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The Determinants of Stunting in the Under-five in Three Municipalities in the Special Capital Region of Jakarta

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Abstract

The COVID-19 pandemic has impacted the global decline in public health status. This study aimed to analyze the determinants of stunting in the under-five in three municipalities in the Special Capital Region of Jakarta, Indonesia. A cross-sectional study was conducted in August-December 2020 with 460 pairs of mothers and children selected by simple random sampling. Stunting was measured using a conventional anthropometric index (length/height-for-age), and anthropometric failure was measured using the Composite Index of Anthropometric Failure. The prevalence of stunting, underweight, and wasting was 41.5%, 35%, and 19.8%, respectively, and 62% of the under-five experienced anthropometric failure. The dominant factor associated with stunting was immunization record (p-value = 0.011; AOR = 2.360; 95% CI = 1.218–4.573). Children who did not receive complete basic immunization were at a 2.4 times greater risk of stunting than children who received complete basic immunization. The dominant factors associated with underweight, wasting, and anthropometric failure were the father's educational level, mother's occupation, and balanced nutrition practice. Increasing coverage of complete basic immunization, improving balanced nutrition practices and socioeconomic conditions is necessary to prevent undernutrition, especially stunting.

Keywords: balanced nutrition practice, under-five, stunting

Introduction

Stunting is a risk factor contributing to child mortality and marks inequality in human development. It also indicates growth and development failure among the under-five.[1,2] The prevalence of stunting has decreased in recent decades worldwide. However, the stunting rate is still high, with an estimated 21.3% of the under-five globally experiencing stunting in 2019.[3] A scientific study has shown that the stunting rate is still high and rate of decline in stunting rates differs in each country.[3]

A study conducted in Maharashtra, India, in 2020 reported that the prevalence of stunting was high (45.9%).[3] The main factors causing undernutrition in urban slum areas are stunting associated with sex and type of family, wasting caused by exclusive breastfeeding, and underweight caused by low family income.[4] A study in Bangladesh also showed that the rate of undernutrition is high in urban areas (45%).[4] Undernutrition occurs among children from low-income and low education level families and whose mothers have malnutrition.[5]

Stunting is also a public health problem in Indonesia. Based on the results of the 2021 Indonesian Nutritional Status Survey, the prevalence of different types of undernutrition: stunting, underweight, and wasting, is 16.8%, 13.7%, and 6.9%, respectively, in urban areas, which includes the Special Capital Region of Jakarta.[6] Widyaningsih, *et al.*, reported that the fifth wave of the Indonesian Family and Life Survey showed that the prevalence of stunting in the under-five is higher in urban (33.7%) than in rural areas (25.0%) and that this condition is associated with economic problems and household expenditures.[7] Geographic and socioeconomic disparities are also factors causing undernutrition.[8]

Therefore, efforts to identify the problem of stunting and other problems related to undernutrition are needed so that appropriate interventions can be carried out according to the type and causes of undernutrition. This study aimed to analyze the determinants of stunting in the under-five in three municipalities in the Special Capital Region of Jakarta, Indonesia. The stunting rate in this region could indicate the health problems in Indonesia, as this region is the center of development,

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especially in the public health sector. In addition, the Special Capital Region of Jakarta could represent the diversity of sociodemographic characteristics of the population of Indonesia. As a result, this study hoped to strengthen the scientific evidence on the determinants of stunting, which can be used as a basis for proper preventive interventions to reduce the prevalence of stunting in Indonesia and globally.

Method

A cross-sectional study was conducted in August-December 2020 in three municipalities in the Special Capital Region of Jakarta, Indonesia, and 460 pairs of mothers and the under-five participated in this study. This study was conducted during the COVID-19 pandemic, hence data collection was carried out during home visits and complied with the established health protocols. The study was conducted after obtaining permission from the health office in the study location. Participants were selected using simple random sampling from three municipalities with high stunting rates compared to other municipalities in this province based on the 2021 Indonesian Nutrition Status Survey: Central Jakarta (19.7%), North Jakarta (20.4%), and East Jakarta (13.4%).[6]

The number of participants was calculated using the one-sample test of proportions with a two-sided alternative hypothesis (Formula 1) using the following assumptions: 5% level of significance, 90% power, 32.16% stunted children in Indonesian urban areas (P_0) based on previous studies, and a Pa 25% smaller than P_0, with this figure referring to data on stunting in the Special Capital Region of Jakarta in 2020.[9] An additional 10% was added to the generated number in anticipation of participants dropping out during the study. Therefore, the calculated minimum sample size was 450 mother-child pairs.

