Multilevel Analysis on the Determinants of Overweight among Children Under Five in Kediri, East Java

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ABSTRACT

Background: Child overweight and obesity are an important public health issue worldwide. Overweight and obese children are likely to stay obese into adulthood and more likely to develop non-communicable diseases like diabetes and cardiovascular diseases. This study aimed to determine factors associated with overweight among children under five in Kediri, East Java, using a multilevel analysis model.

Subjects and Method: This was a case control study conducted at 25 posyandus (integrated family health posts) in Kediri, East Java, from April to May 2018. A sample of 200 children under five was selected by fixed disease sampling. Posyandu was selected by stratified random sampling. Children were located at level 1 and posyandu at level 2 in the multilevel analysis model. The dependent variable was overweight. The independent variables were maternal body mass index (BMI), exclusive breastfeeding, calorie intake, feeding pattern, and nutritional status monitoring. Overweight status was measured by weight for height z-score. The data were collected by questionnaire and analyzed by a multilevel logistic regression model run in Stata 13.

Results: Maternal BMI ≥25 (b= 0.72; 95% CI= -0.98 to 1.54; p= 0.085) and calorie intake exceeding the recommended allowance (b= 1.45; 95% CI= 0.59 to 2.31; p= 0.001) increased the risk of overweight in children under five. Good feeding pattern (b= -1.11; 95% CI= -2.15 to -0.08; p= 0.034), exclusive breastfeeding (b= -0.97; 95% CI= -1.98 to 0.02; p= 0.057), and regular nutritional status monitoring (b= -4.34; 95% CI= -6.42 to -2.21; p<0.001) decreased the risk of overweight. Posyandu showed negligible contextual effect on the incidence of child overweight with ICC= 0.98%.

Conclusion: Maternal BMI ≥25 and calorie intake exceeding the recommended allowance increase the risk of overweight in children under five. Good feeding pattern, exclusive breastfeeding, and regular nutritional status monitoring decrease the risk of overweight in children under five. Posyandu has a negligible contextual effect on child overweight.

Keywords: overweight, children under five, exclusive breastfeeding, maternal body mass index, multilevel analysis

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BACKGROUND

Obesity is still a problem that is in the spotlight of the world. WHO has declared that obesity is a global endemic problem. An International Obesity Institute in London states that 1.7 billion people on Earth are overweight (Setiyaningsih et al., 2015). It is estimated that there are 3.4 million cases of child deaths in the world in 2010 due to cases of obesity, the prevalence of obesity in children reached 47.1% in 2013 (Nugrahani et al., 2016). Data from WHO in 2010 mentioned that nearly forty million children in the world under the age of five are overweight (WHO.2010). Toddlers in Asia including Indonesia have a 2.5 to 3.5% greater risk of obesity (Nugrahani et al., 2016).

The results of the Basic Health Research (Riskesdas) in Indonesia in 2013 stated that the prevalence of obesity in children nationally experienced an increase and decrease over a period of six years from 2007 (12.2%), 2010 (14%), until 2013 (11.9%) (Riskesdas, 2013). Data from the East Java Health Office stated that the prevalence of obesity among under-fives reached a high rate of 17.1%, still above the prevalence rate of obesity in Indonesia. In Kediri there are 324 children under five who have fat nutritional status. The absence of programs from the health service on the handling of obesity in children, making the community also has the assumption that obesity is not a problem that must be addressed.

The causes of obesity are multi-factorial, including genetic factors, socio-economic, environmental, and behavioral conditions (Portela et al., 2015). Obesity can occur due to the interaction of genetic factors and the contribution of environmental changes (Prasetyaningrum et al., 2016). Lack of awareness of parents with overweight children, some studies show that more than 60% of parents under-estimate or disregard the nutritional status of their children (Lundahl and Kidwell, 2014; Reitmeijer-Mentink et al., 2013; Tompkins et al., 2015; Howe et al., 2017).

