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Determinants of the Coexistence Dual Form of Malnutrition in Pairs of Mother and Child Aged 6–59 Months in Bogor District 2019

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Abstract

The dual form of malnutrition (DFM) is defined as multiple nutritional problems in the same household and time. This study aimed to determine the related factor to DFM incidence in pairs of mothers and children aged 6–59 months in Bogor District in 2019. This cross-sectional study used secondary data on the Nutrition and Health of Babakan Madang Subdistrict Toddlers in 2019 and Nutrition Intake and Stunting of Children Under-Five in Bogor District, West Java Province, involving a total sample of 274 households. The dependent variable in this study was DFM, while the independent variables were maternal age during pregnancy, maternal height, maternal breastfeeding history, parity, family income, mother's and father's education level. Bivariate analysis involving the Chi-square test and multivariate analysis with multiple logistic regression tests was used in this study. The results revealed that DFM incidence in the Babakan Madang Subdistrict in 2019 was 42%. The determinants of DFM that were significantly related were maternal height (p-value = 0.000), maternal breastfeeding history (p-value = 0.027), and parity (p-value = 0.049). The analysis results showed that the dominant factor in the prevalence of DFM was the maternal height (OR = 2.704; 95% CI = 1.615-4.528). It is recommended to improving nutrition in adolescence, especially in the case of girls in their role as future mothers.

Keywords: dual form of malnutrition, maternal height, overweight, stunting

Introduction

Nowadays, overnutrition problems such as overweight and obesity have become one of the major public health problems in the world. At the same time, the prevalence of malnutrition is relatively high.¹ These two different nutritional problems can coincide at the individual, household, population, and country levels. The dual form of malnutrition (DFM) is defined as multiple nutritional problems in the same household and time, with the possibility of overweight adults and malnutrition among children.² In this study, DFM is defined as a double nutritional burden that occurs in the same household, as shown by the presence of stunted children (height for age z-score (HAZ) < -2 SD) and overweight/obese mothers (body mass index (BMI) > 25 kg/m²). The incidence of DFM in the mother-child pair can have various negative impacts. Due to malnutrition, around 3 million children worldwide die every year. Millions of children with stunting also experience slower physical and cognitive growth.³ Meanwhile, obesity or

overweight in adults can increase the risk of non-communicable diseases and is known to be the cause of 2.8 million deaths in adults each year.⁴

The prevalence of DFM in mother-child pairs varies considerably, ranging from less than 10% to 26.8% in various countries.⁵ In Indonesia, there is also a high prevalence of stunted children and overweight mothers. The prevalence of stunting in children aged 0–59 months in Indonesia is 30.8%.⁶ In West Java prevalence of stunting in children aged 0–59 months is 31.1%, while overweight and obesity in adults more than 18 years are 13.7% and 23%, respectively.⁶ Study by Wibowo in 2015, using Indonesia Basic Health Research/*Riset Kesehatan Dasar* (Riskesdas) 2010 data showed that the prevalence of DFM in mothers and children pairs aged two to five years is 29.8%.⁷ Study conducted previously in the West Java Province found that the prevalence of DFM involving overweight/obese mothers and stunted child pairs was 30.6%.⁸ The determinants of DFM in mother and child pairs are maternal factors and socioeco-

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conomic aspects. Maternal factors include the mother's pregnancy age, height, higher parity, and maternal breastfeeding history—meanwhile, socioeconomic factors include household income, mother's education level, and father's education level.

Overweight/obese mothers and stunted children under-five were chosen as the target of the study. Children under-five were selected because the first five years of life are when children have rapid brain development and physical growth; besides, those were the target age group for nutritional improvement. Mothers were chosen because mothers belong to the productive age group and determined their key role in the child's growth and development in early childhood.⁸ Mother also played an essential role in nurturing, food providing, and food distributing in the family.¹ Stunting was chosen as an indicator of malnutrition in this study because it reflected the cumulative effects of undernutrition and infection from birth or even before birth. Stunting in childhood was also associated with physical and cognitive growth problems.⁹ Stunting was also reported to affect health in adulthood and the risk of chronic disease. Childhood malnutrition was a risk factor for higher glucose, blood pressure, and lipid levels.¹⁰

Indonesia basic health research 2018 data showed that stunting problems in children under-five still have the highest prevalence compared to the other nutritional problems.⁶ Being overweight in the case of mothers was also shown to be associated with an increased risk of developing various diseases or even death.¹¹ Previous studies by de Onis M and Branca F, Williams, *et al.*, Seidu, *et al.*, and Hruby, *et al.*, tended to be focused on one specific nutritional problem.¹⁰⁻¹³ Studies about the double burden of malnutrition in one household are still rare in Indonesia. The result of this study can show that two different nutritional problems can be influenced by the same factor.