The subdistricts selected for this study were in an area designated as a stunting locus by the Provincial Health Office.[6] Eligible mother-child pairs met the inclusion and exclusion criteria. The inclusion criteria were: 1) mothers at least aged 19 years having children aged 0-59 months, 2) mothers living for at least one year in the study location so that they had the characteristics and lifestyle of urban communities, and 3) babies born at term (37-42 weeks of gestation) and with no congenital disabilities identified since birth. The sample exclusion criteria were the under-five experiencing serious diseases, including cancer and COVID-19, which required the child to be isolated or provided intensive health care. The sample selection procedure is shown in Figure 1.

Data collection was carried out by enumerators who were graduates in public health nutrition and trained in data collection techniques and procedures. The validity and reliability tests for this questionnaire were carried out in a cohort of mothers with appropriate characteristics who lived in other subdistricts (excluding study locations), with as many as 10% of the total participants. Analysis was performed using Pearson product-moment correlation and item correlation–total correlation. The r count value was matched with the product moment r table (0.291) at a significance level of 5%. The corrected item-total correlation for each question was between 0.715 and 0.742 (r count value greater than r table), and Cronbach's alpha was 0.877.

The nutrition knowledge questionnaire consisted of 20 questions covering four principles of balanced nutrition, stunting, and other undernutrition (score range of 0–20). Every correct answer was scored 1, and incorrect answers were scored of 0. The number of

$$n = \frac{\{Z_{1-\alpha/2}\sqrt{P_0(1-P_0)} + Z_{1-\beta}\sqrt{P_a(1-P_a)}\}^2}{(P_a - P_0)^2}$$

Formula 1. Sample Size Estimation

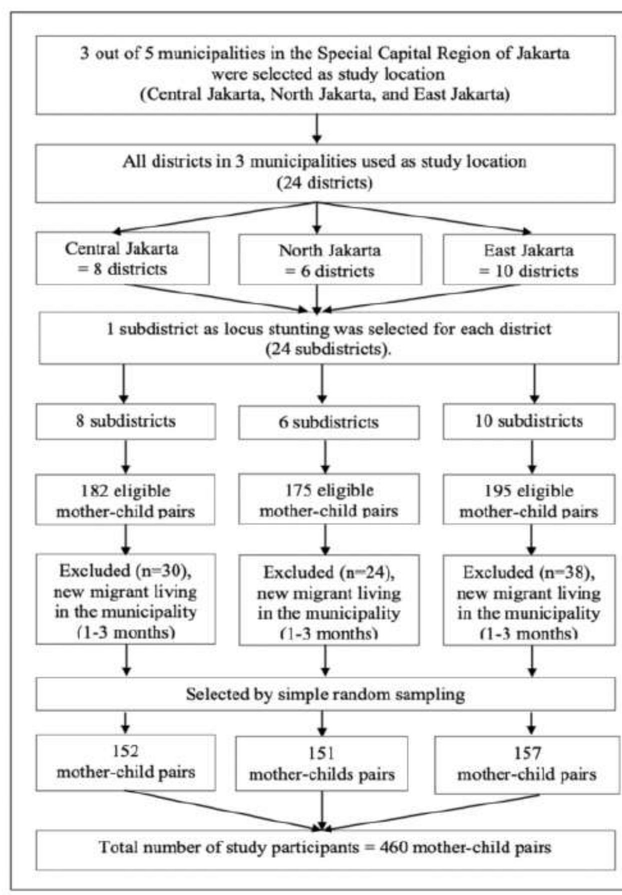

Figure 1. Participant Recruitment Procedures

correct answers was divided by the number of questions multiplied by 100% (number of correct answers/20*100%), so that the score range was 0–100. The scores were then categorized based on the mean value into 1) poor nutritional knowledge (score <70) and 2) good nutritional knowledge (score ≥70).

Parenting style in feeding included two dimensions: 1) demandingness (authoritarian parenting), which referred to the extent to which parents control their child's eating behavior, and 2) responsiveness (supportiveness parenting), or parents' provision of warmth, acceptance, and involvement in feeding. The Nutrition Parenting Questionnaire was adapted from a previous study.[8] It consisted of 24 questions using a 5-point Likert scale (never = 0, rarely = 1; sometimes = 2; often = 3; always = 4) with a total score range of 0–96. There were 17 questions to assess demandingness parenting and 7 to assess responsiveness parenting.