Social factors that influence the attitudes of parents to obese children include the types of parental leadership, ethnic/ race/ ethnicity, income, education, age, and gender of children (Black et al., 2015). In a study conducted by Grazule-viciene in 2017, it was mentioned that the type of maternal care with children and smoking behavior is also associated with the incidence of obesity in children (Grazu-leviciene et al., 2017). Another factor that causes obesity in children is the excessive consumption of unhealthy foods because these foods have high salt, sugar, and fat content in it (Nirvana, 2012).

Obesity in toddlers if not handled properly can continue until adulthood. Obesity has a bad impact on children as adults, not only disrupting physical health, but also psychological and social (Herawati et al., 2016). Some cardiovascular diseases can occur due to obesity are heart, stroke, diabetes, cancer, and ultimately can cause death (Wiardani et al., 2016).

One of the government's efforts to make early detection on fat nutritional status is the establishment of posyandu. One of the objectives of posyandu is to maintain and improve the health of infants, through the monitoring of nutritional status (Rahaju et al., 2008). Posyandu that currently exist still focus on malnutrition and malnutrition cases, not many posyandu that also handle obesity. Indonesian people still think that child obesity is not some-thing that needs to be addressed.

SUBJECTS AND METHOD

1. Study Design
This was an analytics observational study with a case control design. The study was carried out in 25 posyandus located in Balowerti community health center in Kediri, East Java, from April to May 2018.

2. Population and Samples
Stuydy population was all children under five in Balowerti community health center. A sample of 200 chidlren was selected by fixed disease sampling.

3. Study Variables
The dependent variable was children nutritional status. The independent varia-bles were maternal nutritional status, exclusive breastfeeding, feeding pattern, food intake, and nutrition status monitoring at posyandu.

4. Operational Definition of Variables

Maternal nutritional status was calculated by Body Mass Index (BMI) formula, body weight (kg) /height (m²). Maternal weight was measured by weight scale. Maternal height was measured by microtoise. The measurement scale was continuous.

Exclusive breastfeeding was defined as infants only received breast milk from birth to six months of ages. The data were collected by questionnaire. The measurement scale was categorical.

Feeding pattern was defined as maternal behavior in giving food to toddlers which includes food preparation, cooks, and present to child. The data were measured by questionnaire. The measurement scale was continuous.

Food intake was defined as measured from the amount of consumed food consumed consigned in the form of energy by using a 24-hour food recall. Subjects must remember what their children consumed for 24 hours from waking up to going to bed at night. The data were collected by questionnaire. The measurement scale was continuous, but for the purpose of data analysis, it was transformed into dichotomous, coded 0 for <4 times and 1 for ≥4 times

Nutritional status monitoring to posyandu was defined as the regularity of children coming to posyandu for weighing for the last 6 months. The data was measured by questionnaire. The measurement scale was continuous, but for the purpose of data analysis, it was transformed into dichotomous, coded 0 for <4 times and 1 for ≥4 times.

5. Data Analysis

Univariate analysis was done to see the frequency distribution and percentage characteristics of study subjects. Bivariate analysis was conducted to study the relation between performance of midwife and independent variable using chi-square test and odds ratio calculation (OR) with confidence level (CI) equal to 95%. Multivariate analysis used a multilevel logistic regression.

6. Research Ethics

The research ethics include informed consent, anonymity, confidentiality and ethical clearance. The ethical clearance in this research was conducted at Dr. Moewardi hospital, Surakarta.

RESULTS

1. Univariate Analysis

Table 1 shows that children with normal nutritional status was 143 (71.5%) and overweight children was 57 (28.5%). Mother with normal weight was 123 (61.5%) and overweight mother was 38.5%. Toddlers who did not receive exclusive breastfeeding were 135 (67.5%), and those who received exclusive breastfeeding were 65 (32.5%). Children with calorie intake ≥NAR were 147 (73.5%). As many as 174 (87%) children visit posyandu to monitor their nutritional status.

