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Original Research

Risk Factors for Short Stature in Children Age 0-24 months

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Abstract—*This study aims to to examine the risk factors of stunting children aged 0-24 months in Surakata in order to prevent stunting as early as possible. This research was an observational with a cross-sectional study design. This research was conducted in several Integrated Health Post (Posyandu) under the guidance of Sangkrah Health Care, Nusukan Health Care, Pucang Sawit Health Care, Penumping Health Care, and Jayengan Health Care in September- October 2018. Sampling was conducted by by consecutive sampling method. Baby's body length was measured with an infantometer. Risk factors were obtained through interviews using questionares on mothers. Data analysis was conducted using SPSS version 23 with bivariate test (multiple logistic regression). The total correspondents were 139 samples with 128 samples met the inclusion and exclusion criteria. Bivariate analysis results showed a significant relationship between stunting and risk factors for low birth weight, premature baby, and short maternal height. Multivariate analysis showed that the short mother's height factor was the most dominant factor influencing stunting. Short maternal stature (height<145cmm) is the most dominant factor influencing stunting in children aged 0-24 months in Surakarta City.*

Keywords*: short stature, risk factors*

Abstrak—Penelitian ini bertujuan meneliti faktor risiko perawakan pendek pada anak usia 0-24 bulan di Kota Surakarta agar dapat mencegah terjadinya perawakan pendek sedini mungkin. Penelitian ini bersifat observasional dengan desain studi *cross sectional*. Penelitian ini dilakukan di beberapa Posyandu Balita Binaan Puskesmas Sangkrah, Puskesmas Nusukan, Puskesmas Pucang Sawit, Puskesmas Penumping, dan Puskesmas Jayengan pada bulan September – Oktober 2018. Pengambilan sampel dilakukan dengan metode consecutive sampling. Pengukuran panjang badan bayi dilakukan dengan infantometer. Faktor risiko didapatkan melalui wawancara menggunakan kuesioner pada ibu. Analisis data dilakukan menggunakan SPSS versi 23 dengan uji bivariat (uji Chi-Square dan uji Fisher-exact), dan uji multivariat (regresi logistik berganda). Total responden adalah 139 sampel dengan 128 sampel yang memenuhi kriteria inklusi dan eksklusi. Hasil Analisis Bivariat menunjukkan adanya hubungan yang signifikan secara statistik antara perawakan pendek dengan faktor risiko berat badan lahir rendah, umur kehamilan prematur, dan tinggi badan ibu pendek. Hasil Analisis Multivariat menunjukkan bahwa faktor tinggi badan ibu pendek menjadi faktor yang paling dominan mempengaruhi perawakan pendek. Tinggi badan ibu pendek (tinggi<145 cm) merupakan faktor yang paling dominan memengaruhi perawakan pendek pada anak usia 0-24 bulan di Kota Surakarta.

Kata kunci: *perawakan pendek, faktor risiko*

INTRODUCTION

Short stature is indicated by a Z-Score value of less than -2 SD (Standard Deviation) in measuring height for age or body length for age using the WHO Child Growth Standard [1]. Short stature can be used as a risk marker for poor child development. When this situation occurs in children under 2 years old, it will increase the risk of declining cognitive abilities and learning performance in childhood and adolescence, and also have consequences for poor educational and economic levels at the individual, household, or community level [2].

Data from the Nutrition Status Monitoring (PSG=Pemantauan Status Gizi) in 2017 states that the prevalence of short toddlers in Surakarta City is 22.1%. The incidence of underweight, wasting and obesity in toddlers in Surakarta according to the reference is 10.3%, 5.4% and 7% [3]. This shows that the problem of short toddlers in Surakarta City is the biggest nutritional problem compared to other nutritional problems.

Good nutrition in the first 1000 days of life (starting from the mother's pregnancy until the age of 2 years) will have a major impact on the health, growth and success of children in the future. The effect of good nutrition won't be perceived by the individual himself, but also increases productivity and economic prospects in household life or in the community [4]. Short

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stature occurring in the first 1000 days of life is associated with poor outcomes in health, cognitive development, and future educational and economic attainment. Therefore, this period is the most important period in order to achieve good development in the future [5].

