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## Family smoking behavior and stunting among children in rural areas of Sleman, Yogyakarta: A case-control study

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### ABSTRACT

**Background and purpose:** The Stunting is one of the public health concerns in Indonesia. The prevalence of stunting among children under five in Kalasan Sub-district, Sleman District, Yogyakarta was high at 17.01%. One of the significant predictors of stunting is parental/family smoking behavior. This study aims to portray the smoking behavior of family members and its association with stunting.

**Methods:** We used a quantitative method with a case-control design. The study was conducted in Tamanmartani Village, one area with a high incidence of stunting. The cases were 45 children under five years with stunting based on the public health center's data and 45 children with normal nutritional status were selected as control. The data was collected by structured interviews using an online questionnaire which included children's and mother's characteristics, and smoking behavior among family members. Data was then analyzed descriptively and a Chi-square test was performed to assess the association between variables and stunting.

**Results:** Children who experience stunting are mostly at the age of 24-35 months (35.6%), female (53.3%) and with family income below minimum wages (62.2%). The smoking behavior among the family was slightly higher among cases (66.7%) than controls (64.4%). Most smoking family members in both groups were smoking outside the house. There was no statistically significant association between all variables with stunting, however, we found a potential association between the father's smoking, type of cigarette, and higher spending on cigarettes with stunting.

**Conclusion:** Smoking among family members was high in both groups, and smoking among fathers is a potential predictor of stunting. Health promotion strategies to reduce smoking habits, smoke-free home innovations, and cessation services should be conducted to reduce and prevent stunting and to improve health.

**Keywords:** Smoking behavior, stunting, under-five children, family, Indonesia

## INTRODUCTION

The number of children under five who experienced stunting globally in 2017 was 22.2% or 150.8 million. WHO sets the tolerance limit for stunting toddlers as less than 20%.<sup>2</sup> Based on WHO data in Southeast Asia/Southeast Asia Regional (SEAR), Indonesia is included as the third country that has the highest prevalence of stunting.<sup>1</sup> In 2018 the prevalence of stunting in Indonesia was 30.8%.<sup>3</sup> In the Medium-Term Development Plan (RPJMN), the government is targeting a reduction in the prevalence of stunting in Indonesia in 2015-2019 by 28%.<sup>4</sup>

The prevalence of stunting in the Special Region of Yogyakarta (DIY) in 2018 was 21%.<sup>3</sup> Although the stunting rate in DIY has reached the national reduction target, stunting is still a health problem in DIY because the Regional Action Plan for the Nutrition Food of DIY (RAD-PG DIY) targets the decline of stunting in DIY in 2018 and 2019 was 17%.<sup>5</sup>

Based on the 2018 Nutrition Status Monitoring report of Sleman District obtained directly from the Sleman District Health Office, the incidence of stunting in Sleman was 11%. When compared to the National and Yogyakarta Province figures, the stunting problem in Sleman is low, less than 28% of the National target and 17% of the DIY RAD-PG target. However, this shows that stunting remains a problem in Sleman because the target for stunting reduction in the district in 2018 was 10%. Kalasan is a sub-district in Sleman that has a higher incidence of stunting (17.01%) compared to the incidence rate in Sleman District.

Unhealthy environment has been one of the risk factors of stunting. One of the causes of an unhealthy environment is air pollution. Indoor air quality can be influenced by activities in the house, such as smoking behavior in the house. Smoking can release pollutants and remain in the house for a long period. An unclean and polluted environment can make children susceptible to disease which has an impact on their growth and development.<sup>7</sup>

Exposure to cigarette smoke can affect the growth of children, as cigarette smoke contains a large number of harmful pollutants such as Carbon Monoxide, Benzene, and 1,3 Butadiene. Research conducted on rat fetuses exposed to benzene shows a delay in their skeletal development. The nicotine found in cigarettes directly affects human chondrocytes (cartilage cells) via nicotine-specific receptors, causing a delay in the bone growth.<sup>8</sup>

Based on a study conducted by Septiawati, et al (2018), it is shown that there is a relationship between House Air Pollution (HAP) and abnormal growth in length and weight of toddlers for the PB/U indicator. Other risk factors that are also associated with abnormal growth in body length for toddlers are exclusive breastfeeding and exposure to cigarette smoke.<sup>9</sup>

In addition, smoking also causes economic losses due to reduced household income because smoking parents prioritize cigarette spending over buying nutritious food. This is in line with a study conducted by Goi (2015) which shows that there is a significant difference in cigarette expenditure per day in families of children with normal nutritional status and stunting.<sup>10</sup> Cigarette spending in families of children with stunting is higher than in those with normal nutritional status.<sup>10</sup>

