.90)	0.61	7 (87.50)	28 (63.60)	0.18
Adequate	17 (32.70)	2 (25.00)	15 (34.10)		1 (12.50)	16 (36.40)	
Carbohydrate							
Inadequate	49 (94.2)	7 (87.50)	42 (95.50)	0.38	0 (0,00)	42 (95.50)	0.37
Adequate	3 (5.80)	1 (12.50)	2 (4.50)		8 (100.00)	2 (4.50)	
Iron							
Inadequate	0 (0.00)	0 (00)	0 (0.00)			0 (0.00)	
Adequate	52 (100)	8 (100.00)	44 (100.00)			44 (100)	
Diversity of Mother's Intake							
Low intake diversity	15 (28.80)	1 (12.50)	14 (31.80)	0.27	3 (37.50)	12 (27.30)	0.56
Moderate intake diversity	37 (71.20)	0 (0.00)	0 (0.00)		5 (62.50)	32 (72.70)	
High intake diversity	0 (0.00)	7 (87.50)	30 (68.20)		0 (0.00)	0 (0.00)	

a Chi-square analysis, *p-value <0.05; $^{+}$p-value < 0.10

Table 2. Spearman's correlation between milk and sugar-sweetened condensed milk consumption with children height and weight

Characteristics	Children's height for age z-score		Children's weight for age z-score		Intake Adequacy			
					Protein		Calcium	
	p-value	r	p-value	r	p-value	r	p-value	r
Quantity of protein intake	0.07^{+}	0.27	0.16	0.21				
Quantity of calcium intake	0.12	0.23	0.13	0.22				
Frequency of consumption of milk	0.05^{+}	0.28	0.09^{+}	0.25	0.01*	0.44	0.00*	0.74
Frequency of consumption of sweetened condensed milk	0.01*	-0.34	0.01*	-0.38	0.36	0.14	0.43	0.12

*p-value <0.05; $^{+}$p-value < 0.10

The current findings show that the majority of stunting and underweight children have parents who did not reach the highest formal education (college) and low-income families. Previous studies have observed an increased risk of stunting and underweight in families with lower formal education and lower income. Education was also known to be positively associated with paternal employment (24), which indicates that higher education may lead to better occupation. In this study, even though the majority of undernutrition children have fathers with permanent occupation, it is found that they did not earn high incomes. Moreover, stunting and underweight children mostly have non-working mothers. The current result shows that there was a correlation between the mother's income and children's underweight status. Families with lower income were more challenged to acquire better education, health services, sanitation, and food access (25).

In this research population, maternal age at pregnancy and birth interval were not associated with stunting and underweight children. Previous studies have reported that women who were pregnant at an early age were more prone to give birth stunting and underweight children because they also need nutrition for their body development which causes an infant they are carrying did not acquire adequate nutrition (26,27). Mothers also need adequate time to recover and replenish their nutritional reserves that are depleted after pregnancy, delivery, and lactation, so that their children will also acquire an adequate intake for growth and build an immune system (28,29)

Unlike other previous findings in Jawa Tengah, Jawa Timur, and Ambon populations (30), this study shows no association between sanitation as well as children's disease history and nutritional status. Nevertheless, the result of univariate analysis on sanitation variables demonstrates that all of the stunting and underweight children were living in poor sanitation. The findings of children's disease history showed the majority of the stunting and underweight children had a disease history in the last month. An environment that is not properly sanitized can cause infectious diseases that can interfere with the absorption of nutrients and reduce appetite, causing stunting (30,31).

In line with previous studies, the current result shows no significant association between mother's knowledge and exclusive breastfeeding with stunting and underweight (32–34). However, the majority of stunting and underweight children were whose mothers had poor knowledge, which apparently affects breastfeeding practices. In this study, all of the stunting children did not receive exclusive breastfeeding. Mothers with good knowledge will have a better understanding of how to perform feeding practices, food choices, balanced diet, exclusive breastfeeding, and health care for their child that could prevent undernutrition outcomes in children (35,36). Breast milk provides a necessary nutrient that an infant needs for body growth, as well as cognitive development. Breast milk also increases an infant's immune system and prevents infant from experiencing infectious diseases (37). The current study showed that the majority of underweight children were coming from exclusive breastfeeding groups which could occur because of the difference in breastfeeding practice, including the quantity and quality (34).

This study found there were significant and potential associations between children's adequate zinc, fat,

and milk intake with nutritional status. This result is in line with a previous study that found a significant correlation between protein, calcium, and zinc intake with stunting incidence of children under five years (38). Bueno's study (2008) also found that consumption of foods that are low in calcium at a growing age will impact growth, especially in the future or adulthood (39). Research in Bengkulu that was conducted by Yuli et al (40) also found that there was a relationship between intake of energy, protein, fat, carbohydrates, and zinc in the incidence of stunting under five (40).