Based on research conducted in 137 developing countries, the occurrence of short stature in childhood is caused by 18 risk factors, which are divided into 5 major groups, including nutrition and infection in children such as stopping breastfeeding, history of diarrhea, non-exclusive breastfeeding, late management in HIV, and zinc deficiency, and nutrition and infection in pregnant woman such as anemia during pregnancy, fatiguing, malaria during pregnancy, and maternal short stature, teenage pregnancy and short gestation intervals, fetal growth disorders and preterm infants such as low weight. Pre-term with Appropriate-for-Gestational-Age (AGA) category, preterm with Small-for-Gestational-Age (SGA, term with SGA and environmental factors such as poor sanitation, using of unclean water, and use biomass fuel [5].

Previous studies have stated that the risk factors for short stature in children aged 0-23 months are influenced by short baby length, short maternal height, and poor nutrition of pregnant women [6]. Other research states that short stature in children aged 6-24 months is not influenced by maternal education and exclusive breastfeeding status, but is influenced by low birth weight [7].

Due to the importance of knowing the risk factors for short stature in the development of children aged 0-24 months, there is no specific research to discuss this matter, therefore the authors want to find out more about the risk factors for short stature in children aged 0-24 months in Surakarta City to prevent many negative impacts for the future of the child.

METHOD

The research design used was an observational study with a cross-sectional study design. This research was conducted at public health center located in 5 sub-districts (Kliwon Market, Jebres, Banjarsari, Laweyan, and Serengan) in Surakarta City. The subjects studied were children aged 0-24 months who met the inclusion criteria. The sampling technique in this study was the consecutive sampling method.

The dependent variable in this study was short stature, while the independent variables in this study included: 1) social, economic, and family environmental factors (family income, number of family members, house sanitation, parents' education level); 2) maternal characteristic factors (mother's height, mother's nutrition); 3) factors of maternal pregnancy history (mother's age, birth interval, frequency of antenatal care); 4) factors of breastfeeding and weaning food (breastfeeding status, time of giving weaning food, type of weaning food); and 5) infant factors (gender, birth weight, birth length, gestational age, birth order, time of initiation of early breastfeeding, history of infant infection [diarrhea and Acute Respiratory Infection], completeness of immunizations).

To assess short stature, babies are measured using an infantometer. Then record data in the form of sex, date of birth, and body length from the results of measurements using an infantometer. Then the existing data is included in the WHO Anthro application and categorized according to the operational definition of the research.

To assess the risk factors used through the process of filling out questionnaires and interviews. The questionnaire consists of questions in the form of short answers and multiple choices. Answers from respondents were then categorized according to the operational definition of the research.

Then the research results were processed using the IBM SPSS Statistics 23 for Windows application. The test is in the form of a chi-square test or a modified Fisher test to determine the magnitude of the risk effect of each factor, then it is continued with multiple logistic regression tests as a multivariate analysis.

RESULTS

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In this study, researchers got 139 samples. The number of samples that met the inclusion criteria was 128 samples with 11 samples excluded by the exclusion criteria. The research sample consisted of 46 samples of infants aged 0-6 months and 82 samples of children aged 7-24 months.

Table 1
Status Stature Short

Age (months)	Short stature		Not Short Stature	
	N	%	N	%
0-6	2	4.35%	44	95.65%
7-24	21	25.61%	61	74.39%
Total	23	17.97 %	105	82.03%

Table 1 shows that in the study sample there were 23 samples of short stature with 2 samples aged 0-6 months and 7-24 months with 21 samples. This table also shows that there were 105 samples of not short stature with 44 samples aged 0-6 months and 61 samples aged 7-24 months. In addition, it is also known that short stature in children aged 0-24 months in Surakarta City is 17.97%.

Risk Factors for Short Stature

The results of bivariate analysis on samples aged 0-24 months in Surakarta City are shown in Table 2. From the analysis results, it was found that 3 risk factors were known to have a statistically significant relationship to the incidence of short stature ($p < 0.05$), namely the birth weight factor Low ($p=0.006$; OR=5.305; 95% CI= 1.690 – 16.652), Premature Pregnancy Age factor ($p=0.033$; OR=3.2; 95% CI= 1.157 – 8.851), and Short Mother's Height factor ($p= 0.018$; OR=15.6; 95% CI = 1.544 – 157.667).

Other factors such as family income, number of family members, home sanitation, education level of parents, smoking family, gender, birth length, history of infant infection, immunization status, IMD time, maternal nutrition, age during pregnancy, interval births, frequency of antenatal care, breastfeeding status, and timing of complementary feeding did not have a significant effect on the incidence of short stature in children aged 0-24 months in Surakarta City because ($p>0.05$).