The scores on all questions were summed and categorized based on the median score (62) into 1) bad nutritional parenting (score <62) and 2) good nutritional parenting (score ≥62).[10] Balanced nutrition is a daily diet that contains nutrients of the type and in the amount required by the body. It was categorized into 1) less (practices two or fewer of the four principles of balanced nutrition practices), 2) quite good (practices three of the four principles), and 3) good (practices all four principles). Sanitation and hygiene measures included the availability of toilet facilities at home, clean water sources, and clean defecation habits. The questionnaire used was the 2018 Indonesian Basic Health Research questionnaire developed by the Ministry of Health of the Republic of Indonesia.[11]

Nutritional status was assessed using a conventional anthropometric index consisting of weight-for-age (WAZ), height/length-for-age (HAZ), and weight-for-height/length (WHZ). The composite index of anthropometric failure (CIAF) measures nutritional status by combining these three anthropometric indices (WAZ, HAZ, and WHZ).[12] The child's age was calculated in months using the date, month, and year of birth. The ages were categorized into 1) 0–24 months and 2) 25–59 months. Measurement of body length/height was performed twice using a seca digital length board or a stature meter with a level of accuracy of 0.1 cm. The two measurements were averaged; in all cases, the difference between the two measurements was no more than 0.2 cm. Body weight was measured using a seca digital infant scale or digital floor scale with an accuracy of 0.01 kg. Each child was weighed twice, with no more than 0.02 kg differences between the two measurements, and the results were averaged.

Data were analyzed using World Health Organization (WHO) Anthro software and categorized based on the z-score. The category of nutritional status based on the CIAF can be used to identify groups of children with normal nutritional status and six groups of children experiencing anthropometric failure (Table 1): 1) without anthropometric failure or normal (A); 2) wasting only (B); 3) wasting and underweight (C); 4) wasting, under-

Table 1. Category According Stunting and Other Undernutrition Status in the Under-five (n = 460)

Category		Aged 0–24 months	Aged 25–59 months	Male	Female	Total
		n (%)	n (%)	n (%)	n (%)	n (%)
Length/Height-for-age	Severely stunted (< -3 SD)	65 (28.8)	47 (20.1)	54 (24.8)	58 (24.0)	112 (24.3)
	Stunted (-3 SD to < -2 SD)	36 (15.9)	43 (18.4)	41 (18.8)	38 (15.7)	79 (17.2)
	Normal -2 SD to +3 SD	112 (49.6)	136 (58.1)	114 (52.3)	134 (55.4)	248 (53.9)
	Tall (> +3 SD)	13 (5.7)	8 (3.4)	9 (4.1)	12 (4.9)	21 (4.6)
Weight-for-age	Severely underweight (< -3 SD)	24 (10.6)	13 (5.6)	21 (9.6)	16 (6.6)	37 (8.0)
	Underweight (-3 SD to < -2 SD)	57 (25.2)	67 (28.6)	61 (28.0)	63 (26.0)	124 (27.0)
	Normal weight (-2 SD to +1 SD)	131 (58.0)	130 (55.6)	117 (53.7)	144 (59.5)	261 (56.7)
	Risk of overweight (> +1 SD)	14 (6.2)	24 (10.2)	19 (8.7)	19 (7.9)	38 (8.3)
Weight-for-length/height	Severely wasted (< -3 SD)	27 (12.0)	16 (6.8)	17 (7.8)	26 (10.7)	43 (9.3)
	Wasted (-3 SD to < -2 SD)	22 (9.7)	26 (11.1)	22 (10.1)	26 (10.7)	48 (10.4)
	Normal (-2 SD to +1 SD)	107 (47.3)	145 (62.0)	123 (56.4)	129 (53.3)	252 (54.9)
	Possible risk of overweight (> +1 SD to +2 SD)	29 (12.8)	24 (10.3)	26 (12.0)	27 (11.2)	53 (11.5)
	Overweight (> +2 SD to +3 SD)	14 (6.2)	11 (4.7)	11 (5.0)	14 (5.8)	25 (5.4)
	Obese (> +3 SD)	27 (12.0)	12 (5.1)	19 (8.7)	20 (8.3)	39 (8.5)
CIAF	Anthropometric failure (B+C+D+E+F+Y)	153 (67.7)	132 (56.4)	133 (61.0)	152 (62.8)	285 (62.0)
	Without anthropometric failure (A)	73 (32.3)	102 (43.6)	85 (39.0)	90 (37.2)	175 (38.0)
	Wasting only (B)	17 (7.5)	14 (6.0)	11 (5.0)	20 (8.3)	31 (6.7)
	Wasting & underweight	26 (11.5)	22 (9.4)	22 (10.1)	26 (10.7)	48 (10.4)
	Wasting, underweight, & stunting (D)	6 (2.7)	6 (2.6)	6 (2.8)	6 (2.5)	12 (2.6)
	Underweight & stunting	40 (17.7)	47 (20.0)	50 (22.9)	37 (15.3)	87 (19.0)
	Stunting only (F)	55 (24.3)	37 (15.8)	39 (17.9)	53 (21.9)	92 (20.0)
	Underweight only (Y)	9 (4.0)	6 (2.6)	5 (2.3)	10 (4.1)	15 (3.3)