The Department of Health of Bogor District found 19,557 malnourished children in 2019.¹⁴ Studies in Babakan Madang Subdistrict by Putriani EB, *et al.*,¹⁵ found that prevalence of stunting in children aged 6–23 months was 33.2%. The prevalence of stunting and overweight or obesity in West Java is higher compared to the national prevalence, same as stunting prevalence in Babakan Madang Subdistrict that higher than the national stunting rate. Bogor District also had a high rate of malnourished children. Previous studies in Babakan Madang Subdistrict only examined child stunting, while overweight or obesity in mothers has never been studied. Based on the above description, the authors were interested in examining whether the incidence of stunting children in Babakan Madang Subdistrict was also accompanied by the DFM incidence, where the child's mother was overweight/obese. The objective of this study were

to determine factors related to DFM in overweight or obese mothers and children 6–59 months stunted in the Babakan Madang Subdistrict, Bogor District, West Java Province, Indonesia.

Method

This study used secondary data from the 2019 PITTA B umbrella research from the Universitas Indonesia “Nutrition and Health of Toddlers in Babakan Madang Subdistrict, Bogor District 2019”.^{16,17} This data was obtained from a survey undertaken in May 2019 in six out of the nine villages in the Babakan Madang Subdistrict. Secondary data analysis was conducted from March to June 2021. This study used a quantitative analysis method with a cross-sectional design. The target population in this study was all households that have children aged 6–59 months in six selected villages in the Babakan Madang Subdistrict, Bogor District. Subjects that meet the inclusion and exclusion criteria were selected from the overall population. The inclusion criteria were households with children aged 6–59 months and living with birth mothers in six selected villages for a year. If more than one child under-five were in the same household, the youngest one would be chosen. The age limit of the mother was ≥ 18 years. The exclusion criteria included households with single form malnutrition (only mothers who were overweight/obese or their children who were stunted), pregnant women, and children with mental disorders, physical disabilities, and congenital diseases.

Outlying data were excluded from the analysis. Based on the two-proportion hypothesis analysis, the sample size of 274 had a test power of more than 80%. SPSS (version 22, SPSS Inc., Chicago, IL) application was used to analyze the results. Univariate analysis was conducted to obtain an overview of the frequency distribution of the study variables. Bivariate analysis was used to examine the relationship between the dependent variable (DFM) and independent variables (maternal age during pregnancy, maternal height, parity, maternal breastfeeding history, household income, mother's level of education, and father's level of education). The statistical test method used was the Chi-square test and multivariate analysis using a multiple logistic regression test, which aimed to determine the dominant factor of DFM. The dual form of malnutrition (DFM) was defined as the presence of stunted children ($HAZ < -2$ SD) and overweight/obese mothers ($BMI > 25$ kg/m²). All variables in this research were categorized into two, maternal age during pregnancy (older maternal ages for ≥ 35 years old and younger maternal ages for less than 35 years old), maternal height (short stature for mothers more than 150 cm and normal for mothers ≥ 150 cm), parity (household with more than two children and

household with ≤ 2 children), maternal breastfeeding history (currently breastfeeding and not currently breastfeeding), monthly household income (low for < IDR 3,760,000 and high for ≥ IDR 3,760,000 IDR),¹⁸ mother's educational level (low for no schooling, primary, secondary and high for high school, college), and father's educational level (low for no schooling, primary, secondary and high for high school, college).

Results

The result of the bivariate analysis revealed that maternal height, maternal breastfeeding history, and parity were found to have a significant association with the incidence of DFM (Table 1). However, the results did not show a significant association between maternal age during pregnancy, household income, mother's educational level, and father's educational level with DFM incidence.

