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Low access to animal protein, oils and snack caused stunted among 25-59 months old children in Jakarta urban slum during pandemic

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Abstract

Children aged 23-59 months were disproportionately affected by stunting during the COVID-19 pandemic due to economic hardship. This study aimed to investigate the association between food expenditure and the type of food source with stunting among under-five children in Jakarta slums. A comparative cross-sectional design was employed to analyze data from 42 pairs of under-five children and their mothers. Information on household expenditure and food consumption was collected through questionnaires. Statistical comparisons between stunted and non-stunted groups were conducted using independent t-tests and the Mann-Whitney U test. The study revealed a significantly lower overall food expenditure among stunted children compared to their non-stunted counterparts. Notably, spending on animal-based foods and snacks was considerably lower in the stunted group. These findings were confirmed by child nutrient intake, which showed significant differences in energy and macronutrient consumption from animal sources between the two groups. The results highlight the critical role of food expenditure and dietary quality in preventing stunting, particularly in vulnerable populations. In challenging economic conditions, prioritizing allocations for nutrient-dense foods, such as those derived from animal sources, is essential.

Keywords: Animal food, COVID-19, Food expenditure, Nutrient intake, Stunting.

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1. Introduction

Indonesia, like many other countries, continued to struggle with the COVID-19 pandemic until early 2022. This period was marked by a third wave of infections, peaking in February, with DKI Jakarta as the epicenter. Despite the ongoing health crisis, the nation also faced the persistent challenge of stunting. The 2021 National Child Nutrition Status Survey (SSGI)

reported a stunting prevalence of 24.4% nationwide and 16.8% in Jakarta [1]. These figures underscore the government's ongoing struggle to meet its target of reducing stunting to 14% by 2024, as outlined in Presidential Regulation 72/2021.

The COVID-19 pandemic had serious consequences, including a significant economic downturn. Job losses were a prominent impact, with unemployment surging by 2.56 million people until the end of 2020 [2]. This economic upheaval had a detrimental effect on family resilience, particularly in terms of health and nutrition. Food insecurity disproportionately affected low-income households, especially those residing in urban slums. Jakarta, with 445 slum hamlets concentrated in North Jakarta [3], was particularly vulnerable. Research indicates a strong correlation between economic conditions, specifically family expenditure, and the prevalence of stunting [4].

The COVID-19 pandemic severely disrupted healthcare services, particularly at the community level. Prioritizing funding for COVID-19 prevention and treatment led to a reallocation of resources away from stunting prevention, resulting in suboptimal care. This neglect could have long-lasting consequences for stunting rates if left unaddressed. Building health resilience, especially at the household level, is essential to mitigate these challenges. Research has shown a direct link between household food insecurity and stunting [5], highlighting the importance of food security in improving child nutrition [6].

Between 2019 and 2021, Indonesia faced significant food insecurity challenges amidst the COVID-19 pandemic [7]. A substantial proportion of households (22.2% to 27.2%) reported food shortages and reduced consumption due to financial constraints, including rising prices, decreased income, and job losses [7]. This underscores the critical role of income in determining food and nutrition security during economic crises. Furthermore, given the established link between diet and child growth [8], there are fewer studies analyzing household food expenditure during COVID-19 that affect children. Therefore, this study examines the relationship between food expenditure, consumption patterns, and stunting in Jakarta slums during this period.

2. Methods

2.1. Study Design and Population

This cross-sectional comparative study involved mothers and children aged 25-59 months residing in an urban slum in Kebon Bawang Village, North Jakarta, from February to June 2022. The village is classified as a light slum area based on Central Bureau of Statistics (BPS) data. This research is part of a broader study analyzing gut microbiota composition in stunted children under five within the same slum. Sample size determination was based on bacterial ratio differences between stunted and non-stunted children, calculated using an equation. The total sample consisted of 42 children under five, divided into a group of 21 stunted children and a group of 21 non-stunted children [9].

$$n_1 = n_2 = 2\left[\frac{(Z\alpha+Z\beta)SD}{X_1-X_2}\right]^2$$

$n_1 = n_2$ = *the minimal sample size*
$Z\alpha$ = 1.96 for an α of 0.05
$Z\beta$ = 0.842 for 80% power
$X_1 - X_2$ = *the mean between groups*
SD = the standard deviation between groups

Study participants were categorized into stunted and non-stunted groups. Children aged 2-5 years with a height-for-age Z-score (HAZ) ≤ -2 SD were classified as stunted. The non-stunted group comprised children with -1 SD ≤ HAZ ≤ 2 SD. While the WHO defines normal nutritional status as -2 SD ≤ HAZ ≤ 2 SD, a stricter HAZ range of -1 SD ≤ HAZ ≤ 2 SD was used for the non-stunted group to ensure clear differentiation from the stunted group.