Notes: SD = Standard deviation; CIAF = Composite Index of Anthropometric Failure weight, and stunting (D); 5) underweight and stunting (E); 6) stunting only (F); and 7) underweight only (Y). To determine the total number of children who experienced anthropometric failure, the sum of the number of children in groups B, C, D, E, F, and Y was calculated.[12]

Three regional coordinators with a master's degree in public health covering the three studies and six data collectors or enumerators (two per region) who graduated from public health nutrition were assisted by cadres in each subdistrict to carry out direct measurements of mothers and the under-five through home visits. They were given training in measurement techniques and data collection for all the instruments used. Anthropometric measurement tools were calibrated, and the validity and reliability of the questionnaire were assessed before use. The study was conducted following the Declaration of Helsinki, a formal statement of ethical principles issued

Table 2. Characteristics of Mother, Child, and Sanitation and Hygiene According to Stunting and Other Undernutrition Conditions

Variable	Category	Total	Stunting	Underweight	Wasting	CIAF
		n (%)	n (%)	n (%)	n (%)	n (%)
Mother's age	<25 years	63 (13.7)	26 (14.0)	21 (13.5)	12 (13.5)	38 (13.7)
	25–35 years	263 (59.3)	115 (61.8)	96 (62.0)	53 (59.5)	169 (61.0)
	>35 years	124 (27.0)	45 (24.2)	38 (24.5)	24 (27.0)	70 (25.3)
Mother's education level	Uneducated	34 (7.4)	17 (8.9)	12 (7.5)	9 (9.9)	25 (8.8)
	Elementary-junior high school	130 (28.3)	59 (30.9)	54 (33.5)	30 (33.0)	85 (29.8)
	Senior high school	224 (48.7)	92 (48.2)	78 (48.4)	43 (47.2)	141 (49.5)
	Higher education	72 (15.6)	23 (12.0)	17 (10.6)	9 (9.9)	34 (11.9)
Mother's occupation	Housewife	369 (80.2)	152 (79.6)	136 (84.5)	82 (90.1)	233 (81.8)
	Working mother	91 (19.8)	39 (20.4)	25 (15.5)	9 (9.9)	52 (18.2)
Father's education level	Uneducated	16 (3.5)	3 (1.6)	4 (2.5)	4 (4.5)	7 (2.5)
	Elementary-junior high school	107 (23.2)	51 (27.2)	51 (32.5)	27 (30.7)	74 (26.5)
	Senior high school	275 (59.8)	114 (60.6)	93 (59.3)	53 (60.3)	174 (62.4)
	Higher education	62 (13.5)	20 (10.6)	9 (5.7)	4 (4.5)	24 (8.6)
Father's occupation	Unemployed	13 (2.8)	7 (3.7)	5 (3.1)	1 (1.1)	8 (2.8)
	Labor	97 (21.1)	31 (16.3)	35 (21.9)	27 (29.7)	58 (20.4)
	Other	350 (76.1)	152 (80.0)	120 (75.0)	63 (69.2)	218 (76.8)
Family income	<IDR 1,500,000 (<USD 105,152)	173 (37.6)	61 (36.3)	53 (38.1)	27 (34.2)	84 (33.9)
	≥IDR 1,500,000 (≥USD 105,152)	287 (62.4)	107 (63.7)	86 (61.9)	52 (65.8)	164 (66.1)
The number of children	>2	149 (32.4)	62 (33.0)	48 (30.8)	30 (34.1)	93 (33.3)
	≤2	311 (67.6)	126 (67.0)	108 (69.2)	58 (65.9)	186 (66.7)
Maternal and child health care	Never	8 (1.7)	0 (0.0)	1 (0.6)	1 (1.1)	1 (0.4)
	Midwife	317 (68.9)	146 (76.8)	124 (78.0)	69 (77.5)	216 (76.6)
	Doctor and others	135 (29.4)	44 (23.2)	34 (21.4)	19 (21.4)	65 (23.0)
Mother's nutrition knowledge	Bad (<70)	201 (43.7)	27 (14.1)	26 (16.1)	19 (20.9)	45 (15.8)
	Good (≥70)	259 (56.3)	164 (85.9)	135 (83.9)	72 (79.1)	240 (84.2)
Child's age	0–24 months	226 (49.1)	101 (52.9)	81 (50.3)	49 (53.8)	153 (53.7)
	24–59 months	234 (50.9)	90 (47.1)	80 (49.7)	42 (46.2)	132 (46.3)
Child's sex	Male	218 (47.4)	95 (49.7)	82 (50.9)	39 (42.9)	133 (46.7)
	Female	242 (52.6)	96 (50.3)	79 (49.1)	52 (57.1)	152 (53.3)
Child's birth weight	<2,500 gram	41 (8.9)	24 (12.6)	18 (11.2)	9 (9.9)	32 (11.2)
	≥2,500 gram	419 (91.1)	167 (87.4)	143 (88.8)	82 (90.1)	253 (88.8)
Child's immunization record	Not given	9 (2.0)	149 (78.0)	129 (80.6)	72 (81.8)	226 (80.4)
	Incomplete	74 (16.0)	42 (22.0)	31 (19.4)	15 (17.1)	54 (19.2)
	Complete	377 (82.0)	0 (0.0)	0 (0.0)	1 (1.1)	1 (0.4)
Early initiation of breastfeeding	No	79 (17.0)	30 (15.7)	31 (19.3)	18 (19.8)	51 (17.9)
	Yes	381 (83.0)	161 (84.3)	130 (80.7)	73 (80.2)	234 (82.1)
Early complementary feeding	<6 months	93 (20.2)	30 (16.8)	25 (16.2)	16 (18.6)	44 (16.4)
	≥6 months	367 (79.8)	149 (83.2)	129 (83.8)	70 (81.4)	224 (83.6)
Nutritional parenting	Bad	244 (53.0)	95 (49.7)	81 (50.3)	47 (51.6)	143 (50.2)
	Good	216 (47.0)	96 (50.3)	80 (49.7)	44 (48.4)	142 (49.8)
Balanced nutrition practice	Bad	302 (65.7)	111 (73.5)	90 (71.4)	55 (68.8)	161 (69.4)
	Pretty good	116 (25.2)	31 (20.5)	29 (23.0)	20 (25.0)	55 (23.7)
	Good	42 (9.1)	9 (6.0)	7 (5.6)	5 (6.2)	16 (6.9)
Toilet facility	No	15 (3.3)	8 (4.2)	10 (6.2)	4 (4.4)	12 (4.2)
	Yes	445 (96.7)	183 (95.8)	151 (93.8)	87 (95.6)	273 (95.8)
Defecation habit	Rivers and other	15 (3.3)	8 (4.2)	10 (6.2)	4 (4.4)	12 (4.2)
	Toilet	445 (96.7)	183 (95.8)	151 (93.8)	87 (95.6)	273 (95.8)
Drinking water source	Local government-owned water utility	195 (42.4)	91 (47.6)	77 (47.8)	39 (42.8)	130 (45.6)
	Branded bottled drinking water	134 (29.1)	50 (26.2)	42 (26.1)	21 (23.1)	76 (26.7)
	Refill drinking water	131 (28.5)	50 (26.2)	42 (26.1)	31 (34.1)	79 (27.7)