Multivariate analysis was obtained using multivariate modeling after conducting confounding and interaction tests. Variables were gradually eliminated from modeling from the variable with the largest p-value. Table 2 was the final modeling of the multiple logistic regression analysis. The results of the multivariate analysis showed

that the dominant factor concerning DFM was maternal height. It was found that households with a maternal height less than 150 cm may increase the odds of having DFM by a factor of 2.7 after being controlled by maternal age during pregnancy, mother's breastfeeding history, and parity as confounding variables (Table 2).

Discussion

The dual form of malnutrition is defined as the presence of stunted children aged 6–59 months and overweight/obese mothers in the same household. Children are stunted when the height-for-age is less than -2 SD from the median of WHO child growth standards. Mothers are defined as overweight if the value of BMI > 25.0–27.0 kg/m² and defined as obese if the BMI > 27.0 kg/m².¹⁹ Stunting in a child under five reflects chronic nutritional problems and overweight/obesity in mothers describes the current nutritional status.¹⁸ The DFM occurs due to a nutritional transition where the problem of obesity continues to develop.¹⁸ At the same time, the problem of malnutrition also persists as a consequence of the long-term effects of malnutrition in early life.²⁰

The results showed that the prevalence of DFM incidence in mothers and children aged 6–59 months

Table 1. Determinants of Dual Form of Malnutrition

Variable	Category	Dual Form of Malnutrition						p-value	OR	95% CI
		Yes		No		Total				
		n	%	n	%	n	%			
Maternal age during pregnancy	≥35 years	16	57.1	12	42.9	28	100	0.154	1.912	0.867–4.219
	<35 years	99	41.1	142	58.9	241	100			
Maternal height	<150 cm	69	53.5	60	46.5	129	100	<0.001*	2.475	1.513–4.048
	≥150 cm	46	31.7	99	68.3	145	100			
Currently breastfeeding	No	85	47.2	95	52.8	176	100	0.027*	1.841	1.099–3.083
	Yes	32	32.7	66	67.3	98	100			
Parity	>2 child	44	51.8	41	48.2	85	100	0.049*	1.738	1.035–2.918
	≤2 child	71	38.2	115	61.8	186	100			
Household income	Low	76	42.5	103	57.5	179	100	0.924	1.059	0.639–1.755
	High	39	41.1	56	58.9	95	100			
Mother's educational level	Low	91	42.5	123	57.5	214	100	0.840	1.110	0.619–1.989
	High	24	40.0	36	60.0	60	100			
Father's educational level	Low	66	43.1	87	56.9	153	100	0.869	1.075	0.659–1.752
	High	48	41.4	68	58.6	116	100			

Notes: *Significance p-value<0.05, OR = Odds Ratio, CI = Confidence Interval

Table 2. Multivariate Analysis of Determinants of Dual Form of Malnutrition

Variable	Coef B	p-value	OR	95% CI
Maternal age during pregnancy (≥35 years)	0.657	0.155	1.928	0.779–4.771
Maternal height (<150 cm)	0.995	0.000	2.704	1.615–4.528
Currently breastfeeding (No)	0.707	0.012	2.028	1.169–3.520
Parity (>2 child)	0.474	0.109	1.606	0.899–2.868

Notes: * significant (p-value < 0.05), OR = Odd Ratio, CI = Confidence Interval

pairs in Babakan Madang Subdistrict was 42%. In comparison, other study has found that the prevalence of DFM in Malaysia was 19.4%.²¹ Another study in Guatemala found that the prevalence of DFM was 17%.²² A study conducted in rural areas of Indonesia found that the prevalence of DFM was 11%.¹⁹ Another study conducted in urban areas of Indonesia found a prevalence of DFM of 24.7%.¹ When compared to the above studies, DFM in Babakan Madang Subdistrict has a higher prevalence. The DFM can have many negative impacts on both child and mother. Stunting in children can increase the risk of children experiencing infections, physiological disorders, mucosal integrity disorders, and undernutrition, including micronutrient deficiencies, compared to children with normal nutritional status.^{10,23} Obesity in mothers or adults also has many adverse effects. A high percentage of body fat may increase the risk of cardiovascular disease, diabetes, cancer, asthma, and musculoskeletal disorders.^{12,24}