Table 1. Univariate Analysis

Variable	n	(%)
Children nutritional status		
Normal weight	143	71.5
Overweight	57	28.5
Mothers nutritional status		
Normal weight	123	61.5
Overweight	77	38.5
Exclusive breastfeeding		
Not exclusive	135	67.5
Exclusive	65	32.5
Food pattern		
Poor	140	70
Good	60	30
Calorie Intake		
≥NAR	147	73.5
<NAR	53	26.5
Nutrition status monitoring		
Irregular weight	26	13
Regular weight	174	87

Table 2. Bivariate analysis on the determinants of child overweigth

Independent Variables	Normal		Fat		Total		OR	95% CI	p
	n	%	N	%	n= 200	%			
Maternal BMI									
Normal	95	23	28	77	123	100	2.05	1.98 to	0.023
Overweight	48	62.3	29	37.7	77	100		3.82	
Exclusive Breastfeeding									
Not Exclusive									
Breastfeeding	90	66.7	45	33.3	135	100	2.208	1.073 to	0.029
Exclusive Breastfeeding	53	81.5	12	18.5	65	100		4.55	
Feeding Pattern									
Poor	93	66.4	47	33.6	140	100	2.52	1.17 to	0.015
Good	50	83.3	10	16.7	60	100		5.42	
Calorie Intake									
According to NAR	121	82.3	26	17.6	147	100	6.55	3.28 to	<0.001
Exceeding the NAR	22	41.5	31	58.5	53	100		13.09	
Nutritional Status Monitoring									
Irregular Weight	1	4	25	96	26	100	0.35	0.17 to	0.002
Regular Weight	142	81.6	32	18.4	174	100		069	

Table 3. The result of multilevel logistic regression

Variable	Coefficient (b)	95% CI		p
		Lower Limit	Upper Limit	
Fixed Effect				
Maternal Nutritional Status	0.72	-0.98	1.54	0.085
Exclusive Breastfeeding	-0.97	-1.98	0.02	0.057
Feeding Pattern	-1.11	-2.15	-0.08	0.034
Food Intake	1.45	0.59	2.31	0.001
Random Effect				
Nutritional Status Monitoring	-4.34	-6.42	-2.21	<0.001
Var (Constants)	2.66	0.53	4.79	0.014
Observation Score= 200				
ICC = 0.98%				
Likelihood Ratio Test p = -75.06				

2. The results of bivariate analysis

The bivariate analysis looked at the relationship between independent variables (maternal nutritional status, exclusive breastfeeding, feeding pattern, food intake, and nutritional status monitoring at health center) and dependent variable (over-weight). The result of bivariate analysis can be seen in table 2.

3. Multilevel Analysis

Table 3 shows that maternal nutritional status was associated with overweight in children under five. Overweight children increased the risk of overweight among children (b= 0.72; 95% CI= -0.98 to 1.54; p= 0.085).

There was a negative effect between exclusive breastfeeding and overweight in children under five. Exclusive breastfeeding reduced the risk of overweight in children (b= -0.97; 95% CI= -1.98 to 0.02; p= 0.057).

There was a negative effect between feeding pattern and child overweight. Good feeding pattern reduced the risk of over-weight among children (b= -1.11; 95% CI= -2.15 to -0.08; p= 0.034).

There was a positive effect between food intake and overweight in children. Higher food intake (≥NAR) increased the risk of overweight in children (b= 1.45; 95% CI= 0.59 to 2.31; p= 0.001).

There was a negative effect of nutritional status monitoring at posyandu and child overweight. Regular nutritional status monitoring at posyandu reduced the risk of child overweight (b= -4.34; 95% CI= -6.42 to -2.21; p<0.001).

In table 3, the score of ICC= 0.98%. The indicator showed that the health center in each strata has less contextual effect on the status of obese toddlers in health center. Lack of cadres and health personnel activeness in handling obese toddlers lead to lack of contextual effect of health center on obese toddlers at the community level. Most of nutrition program of toddlers at health center still focused on malnourished and stunting toddlers only. There was still no program from health services, community health center, and health center regarding the handling of obese toddlers.

However, from the results of individual levels, it can be concluded that the multivariate effect explained about the influence of more than the independent variables namely maternal nutritional status, exclusive breastfeeding, feeding pattern, food intake, and monitoring of nutritional status in posyandu.