Notes: IDR = Indonesian Rupiah; CIAF = Composite Index of Anthropometric Failure by the World Medical Association used as a guideline for health study to protect the human rights of study participants.

Results

Table 1 shows that among the 460 children, the prevalence of stunting was 41.5% (24.3% of children were severely stunted and 17.2% were stunted). The prevalences of underweight, wasting, and anthropometric failure were 35%, 19.8%, and 62%, respectively. The findings indicated that stunting and other undernutrition prevalences were higher in children aged 0–24 months than in children aged 25–59 months. Table 2 shows that most children suffering from stunting (61.8%), underweight (61.9%), wasting (59.6%), and anthropometric failure (61.0%) had mothers aged 25–34 years. Most of the stunted children (60.6%) had fathers whose highest level of education was senior high school. Participants generally had toilet facility and defecated in the latrine at home. Almost half of the stunted under-five (47.6%) consumed clean drinking water processed by the Local Government-owned Water Utility.

In Table 3, the significant (p-value <0.05) factors associated with stunting are shown to be family income, maternal and child health care, birth weight, immunization record, and balanced nutrition practice. Based on binary logistic regression analysis (Table 4), the dominant factor associated with stunting was immunization record (p-value = 0.011; AOR = 2.360; 95% CI = 1.218–4.573); thus, children who did not receive complete basic immunization were at an approximately 2.4 times higher risk of stunting than children who received complete basic immunization. The father's education level was the dominant factor associated with underweight (p-value = 0.026; AOR = 1.738; 95% CI = 1.068–2.828). Fathers with low levels of education were 1.7 times more likely to have underweight children than fathers with higher education.