2.2. Study Variable

Data were collected through a door-to-door household survey encompassing food expenditure, nutrient intake, and socioeconomic factors. Food expenditure, categorized into staple foods, animal-based foods, plant-based foods, vegetables, fruits, oils, snacks, and beverages, was assessed. This classification aligns with the Gibson Semi-Quantitative Food Frequency Questionnaire (SQ FFQ) used for nutrient intake calculations [10]. The percentage of food expenditure allocated to each category was determined by dividing the expenditure for each food group by total household expenditure. Socioeconomic variables included gender, parental occupation (categorized as unemployed, laborer, self-employed, private employee, civil servant, or other for fathers and employed or unemployed for mothers), and parental education (classified as low—elementary to junior high school—or high—high school and above).

2.3. Statistical Analysis

Data were processed using SPSS Statistics version 27.0 (IBM Corp, Armonk, NY, USA). To compare food expenditure and nutrient intake between stunted and non-stunted groups for each food category, continuous data were analyzed. Initially, the Mann-Whitney U test was conducted to assess data distribution. As the data were determined to be normally distributed, the independent t-test was employed for subsequent analyses.

2.4. Ethical Consideration

Ethical consideration has been approved by the Ethical Committee of the Faculty of Medicine University of Indonesia with number KET 22/UN2.F1/ETIK/PPM.00.02/2021. Each participant must fill out an informed consent form signed by their guardian.

3. Results

3.1. Participants Characteristics

Participant characteristics are shown in Table 1. The stunted group comprised 57.1% females (n=12), while the non-stunted group had a slightly higher proportion of males (66.7%, n=14). Over 30% of fathers in both groups were employed in the private sector. However, unemployment among fathers was more prevalent in the stunted group (9.5%). Most mothers in both groups were not employed (76.2% and 71.4% for the stunted and non-stunted groups, respectively).

Table 1.
Characteristics of Subject.

Characteristics	Stunted	Non-Stunted
	n(%)	n(%)
Gender		
Male	9 (42.9)	14 (33.9)
Female	12 (57.1)	7(66.7)
Father's occupation		
Doesn't work	2(9.5)	0(0.0)
Laborer	5(23.8)	2(9.5)
Self-employed	5(23.8)	4(19.0)
Private employees	7(33.4)	13(61.9)
Civil servant	0(0.0)	1(4.8)
Other	2(9.5)	1(4.8)
Mother's occupation		
Doesn't work	16(76.2)	15(71.4)
Working	5(23.8)	6(28.6)
Father's Education		
Low	4(19.0)	2(9.5)
High	17(81.0)	19(90.5)
Mother's Education		
Low	13(59.1)	8(40.9)
High	8(40.9)	13(59.1)
Number of Family Member (Min.-Max.)	(3 – 9)	(4 – 8)

Table 1 indicated that most fathers in both groups had a high level of education (81.0% stunted, 90.5% non-stunted). However, mothers in the stunted group were more likely to have a lower education level (59.1%) compared to mothers in the non-stunted group (68.2%). The average family size was similar between the two groups, with a mean of five members. The stunted group had a family size range of 3 to 9 individuals, while the non-stunted group ranged from 4 to 8 members.

3.2. Household Expenditure and Nutrient Intake

Household expenditure was shown in Table 2. Both stunted and non-stunted groups allocated a larger proportion of their budget to food compared to non-food items. Overall, the non-stunted group exhibited higher expenditure per family member across all expenditure categories. A statistically significant difference in monthly food expenditure per family was observed between the two groups (p=0.046), with the non-stunted group spending an average of 439,938 IDR compared to 419,356 IDR for the stunted group. Moreover, the non-stunted group displayed greater access to most food groups. Table 3 reveals significant differences in food expenditure for animal-based foods (p=0.004) and snacks (p=0.026) between the two groups.

Table 2.
Comparison of Household Expenditure of Stunted and Non-Stunted.

Variable	Stunted	Non-Stunted	P-value
Food expenditure per number of family per month (IDR)	439.94 ± 193.46	519.36 ±102.18	0.046[b]
Non-food expenditure per number of family per month (IDR)	407.59 ± 275.41	418.09 ± 189.57	0.660[b]
Total expenditure per number of family members per month (IDR)	842.22 ± 439.58	946.14 ± 298.48	0.134[b]
Percentage of food expenditure per number of family per month (%)	55.1 ± 11.7	57.4 ± 11.7	0.526[a]
Percentage of food expenditure per number of family per month (%)	45.9 ± 10.6	45.1 ± 19.9	0.606[b]

Note: Data analyzed using [a]Independent *t*-test; [b]Mann-Whitney U test.