There were no statistically significant differences between maternal age during pregnancy and DFM. This finding was not in line with a study in the Republic of the Marshall Islands which found such a relationship (p-value < 0.001; OR = 1.19; 95% CI = 1.12–1.26).²⁵ There was a great deal of evidence that stunting in children under five is related to maternal age during pregnancy. However, the evidence regarded maternal age during pregnancy and DFM is still limited. For more than 35 years mothers, aging can cause decreased nutritional absorption. It causes nutritional intake imbalance on the mother's part during pregnancy and increases the risk of having a stunted child.²⁶ Changes in body composition are consistent with age changes, as mothers get older BMI will also increase.²⁷ The mechanisms related to the effects of estrogen hormones can affect body composition with age when there is an increase in body fat mass and a decrease in fat-free mass.^{13,27} This study did not find a significant relationship between maternal age during pregnancy and DFM incidence. In this study, 57.1% of families with a maternal age during pregnancy more than 35 years experienced DFM, higher than the 41.1% of families with a maternal age during pregnancy less than 35 years. These results aligned with the theory stated above, which suggests that the risk of obesity is higher with greater age. Irregular physical activity after giving birth can increase the risk. Older mothers also have a higher risk during pregnancy which can impact the growth of their children.

This study showed that parity had statistically significant with DFM (p-value = 0.049). This finding was similar to a study by Mahmudiono, *et al.*,¹ where OR = 1.852; 95% CI = 1.184–2.898) stated that higher parity might increase the risk of DFM. Mothers with multiple children may have less time to provide equal care to each

child when compared to families with fewer children.² Having multiple siblings can cause growth delays due to competition to get a source of nutrients available at home.²⁸ The amount of parity is also associated with the risk of low birth weight, and low birth weight can ultimately increase the risk of stunted children.^{29,30} Another study found a positive correlation between higher parity and the risk of obesity in middle-aged women in China.³¹ Postpartum obesity is associated with the transition that mothers experience during pregnancy. Lifestyle alteration related to energy intake and energy expenditure during pregnancy can lead to long lifestyle changes, even after pregnancy. The continuous repetition of these changes throughout pregnancies can change the mother's lifestyle forever.³¹ It explains the increased risk of obesity in mothers with higher parity. Given that higher parity can increase the risk of DFM related to the physiology of the mother's body after repeated pregnancies, the birth spacing can be examined to support this theory. The increasing number of family members can affect family care and the ability to purchase food to meet the family's needs. Both factors can affect the children's and the mother's nutritional status.

Maternal breastfeeding history was a condition where the mother breastfeeds her child during the research period. This study showed that maternal breastfeeding history was statistically significant with DFM (p-value = 0.027). This finding was similar with Sunuwuar, *et al.*, study (OR = 1.97; 95% CI = 1.10–3.51).³² Children who are breastfed may have a higher chance of achieving adequate daily nutritional needs and a lower risk of stunting.¹⁹ During the first 4 to 6 months of age, exclusively breastfed infants grow faster than infants who are not.³³ Breastfeeding is also associated with a decreased risk of being overweight on the mother's part because it can increase the calorie expenditure of the mother.³² Breastfeeding has been shown to impact both children and their mothers positively. In older children, appropriate complementary feeding should be given to support the child's nutritional needs.

There were no statistically significant differences between household income (p-value = 0.924), mother's educational level (p-value = 0.840), and father's educational level (p-value = 0.869) with DFM. Low-income levels can affect food security and access to adequate amounts of food.³⁴ Consumption expenditure is limited because of increased food prices and socio-economic constraints.³⁵ Consequently, such a household is forced to buy cheap food with excessive energy content.³⁵ This study did not find a significant relationship between family income and the incidence of DFM. The focus of the research was only to discuss household income without examining household consumption

expenditure.

Lower maternal and paternal education levels may increase the risk of DFM. The father's education level as the head of the family is a strong social determinant of his family's health. A higher education level may have an essential role in ensuring better nutritional status for his wife and children. As the person who is generally responsible for household food, the mother may be unable to make healthy food choices for the family due to the low education.^{1,2,36} Education is always considered a determinant of food security and household nutrition. However, nutritional knowledge, accessibility, and the affordability of quality food determine DFM. This situation might be the reason why no significant relationship was found in this study.