The mother's occupation was the dominant factor

Table 3. Factors Associated with Stunting

Variable	Stunting		Underweight		Wasting		CIAF	
	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)
Mother's age	0.966	1.027 (0.705–1.495)	1.000	0.984 (0.667–1.453)	0.029	0.573 (0.356–0.924)*	0.633	0.895 (0.612–1.308)
Mother's education level	0.129	1.375 (0.934–2.023)	0.089	1.440 (0.968–2.141)	0.130	1.476 (0.92–2.357)	0.096	1.435 (0.961–2.144)
Mother's occupation	0.881	0.938 (0.590–1.492)	0.115	1.548 (0.932–2.568)	0.012	2.612 (1.258–5.425)*	0.334	1.294 (0.812–2.063)
Father's education level	0.242	1.319 (0.863–2.018)	0.001	2.077 (1.348–3.201)*	0.030	1.792 (1.086–2.954)*	0.045	1.625 (1.034–2.553)*
Father's occupation	0.116	2.525 (0.728–8.749)	0.329	1.570 (0.472–5.226)	0.323	0.397 (0.050–3.139)	0.343	1.652 (0.432–6.313)
Family income	0.008	1.832 (1.187–2.830)*	0.005	1.936 (1.243–3.014)*	0.317	1.356 (0.802–2.291)	0.009	1.909 (1.198–3.041)*
The number of children	0.441	0.835 (0.557–1.251)	1.000	0.998 (0.655–1.520)	0.527	0.825(0.503–1.354)	0.155	0.72 (0.472–1.098)
Maternal and child health care	0.009	1.785 (1.171–2.722)*	0.009	1.854 (1.187–2.895)*	0.109	1.614 (0.936–2.781)	0.000	2.268 (1.504–3.421)*
Nutritional knowledge	1.000	1.032 (0.605–1.762)	0.381	1.323 (0.771–2.271)	0.048	1.900 (1.049–3.441)*	0.179	1.539 (0.868–2.730)
Child's age	0.207	1.293 (0.892–1.875)	0.784	1.075 (0.733–1.578)	0.375	1.266 (0.799–2.005)	0.017	1.62 (1.107–2.369)*
Child's sex	0.450	1.175 (0.810–1.703)	0.309	1.244 (0.848–1.826)	0.395	0.796 (0.501–1.264)	0.763	0.926 (0.636–1.351)
Child's birth weight	0.032	2.130 (1.111–4.086)*	0.280	1.510 (0.789–2.891)	0.873	1.156 (0.531–2.516)	0.040	2.333 (1.086–5.013)*
Child's immunization history	0.016	1.890 (1.150–3.107)*	0.336	1.324 (0.800–2.193)	0.815	1.130 (0.615–2.076)	0.057	1.750 (1.016–3.013)
Early initiation of breastfeeding	0.622	0.854 (0.518–1.407)	0.413	1.273 (0.772–2.101)	0.526	1.266 (0.705–2.273)	0.596	1.187 (0.713–1.976)
Early complementary feeding	0.181	1.514 (0.872–2.627)	0.355	1.357 (0.776–2.373)	0.210	1.579 (0.841–2.965)	0.064	1.873 (1.005–3.490)
Parenting style in feeding	0.270	0.797 (0.550–1.156)	0.445	0.845 (0.576–1.240)	0.857	0.933 (0.589–1.476)	0.140	0.738 (0.505–1.078)
Balanced nutrition practice	0.004	1.976 (1.263–3.093)*	0.059	1.601 (1.009–2.542)	0.440	1.276 (0.752–2.164)	0.015	1.742 (1.132–2.681)*
Toilet facilitiy	0.498	0.611 (0.218–1.715)	0.019	0.257 (0.086–0.765)*	0.343	0.668 (0.208–2.149)	0.114	0.397 (0.110–1.426)
Defecation habit	0.498	1.636 (0.583–4.591)	0.019	3.894 (1.308–11.597)*	0.726	1.496 (0.465–4.812)	0.114	2.520 (0.701–9.059)
Drinking water source	0.068	1.444 (0.992–2.101)	0.103	1.406 (0.955–2.070)	1.000	1.024 (0.644–1.628)	0.091	1.419 (0.966–2.086)

Notes: OR = Odd Ratio, CI = Confidence Interval, CIAF = Composite Index of Anthropometric Failure
*Statistically significant (p-value<0.05)

Table 4. Binary Logistic Regression Analysis of Factors Associated with Stunting and Other Undernutrition among the Under-five

Caracteristic		Variable	p-value	AOR	95% CI
CAI	Stunting	Immunization history	0.011	2.360	1.218–4.573
	Underweight	Father's education level	0.026	1.738	1.068–2.828
	Wasting	Mother's occupation	0.009	2.652	1.273–5.525
CIAF	Anthropometric failure	Balanced nutrition practices	0.033	2.319	1.069–5.033

Notes: AOR = Adjusted Odd Ratio, CI = Confidence Interval, CAI = Conventional Anthropometric Indices, CIAF = Composite Index of Anthropometric Failure associated with wasting (p-value = 0.009; AOR = 2.652; 95% CI = 1.273–5.525). Children with working mothers had a 2.7 times higher risk of wasting than children with housewife mothers. The dominant factor associated with anthropometric failure was balanced nutrition practices (p-value = 0.033; AOR = 2.319; 95% CI = 1.069–5.033). Children of mothers who did not practice balanced nutrition for their children had a 2.3 times higher risk of experiencing anthropometric failure than children of mothers who practiced balanced nutrition.