DISCUSSION
1. The effect of maternal nutritional status on child overweight

There was a significant effect between maternal nutritional status and child overweight. Overweight mother increased the risk of overweight in their children.

The result of this study was in line with a study by James *et al.* (2013) and Portela *et al.* (2015), which stated that obesity in mothers has a strong relationship with the obesity in their children.

Factors of parental nutritional status could affect the obesity in toddlers because the behavior of parents in eating foods and physical activity could affect the children to support the obesity and obesity can also be derived genetically (James *et al.*, 2013). Obese mothers did not directly make their children fat, however, this relationship can be caused by some unhealthy parental behavior that could be imitated by the children and even formed behavioral habits for children that lead to the occurrence of obesity.

2. The effect of exclusive breastfeeding on overweight

There was a statistically significant effect between exclusive breastfeeding and child overweight. Exclusive breastfeeding reduced the risk of child overweight Park *et al.* (2018), Marseglia *et al.* (2015), Yan *et al.* (2014), Nugrahani *et al.* (2016), Saputri, (2013).

Children who did not receive exclusive breastfeeding increased the risk overweight 4.2 (Saputri, 2013). Longer breastfeeding reduced the incidence of obesity in children (Yan *et al.*, 2014). Giving formula milk and weaning food at an early age for infant can lead to abnormal fat deposit and increased the risk of obesity in children under five (Park and Lee, 2018).

The content of nutrients contained in breast milk was a component that has been complete and appropriate for the baby. If formula milk or other food was given to the children, it could disturb the balance of absorption of existing nutrients that can lead to obesity in children.

3. The effect of feeding pattern on child overweight

There was a negative effect between feeding pattern and overweight in children. Good feeding pattern reduced the risk of child overweight. This findings is in line with (Purnama *et al.*, 2015) (Herawati *et al.*, 2016) (Demir *et al.*, 2017).

Parental behavior can also affect the eating behavior of the children, which in this case was the parental behavior in

feeding their children (Herawati *et al.,* 2016). If the parents did not control the food intake of their children, it would increase the risk of obesity in children (Purnama *et al.*, 2015).

Children were very easy to imitate what was done by their parents, if the parents often consume foods, especially high-calorie and high sugar type of foods, then this would also be imitated by the children. The type of food consumed or available at home would also depend on parental preferences. In addition, children were still not able to independently determine what they eat, so it was the parents' duty to prepare the food for children. The behavior of feeding patterns for children could affect the incidence of obesity.

4. The effect of food intake on child overweight

There was a positive effect between food intake and child overweight. Higher food intake increased the risk of overweight among children under five. This finding is in line with Huang *et al.* (2015), Mandal *et al.* (2014), and Setiyaningsih *et al.* (2015).

Components of nutrients such as calcium and fiber was very influential to suppress the occurrence of obesity in children, while vitamin B, high-sugar foods, and carbohydrates can caused obesity (Huang *et al.*, 2015). Children who consumed unhealthy foods ≥32 times/week tend to have higher risk by 4.26 times for obesity than toddlers who consume unhealthy foods <32 times/week (Setiyaningsih *et al.*, 2015).

Children were generally very difficult to eat vegetables and fruit, they prefer fried food, high sugar, and high salt. This high-calorie food intake without parental control can certainly cause obesity in children. Currently, any kind of variation of snacks or fast food was more diverse and also made the toddlers to eat high-calorie foods.

5. The effect of nutritional status monitoring on overweight

There was a negative effect of nutritional status monitoring in posyandu on overweight among children under five. Nutritional status monitoring in posyandu reduced reduced the risk of overweight.

Posyandu was the first place for children to monitor their nutritional status. If the health center was poorly utilized by parents, it can be ascertained that children with fat nutritional status would not get any intervention.

There were still many assumptions in the community that obese toddlers were adorable and healthy, so that many parents did not consider that fat was an issue of abnormal nutritional status. Posyandu was supposed to monitor child nutritional status.

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