Table 3.
Food Expenditure by Type of Food

Food Expenditure (IDR)	Stunted	Non-stunted	P-value
Staple food	112,462 ± 40.87	120,877 ± 32.70	0.308[b]
Animal food	131,382 ± 82.38	188,787 ± 53.26	0.004[b]
Plant food	22,195 ± 16.04	27,619 ± 15.50	0.144[b]
Vegetables	36,003 ± 28.23	37,380 ± 27.69	0.686[b]
Fruits	16,639 ±10.81	38,952 ± 24.43	0.890[b]
Oils	16,639 ± 10.81	16,922 ± 10.53	0.880[b]
Snacks	53,250 ± 32.18	73,420 ±23.72	0.026[a]
Beverages	20,753 ± 15.41	17,796 ±10.53	0.860[b]

Note: Data analyzed using [a]Independent *t*-test; [b]Mann-Whitney U test

Table 4 showed nutrient intake by food group. Overall, the stunted group consumed lower amounts of nutrients from all food categories compared to the non-stunted group. Notably, significant differences in energy (p=0.008), protein (p=0.024), fat (p=0.012), and carbohydrate (p=0.024) intake from animal-based foods were observed between the two groups.

Table 4.
Nutrient Intake Based on Type of Food.

Nutrient	Staple Food	Animal Food	Plant Food	Vegetables	Fruits	Oils	Snacks	Beverages
Energy (Cal)								
Stunted	504 ± 137	261 ± 123	34 ± 25	10 ± 5	39 ± 21	79 ± 25	74 ± 51	30± 32
Non-stunted	575 ± 145	370 ± 138	52 ± 69	8 ± 4	42 ± 49	93 ± 19	90 ± 87	34± 39
P-value	0.112[a]	0.008[b]	0.496[2]	0.195[a]	0.385[b]	0.036[b]	0.870[b]	0.588[b]
Protein (g)								
Stunted	9.6 ± 2.4	16.9 ± 7.9	2.7 ± 1.9	0.5 ± 0.3	0.5 ± 0.3	0.0 ± 0.0	1.5 ± 1.4	2.2 ± 9.8
Non-stunted	10.9 ± 2.7	21.6 ± 7.3	4.1 ± 4.7	0.3 ± 0.2	0.9 ± 2.5	0.0 ± 0.0	1.5 ± 2.1	1.7 ± 7.4
P-value	0.687[a]	0.024[b]	0.406[b]	0.155[b]	0.279[b]	0.311[b]	0.450[b]	0.638[b]
Fat (g)								
Stunted	2.2 ± 0.7	18.1 ± 8.3	2.4 ± 1.9	0.2 ± 0.2	1.4 ± 1.3	8.9 ± 2.8	3.0 ± 3.1	0.2 ± 0.5
Non-stunted	2.6 ± 1.8	25.4 ± 9.3	3.5 ± 4.8	0.3 ± 0.5	2.1 ± 3.0	10.5 ± 2.2	3.6 ± 5.1	0.2 ± 0.8
P-value	0.571[b]	0.012[a]	0.372[b]	0.465[b]	0.268[b]	0.036[b]	1.00[b]	0.977[b]
Carbohydrate (g)								
Stunted	106.4 ± 30.9	7.4 ± 4.9	1.2 ± 0.8	1.6 ± 0.8	8.7 ± 4.8	0.01 ± 0.05	10.2 ± 8.6	6.2 ± 6.8
Non-stunted	120.4 ± 33.5	13.6 ± 11.0	1.7 ± 1.9	1.5 ± 0.9	7.7 ± 3.6	0.02 ± 0.07	12.9 ± 14.1	6.6 ± 6.5
P-value	0.166[a]	0.024[a]	0.473[b]	0.694[a]	0.463[a]	0.311[b]	0.753[b]	0.753[b]

Note: Data analyzed using [a]Independent *t*-test; [b]Mann-Whitney U test.

4. Discussion

4.1. Participant Socio-Economy

This study examined household expenditure allocation, particularly food spending, among families with stunted and non-stunted children under five residing in Jakarta slums during the COVID-19 pandemic. The pandemic significantly disrupted social and economic conditions. A study by UNICEF, UNDP, PROSPERA, and SMERU Research Institute reported a gradual decline in household income across 34 Indonesian provinces between 2020 and early 2021 [11]. Moreover, the pandemic exacerbated unemployment and poverty [12]. Research conducted in the Bogor region found that job losses among household heads heightened family vulnerability [13].