Discussion

This study found that the rates of stunting, underweight, wasting, and anthropometric failure were in the very high category according to the cut-off values for public health significance set by the WHO (for stunting, underweight, and wasting, the values are 40%, 30%, and 15%, respectively).[3] In this study, the prevalence of stunting in children aged 0–24 months was higher than in children aged 25–59 months. The higher stunting rate in children aged 0–24 months was associated with a lack of balanced nutrition practice. Low food intake was also associated with a higher susceptibility to infectious diseases compared to children aged 25–59 months.[13] A study in India showed that the stunting rate in children under two was 38%.[14] In addition, a study by Wali, *et al.*,[15] reported that undernutrition was higher in children aged 0–23 months than in children aged 24–59 months. The high migration rate of the rural population to the Special Capital Region of Jakarta is associated with nutritional fulfillment, limited housing, poor environmental sanitation conditions, and strain on health services that are disproportionate to the population.[16] Furthermore, the implementation of balanced nutrition practices is not optimal; specifically, there is evidence of low food diversity, unbalanced food portions, and consumption of foods high in sugar, salt, and fat.[17]

This study also revealed that stunted children were more common in families with higher income levels. A higher family income was associated with the employment status of the mother and father. Working parents entrust their children to their closest family or caregivers while they are at work. A previous study also reported that working mothers in urban areas entrust their children to their closest family while they are at work; as a result, the practice of feeding children is not always carried out by the mother.[18]

The results of this study indicated that the stunting rate was higher among children with mothers with good nutritional knowledge than among mothers with poor nutritional knowledge. Even if mothers have good knowledge, mothers in urban areas generally have time constraints in providing healthy food, especially if they are working mothers.[12] However, in this study, fathers' nutritional knowledge was not analyzed because almost all of them worked full-time, making it difficult to fill out the questionnaire. In addition, the under-five with a birth weight of <2,500 grams were at greater risk of stunting than children with a birth weight of ≥2,500 grams. Babies with low birth weights tend to have a poor immune system compared to babies with normal birth weights. They can also experience growth retardation due to digestive tract disorders, which result in a deficiency of nutrient reserves in the body, thus increasing the risk of stunting.[19-21]

Almost all mothers in this study had sanitation facilities and a habit of defecating in their homes' latrines. However, based on the observations during home visits, most toilets were in an unacceptable condition and had poor sanitation. A study by Frimawaty,[16] in an urban area showed that poor environmental sanitation conditions, especially the lack of house ventilation, were a significant factor associated with pneumonia in the under-five. Furthermore, infectious diseases directly affect nutritional status. In addition, lack of thermal comforts such as lighting and room temperature, protective types of walls, and ceilings are also sanitary factors associated with an increased risk of infectious diseases of the respiratory tract.[12,22]

The dominant factor associated with stunting in this study was immunization record. The under-five who did not receive complete basic immunization were at a 2.4 times greater risk of experiencing stunting than the under-five who received complete basic immunization. In urban areas, stunting can be caused by infectious diseases associated with incomplete immunization and lack of practice of balanced nutrition.[23] Shinsugi, *et al.*, showed that incomplete immunization coverage is the dominant factor associated with stunting, as children who did not receive complete immunization were 1.5 times more likely to suffer from stunting than children who received complete immunization.[20] In addition, strong scientific evidence shows that providing immunizations and fulfilling nutritional intake, especially intake of animal proteins through consumption of milk, meat/fish, and eggs, can prevent stunting.[24] Animal protein plays a role in the formation of body cells and tissues, strengthens bones and muscles, as a source of energy, forms enzymes and hormones in the body, and contributes to the development of the immune system.[24]

The dominant factor associated with underweight was the father's education level. Vollmer, *et al.*,[25] reported the predicted prevalence of childhood underweight for all maternal and paternal educational attainment levels based on categorical exposure. They found that parental education is associated with changes in children's health, as higher education will lead to increased parental knowledge of health and changes in parental values, increased household income, and adequate allocation of resources for children's health.[25] A similar study showed that children whose fathers completed secondary education were less likely to be underweight than those with uneducated and had no formal schooling fathers.[26] Father's education is associated with household income because of his role as the main breadwinner; in addition, he is often the decisionmaker regarding nutrition and health.[26]