Dominant Risk Factors for Short Stature

Table 3 shows the results of multivariate data analysis of risk factors for short stature in children aged 0-24 months in Surakarta City. From the results of this analysis it was found that children aged 0-24 months in the city of Surakarta who were born with low birth weight (birth weight < 2500 grams) had a log odds of experiencing short stature 2,373 higher than normal birth weight, and was not statistically significant. (95% CI 0.723-7.789; p=0.154).

From the results it was found that children aged 0-24 months in Surakarta who were born prematurely (gestational age <37 weeks) had a log odds of experiencing short stature 4,412 higher than normal gestational age, and statistically significant (95% CI = 1,219- 15.971;p=0.024). In addition, it was found that children aged 0-24 months in Surakarta who were born to mothers who were short (height <145 cm) had a log odds of experiencing short stature 25,625 higher than mothers of normal height (height ≥ 145 cm), and statistically significant (95% CI = 2.443 – 268.829; p=0.007).

Table 2

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Bivariate Analysis of Risk Factors for Short Stature in Children Aged 0-24 Months in Surakarta City

Risk Factors	OR	95 % CI for OR	p
High Family Income*	1,222	0.495 – 3.021	0.817
Number of Family Members Many	1275	0.514 – 3.165	0.650
Good Home Sanitation*	1,467	0.561 – 3.834	0.450
Low Parents Education Level	1,840	0.719 – 4.707	0.251
Smoking Families Exist	1,542	0.560 – 4.246	0.472
Female gender*	1,519	0.593 – 3.891	0.487
Low birth weight	5.305	1690–16652	0.006
Short Birth Body Length	2057	0.795 – 5.320	0.191
Premature Pregnancy	3,200	1.157 – 8.851	0.033
No History of Infant Infection*	1,201	0.482 – 2.992	0.815
Incomplete Immunization Status	1.162	0.300 – 4.503	0.733
Delayed IMD Time	1914	0.767 – 4.777	0.227
Short Mother's Height	15.6	1,544 – 157,667	0.018
Nutrition for Good Mothers*	1,333	0.153 – 11.641	1,000
Age When Pregnant < 19 Years	1.155	0.229 – 5.833	1,000
Birth Interval < 2 Years	1,576	0.473 – 5.248	0.356
Frequency of Non-Routine Antenatal Care	2,963	0.889 – 9.872	0.131
Status of Non-Exclusive Breastfeeding	1636	0.661 – 4.051	0.353
The timing of giving weaning food is not appropriate	2,844	0.994 – 8.138	0.061

Note: *= not in accordance with the theoretical basis of the research literature review.
** OR= Odd rasio; CI = Convident Interval

Table 3
Multivariate Data Analysis of Risk Factors for Short Stature in Children Aged 0-24 Months in Surakarta City

Variable	OR	95% CI	P
Low birth weight (<2500 grams)	2,373	0.723 – 7.789	0.154
Premature Pregnancy (< 37 weeks)	4,412	1,219 – 15,971	0.024
Short Mother's Height (< 145cm)	25,625	2,443 – 268,829	0.007
Constant	0.117	-	0.000
-2 Log Likelihoods	102,988		
Nagelkerke R Square	0.210		

DISCUSSION

Based on the characteristics of the data in this study, it was found that the prevalence of short stature in children aged 0-6 months was significantly different from the prevalence of short stature in children aged 7-24 months, namely 4.35% and 25.61%. After 6 months of age, children are more susceptible to infections, such as diarrhea and respiratory infections. In

addition, children aged 7-24 months experience more health problems due to inadequate energy and nutritional intake. Even children aged 7-24 months also need more protein intake to boost the immune system [8] .

Before the age of 6 months, babies get the main source of nutrition from breast milk (breast milk), therefore the risk of nutritional deficiencies and infections in this period is very rare. This phenomenon is different from babies aged 7-24 months, where children who experience short stature during this period are possible because they receive weaning food (complementary food for breast milk) that are inadequate to meet the baby's nutrition. This leads to stunted growth and short stature [8]. This also happened similarly to a study conducted by Arundito et al in 2017, where the prevalence of children aged 0-6 months, 7-12 months, and 13-24 months respectively was 7.46%, 18.32%, and 25.91% [9]. This illustrates that as children aged 0-24 months get older, their likelihood of having short stature increases.