Zinc, protein, calcium, and fat are nutrients that are important for the growth of children. Zinc is a micronutrient that functions for immunity. Zinc has functions in T cells and in the formation of antibodies by B cells. Zinc also has functions in bone metabolism, fulfillment of free radicals, oxygen transport, formation of membrane structure and function, and blood clotting processes. Children's intake of adequate zinc such as zinc will interfere with a child's growth, especially during the growth period which will have an impact on stunting (41). As well as zinc, the lack of protein in the long term can result in the cessation of the growth process. Bone growth in humans begins with the synthesis of cartilage, which then undergoes ossification. Cartilage synthesis requires sulfur, while the body obtains sulfur through the catabolism of the amino acid methionine and cysteine. The amino acids themselves are protein building blocks, so adequate protein intake or foods containing high sulfur amino acids are needed for children (42).

Calcium also has an important role in the process of growth of a person, especially in children. Calcium is the main element of bones and teeth (43). Calcium is an important element of bone formation, in particular in the bone mineralization process. Bone density, bone size, and height can be used as indicators of the quality of growth and bone formation (44). If someone has a deficiency of calcium, then the mineralization of bones and teeth will be disrupted, and growth will also stop. Adequate calcium supply from food is essential to optimize the process growth and maintenance of calcium balance in optimal body (43). Moreover, fat also has a role in children's growth. Fat as a source of energy produces 9 kcal per gram in the body. In addition, fat is also a reserve most of the energy is stored inside the body, which is stored in the subcutaneous tissue (subcutaneous), around the internal organs intramuscularly (45). Children with low fat intake are at risk stunting higher than toddlers who have sufficient fat intake (46).

Meanwhile, the consumption of SCM is inversely correlated with HAZ and WAZ, which means that higher SCM consumption is found in children with lower HAZ and WAZ. SCM is obtained by removing some of the water from the milk fresh or recombined milk powder through the process of evaporation (evaporation) so that a certain concentration is obtained. After the heating process is complete, sugar is added to give it a sweet taste and help the thickening process as well as a natural preservative. The sugar content of SCM is high as a result of this process. As with powdered milk, the use of water is not the right dose, and contamination can be harmful to consumers. SCM is more appropriate to be consumed as a mixture of food ingredients because of its very high sugar (average 40%) (46). The wrong perception of society is SCM is milk that is good for growth and given to children as a substitute for breast milk / as follow-up milk after breastfeeding or

complementary feeding, which in this case may be caused by wrong perception and ignorance of the impact of SCM which can cause diabetes, obesity, and malnutrition (47) (11). According to a 2015 study by Palupi, children aged 5 to 6 who consumed the most SCM had moderate acute malnutrition and severe acute malnutrition, measured by WHZ of less than -2 and -3 SD. This could occur because children might consume fewer nutrient-dense foods and beverages as a result of the high sugar content and reduction in the other nutritious intake (47,48).

This study has several limitations including a relatively low number of sample sizes for the population and only represents three integrated healthcare centers. This cross-sectional study also could not show a causal relationship between independent and dependent variables. However, this study is able to give a focused insight into the participating integrated healthcare centers. This study also provided data with standardized measurement tools and involved trained operators to measure body weight and height. The questionnaires, including the SQ-FFQ used in this study also tested for validity and reliability. The dietary recall is also administered by trained operators. Therefore, several risks of bias from tools and operators can be reduced. Furthermore, the current study assessed a wide range of variables and was able to give information from a variety of perspectives. The current result shows the importance of the choice of complimentary beverages for children to their growth, although studies with wider populations and longitudinal timelines would provide better conclusions. Further quantitative study also advised to obtain personal reasoning and more information related to the role of socioeconomic conditions to the children's dietary choices.

Conclusion

In conclusion, the results confirmed a positively significant association between mothers' income and children's intake with nutritional status. Education about children's nutritional status and complimentary beverage consumption to mothers with children under 5 years old, as well as mothers' support systems and cadres, are necessary to increase mothers' knowledge and encourage them to feed their children dairy products after 6 months. Sociodemographic, exclusive breastfeeding history, sanitation, and food intake also might influence the likelihood of stunting and being underweight in children. Further interventions that can be addressed include comprehensive sanitation programs in the home environment and massive education about feeding practices, particularly among low-income families. This study may be a trigger for further qualitative research, such as on SCM. We also suggest another study in a wider population.

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