The non-stunted group predominantly comprised fathers employed in the private sector, while the stunted group included a higher proportion of unemployed fathers likely impacted by the COVID-19 pandemic. Previous research has linked occupational status to family income, which in turn influences food choices and purchasing decisions [14]. For example, a study in Kupang Regency, Indonesia, reported a 4.043 times higher risk of stunting among children with unemployed fathers compared to those with employed fathers [15]. Consistent with other studies, the majority of mothers in the current study were housewives.

Parental education levels were assessed based on the highest degree attained. While most fathers held higher education degrees, mothers in the non-stunted group were more likely to have higher educational qualifications compared to those in

the stunted group. Research suggests that parental education, particularly maternal education, influences food choices and child nutrition [16-18].

Family size, measured by the number of household members, is another potential factor influencing food availability. Previous studies have linked larger family size to increased risk of stunting [19]. However, in this study, the average family size was similar between the stunted and non-stunted groups, with a mean of five members per family.

4.2. Low Access of Food and Nutrient Intake among Stunted Children

Both stunted and non-stunted groups allocated a larger proportion of their monthly budget to food compared to non-food items. Food expenditure is a key indicator of household food security. Generally, households with adequate food expenditure are at a lower risk of stunting [20].

The results of this study illustrated that in both groups allocated a greater proportion of their budget to food compared to non-food expenses. The stunted and non-stunted groups spent approximately 55.1% and 57.4% of their monthly income per person on food, respectively. Consistent with these findings, a study by the SMERU Research Institute reported increased food expenditures during late 2020 and early 2021 [11]. Given that households spending 50.0-65.0% of their income on food are classified as having moderate food insecurity [21], both groups in this study exhibited this status. Food insecurity is linked to adverse health outcomes, particularly among children. A study in Kolkata, India, revealed a strong association between household food insecurity and childhood stunting, with over 20% of under-five children in food-insecure households experiencing stunting [22].

Non-stunted children had higher monthly food expenditures per family compared to stunted children. A notable finding was the significant difference in spending on animal-based foods and snacks between the two groups, with non-stunted families allocating more to these categories. Adequate household food expenditure is crucial for overall family nutrition. Previous research has established a link between monthly food expenditure and stunting prevalence [23].

Despite Indonesia's middle-income status, it ranks fifth globally in the burden of stunted children [24]. Nutrient intake is a critical determinant of child nutritional status. Previous research has linked energy and macronutrient intake to stunting [8]. This study found no significant differences in energy and macronutrient intake between the two groups across most food categories, except for animal-based foods and fats. This similarity may be attributed to the shared geographic location and potentially similar food availability for both groups. Nutrient intake patterns aligned with food expenditure levels, consistent with findings from other studies linking food expenditure to nutritional intake [25].

The non-stunted group demonstrated greater consumption of animal-based foods compared to the stunted group. Significant differences in energy, protein, fat, and carbohydrate intake from animal sources were observed between the two groups. Protein plays a crucial role in tissue maintenance, repair, and growth, and can also serve as an energy source when carbohydrate and fat intake is insufficient [26]. The recommended dietary allowance (RDA) for protein is 20g for children aged 24-48 months and 25g for children aged 48-60 months [27].

While all groups met protein intake requirements across all food groups, protein quantity alone does not guarantee optimal growth. Protein quality, determined by amino acid composition, is crucial for absorption and utilization. Animal-sourced proteins generally offer a superior amino acid profile compared to plant-based proteins. Previous research has reported lower essential amino acid intake in stunted children [28, 29]. Additionally, stunting can be attributed to type II nutrient deficiencies, including protein and amino acids, which disrupt growth by conserving the nutrient rather than utilizing it for tissue building [30]. Therefore, further investigation into protein quality and its impact on stunted children is warranted.

This study's strength lies in its focus on a slum community during the pandemic, providing insights into family resilience strategies for improving child nutrition under challenging circumstances. However, a limitation is the lack of pre-pandemic data for comparison.

5. Conclusion

This study revealed lower food expenditures among stunted compared to non-stunted children. Moreover, the stunted group allocated significantly less to animal-based foods. These findings align with nutritional intake data, as the stunted group consumed less animal protein. Given the crucial role of animal protein in child growth and development, these results emphasize the importance of dietary quality over quantity. The study highlights the disparities in food expenditure and consumption between stunted and non-stunted children in a slum setting. Prioritizing animal-based protein intake, even amidst limited resources, is essential for preventing stunting. Public health interventions should focus on educating families about the importance of nutrient-dense foods and providing practical strategies for incorporating them into their diets.

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