Based on the results of bivariate analysis, it was found that there were 3 risk factors that had a significant relationship with short stature in children aged 0-24 months in Surakarta City, namely low birth weight (birth weight < 2500 grams), premature gestational age factor (gestational age < 37 weeks), and short mother's height (mother's height <145 cm). After multivariate analysis, it was found that the most dominant factor influencing short stature in children aged 0-24 months in Surakarta City was the short mother's height.

Relationship Between Low Birth Weight (LBW) and Short Stature

The results showed that babies with low birth weight (birth weight < 2500 grams) experienced more short stature than normal birth weight. Statistically, bivariate analysis showed that there was a relationship between birth weight and short stature. Babies with LBW are 5.3 times more at risk of having short stature than babies with normal birth weight.

Research conducted by Aryastami et al showed that LBW is the most dominant factor influencing stunting in children aged 12-23 months in Indonesia [10]. A study in Pakistan also concluded that LBW is the dominant factor affecting growth failure in the first three years of life [11] . Babies with LBW tend to have growth restriction when they are still fetuses. In addition, LBW is also a marker that the nutritional status of the mother during pregnancy is poor, such as experiencing energy deficiencies and micronutrient deficiencies. That's why LBW can cause stunted growth in infancy and children [12] .

The Relationship Between Premature Babies and Short Stature

The results showed that babies with premature gestational age (gestational age < 37 weeks) experienced more short stature than normal gestational age. Statistically, bivariate analysis showed that there was a relationship between gestational age and short stature. Premature babies are 3.2 times more at risk of having short stature than babies with normal gestational age.

This study is in accordance with that conducted by Prawirohartono et al in 2016, which showed that there is a very significant relationship with the risk of stunting events [13]. A research review conducted in Indonesia by Beal et al in 2017 also said that one of the determinants of stunting in Indonesia is babies with premature births [14] . Slow growth in infants with gestational age < 37 weeks is influenced by restrictions that have occurred since in the womb due to the short gestational age. Generally, babies who experience restriction from the womb will show growth failure in the next period of life [15]. However, Simondon et al revealed that if babies who have experienced restrictions since their fetal period are given adequate nutritional intake, intra-uterine restrictions can be controlled. However, seeing from the majority of samples that they do have low incomes, this condition will reduce the family's economic ability to buy food with adequate nutrition for the baby [16]. This makes babies who experience intra-uterine growth restriction unable to properly catch up with growth retardation.

The Relationship Between Maternal Height and Short Stature

The results showed that babies with short maternal height (mother height < 145 cm) had more short stature than babies with normal maternal height. Statistically, bivariate analysis showed that there was a relationship between maternal height and short stature. Babies with short mother's height are 15.6 times more at risk of having short stature than babies with short mother's height.

This study is in accordance with research conducted in Semarang in 2011 which stated that short maternal height has a relationship with the incidence of stunting in children aged 24-36 months [17] . An analysis of secondary data conducted by Sinha et al in 2017, stated that pregnant women with a height below 150 cm will be at great risk of giving birth to babies with LBW [18] . They also concluded that LBW babies born to mothers with short stature have a high risk of giving birth to babies with stunting and will experience slow growth after birth. Mendes also mentioned that mothers with height <145 cm have a greater risk of short stature compared to mothers with other height categories [19] .

Genetic factors have an important role in the growth of children. Maternal height is the result of a complex interaction between genetic and environmental factors. A child's height can be influenced by their parents if the height is a result of genetics, not due to insufficient parental intake during their childhood. Short parents will carry the gene in the chromosome and pass it on to their children. A systemic analysis by Murray et al in 2012, said that mothers with short height can not only result in impaired child growth, but can also cause death in the fetus [20] . Short mothers can limit blood flow to the uterus so that the flowing nutrients cannot meet the nutritional needs of the uterus, placenta, and fetus. This will eventually lead to growth delays resulting in short stature.

Based on the results of multivariate analysis, short mother's height is the most dominant factor influencing children aged 0-24 months in Surakarta City. However, it is still not known for certain whether the short mother's height is caused by a lack of nutrition during childhood or due to genetics. This is because, during the research interview, the researchers only asked about the mother's height without tracing the nutritional adequacy of the mother when she was young.

CONCLUSION

Risk factors that have a significant relationship with short stature in children aged 0-24 months in Surakarta are low birth weight, premature gestational age, and short maternal height. The most dominant risk factor affecting short stature in children aged 0-24 months in Surakarta City is short mother's height.

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