Multivariate analysis found that the dominant factor of DFM in Babakan Madang Subdistrict was maternal height (OR = 2.704; 95% CI = 1.615–4.528). It was found that households with maternal height less than 150 cm may increase the odds of having DFM by 2.7 times higher after being controlled by maternal age during pregnancy, mother's breastfeeding history, and parity as confounding variables. The short stature of the mother indicates malnutrition at the beginning of the mother's life. Lack of an adequate nutritional history and poor development in the first 1,000 days of life can lead the mother to be of short stature in adulthood and possible complications during childbirth. The long-term impact of poor maternal health and inadequate nutrients during pregnancy will lead to the fetus having poor growth in the uterus and can increase the risk of low birth weight, which may affect the child's health and development.^{2,37-39} Those situations explained the association between maternal height and the risk of stunting in nutritional transmission between generations. Mothers who experienced stunted or poor fetal growth were more likely to gain excess weight during adolescence and had a higher risk of nutrition-related diseases. This may eventually increase the risk of obesity and chronic disease in adulthood.^{19,40}

This study recommends intervention in the education of adolescent girls and pregnant women to prevent DFM. Improving the awareness of the importance of nutrition for adolescent girls as future mothers can be done through intervention by providing nutrition education, micronutrient supplementations, and the treatment of comorbidities. Improving the nutritional status of adolescents can reduce the risk of them experiencing problems related to nutrition when they are adults and prepare them for pregnancy in the future. For mothers who are already short in height, intervention can occur during pregnancy by monitoring such women to ensure quality nutrition and regular antenatal care (ANC) checks. Such an intervention would aim to reduce the

risk for adolescent girls and pregnant women in terms of giving birth to stunted children and preventing the possibility of DFM incidents in the future.

The advantage of this study lies in providing the latest overview regarding the prevalence of DFM incidence in pairs of mothers and children aged 6–59 months in Babakan Madang Subdistrict. A limitation of this study is the use of secondary data, which meant that the study variables were limited. Due to the limited amount of primary data, some variables could not be analyzed in this study. Variables that were direct factors related to DFM, such as intrahousehold food distribution, could not be analyzed due to these limitations. Secondary data was used because collecting the data directly was impossible due to the pandemic. This study requires direct measurement data that cannot be obtained using online questionnaires. All available data that match the various criteria were included in the study to remedy this limitation. Possible study bias resulting from secondary data can exist during data processing, and this possibility was overcome by screening and cleaning data before data processing. Outlier data were also excluded to avoid possible bias. Future study is expected to use other determinants that directly affect the incidence of DFM, such as energy intake and the use of other nutrients in mothers and toddlers. Similar research should be conducted in the broader area.

Conclusion

The dual form of malnutrition (DFM) incidence in pairs of mothers and children aged 6–59 months in Babakan Madang Subdistrict is high prevalence at 42%. The bivariate analysis showed that short maternal stature, not currently breastfeeding, and having higher parity are all significantly associated with DFM. Dual form of malnutrition can be prevented by improved nutrition in adolescence, especially in the case of girls in their role as future mothers. Consequently, when they become pregnant as adults, this might reduce the risk of experiencing nutritional problems.

Abbreviations

DFM: Dual Form of Malnutrition; HAZ: Height for Age; SD: Standard Deviation; BMI: Body Mass Index; RISKESDAS: *Riset Kesehatan Dasar*; OR: Odd Ratio; WHO: World Health Organization; ANC: Antenatal Care.

Ethics Approval and Consent to Participate

This study has been approved by the Commission for Research Ethics and Public Health Service, Faculty of Public Health, Universitas Indonesia Number: 133/UN2.F10.D11/PPM.00.02/2021.

Competing Interest

The author declares that no significant competing financial, profession-

al, or personal interests might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

The data supporting this study's findings are available from the corresponding author upon reasonable request.

Authors' Contribution

MDK, T, and AS were involved in the design study, data compilation and analysis, and manuscript revision. TS was the primary data owner.

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