This study also showed that the availability of toilet facilities at home was a protective factor against underweight. Availability of toilets is associated with environmental cleanliness, and the safe disposal of feces is especially important to prevent the emergence of diseases caused by bacteria that cause infectious diseases such as diarrhea, as well as the occurrence of pneumonia as a result of fecal contamination in the air.[12,16]

The dominant factor associated with wasting was the mother's occupation. Working mothers have less time to prepare healthy meals and accompany their children at mealtimes.[27,28] This study's findings also indicated that maternal age was a protective factor for wasting. A maternal age of 25-35 years is associated with optimal intrauterine growth, thereby preventing low birth weight. Under this age range, mothers have higher fertility rates, adequate physical conditions to get pregnant, be more stable psychological conditions, and have a lower risk of pregnancy complications; thus, the nutritional care pattern provided to children is improved, preventing them from experiencing wasting.[12]

This study also revealed that balanced nutrition practice was a dominant factor of anthropometric failure in children. A previous study reported that poorly balanced nutrition practices during the first 1,000 days of life have an important role in causing growth failure. Unbalanced nutrition practices, which include providing food that is inappropriate for a child's age, lack of food diversity, and low food intake, may cause stunting in the under-five.[29,30]

The strength of this study was identifying undernutrition in children caused by macronutrient deficiencies using a single anthropometric index and the CIAF, which could provide comprehensive information that could serve as a basis for determining appropriate interventions based on the type of undernutrition experienced by the under-five. While, the limitation was overnutrition was not identified as a serious health problem in the urban area under study. In addition, this study did not evaluate micronutrient deficiencies that could cause hidden hunger, which was also associated with undernutrition in the under-five experienced.

A bias that might have arisen in this study was measurement bias, which included 1) bias from measurement tools and enumerators and 2) recall bias, as mothers had to remember information from the past. The bias of measuring instruments could be overcome by using the right measuring tools and calibrating them or testing their validity and reliability before use. To prevent systematic bias, enumerators were provided training in anthropometric measurement techniques/procedures. Regarding recall bias, one component of the collected data that could be impacted by bias was balanced nutrition practice, as the information provided was not about actual behavior.

In addition, the COVID-19 pandemic has resulted in behavioral changes, especially food consumption patterns; therefore, participants had to recall their food before and during the COVID-19 pandemic. This bias was overcome by explaining to the participants the importance of filling out the information they knew, explaining, and accompanying the participants while they filled out the questionnaire. Participants were also given sufficient time to complete the questionnaire and carry it out in comfortable conditions. Future studies are expected to assess overnutrition. Studies on micronutrient deficiencies also need to be carried out to prevent hidden hunger. Hence, appropriate interventions can be implemented according to the type and causes of these nutritional problems. The problem of the triple burden of malnutrition then can be handled optimally.

Conclusion

This study demonstrates that the prevalence of stunting and other undernutrition is still high in urban areas in Indonesia. Immunization record is the dominant factor associated with stunting in the under-five. Those who do not receive complete immunization are at greater risk of experiencing stunting than those who receive complete immunization. Father's education level is the dominant factor associated with underweight, while mother's occupation is the dominant factor associated with wasting. Balanced nutrition practice is the dominant factor associated with anthropometric failure. Specific interventions, including improving feeding practices and immunizations to the under-five, need to be carried out synergistically to improve families' socioeconomic conditions and optimally prevent stunting and other malnutrition conditions.

Abbreviations

WAZ: Weight-for-Age; HAZ: Length/Height-for-Age; WHZ: Weight-for-Length/Height; CIAF: Composite Index of Anthropometric Failure; WHO: World Health Organization; SD: Standard Deviation; AOR: Adjusted Odds Ratio; CI: Confidence Interval.

Ethics Approval and Consent to Participate

This study was approved by the Health Research Ethics Commission, Faculty of Public Health, Universitas Muhammadiyah Jakarta, with approval number 10.152.B/KEPK-FKMUMJ/VI/2020.

Competing Interest

The authors declare no conflicts of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

Availability of Data and Materials

The data supporting this study's findings are available on request from the author due to privacy/ethical restrictions. The data are not publicly available because they contain information that could compromise the privacy of research participants.

Authors' Contribution

Conceptualization: TAEP; data curation: TAEP, YCH; formal analysis: CNS, MFZ; data collection: HDJ, LHR; supervision: ADR; writing—original draft: TAEP; writing—review and editing: TAEP. All authors have reviewed and approved the manuscript.

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