Research conducted by Irwanti, Julia, and Prabandari (2013) shows that there is no significant difference in energy and protein intake for children under five who live in poor households with smokers and without smokers. However, there is a significant difference in the percentage of food expenditure, namely food

expenditure is lower in households with smokers. There is no significant difference in energy and protein intake because most toddlers consume energy and protein sources at low prices.<sup>11</sup>

Basic Health Research data 2018 shows that the average number of smokers over the age of 15 in Indonesia was 33.8%.<sup>3</sup> Of these, 62.9% were male smokers and 4.8% were female. The percentage of smoking in buildings/rooms in Indonesia was 80.6% and in DIY the percentage of smoking in buildings/rooms was 59.9%.<sup>3</sup> Meanwhile, based on the results of a preliminary study that was conducted on 18-19 May 2019 in Randugunting Hamlet, Tamanmartani Village, Kalasan Sub-District in 10 mothers who had stunting toddlers, it was known from the interview that there were 7 (70%) family members who had smoking behavior.

Therefore, researchers are interested in examining the relationship between the smoking behavior of family members and the incidence of stunting in toddlers in Tamanmartani Village, Kalasan District, Sleman District. The purpose of this study is to determine the relationship between the smoking behavior of family members and stunting among toddlers in Tamanmartani Village, Kalasan Sub-District, Sleman District.

## METHOD

This is a quantitative study with a case-control design that uses a retrospective approach. Case-control design is a design to identify current diseases and then risk factors that occurred in the past.<sup>12</sup> The study was conducted in Tamanmartani Village, one of the villages in the working area of Kalasan Public Health Center that has high stunting incidence.

In this study, the criteria for the cases was stunted children (age 0-59 months) and the criteria for the controls was children with normal nutritional status. Forty-five (45) stunted children from Tamanmartani Village were identified from the Kalasan Public Health Center. We used 1:1 case and control ratio, hence we selected 45 children with normal nutritional status as the control group. The respondents of this study were mothers of those selected children.

The data was collected by interviewing the mothers using structured questionnaires developed with the Kobo toolbox application. The dependent variable of this study was stunting status. We also collected data regarding the children's characteristics including age, sex, history of exclusive breastfeeding and main caregivers; mothers' and family characteristics including education, family income, smoking behaviors among family members (relationship of smokers to the children, location where the smokers smoked their cigarettes, cost of buying cigarette, smoking while holding/accompanying the children).

Univariate and bivariate data analysis was conducted in this study. Bivariate analysis was carried out using chi-square statistical test.<sup>13</sup> This research has been approved by the Ethics Committee of Universitas Respati Yogyakarta, Faculty of Health Sciences with Health Research Ethical Clearance number: 0683/FIKES/PL/II/2020.

## RESULT

Table 1 describes the comparison of cases' and controls' characteristics. The age distribution of both groups

shows that more than one-third (35.6%) of the stunted children were aged 24-35 months, while one-third (33.3%) of the control were aged 36-47 months. There were slightly more girls in the cases (53.3%) than the control (46.7%). The exclusive breastfeeding coverage was high in both groups, but slightly higher among the children with normal nutrition status (88.9% versus 84.4%). The history of illness was slightly lower among the cases group (20.0%) compared to the control (26.7%).

The most frequent main caregivers of both groups were the mothers. Mother's education of higher degree education (diploma/bachelor) for the controls group has a higher proportion (26.7%) compared to the cases group (8.9%). Whilst for the head of household income, 42.2% of the controls have income equal to or above the regional wage threshold ( $\geq$ IDR 1,846,000) compared to 37.8% of the cases.

**Table 1 Characteristics of the children and mothers who participated in the study**

Characteristics of toddlers	Nutritional status				p
	Cases		Controls		
	n	%	n	%	
<b>Age (months)</b>					
6-11	1	2.2	2	4.4	0.29
12-23	9	20.0	11	24.4	
24-35	16	35.6	10	22.2	
36-47	8	17.8	15	33.3	
48-59	11	24.4	7	15.6	
<b>Sex</b>					
Male	21	46.7	24	53.3	0.52
Female	24	53.3	21	46.7	
<b>Exclusive Breastfeeding</b>					
Yes	38	84.4	40	88.9	0.53
No	7	15.6	5	11.1	
<b>History of illness</b>					
Diarrhea	7	15.6	9	20.0	0.71
Typhus	0	0.0	1	2.2	
Acute respiratory tract inspection	2	4.4	2	4.5	
none	36	80.0	33	73.3	
<b>Main Caregiver</b>					
Mother	37	82.2	42	93.3	0.25
Father	1	22.2	0	0.0	
Grandmother	3	6.7	3	6.7	
Baby sitter	2	4.4	0	0.0	
Neighbor	2	4.4	0	0.0	
<b>Education</b>					
Elementary	3	6.7	3	6.7	0.085
Junior/senior high school	38	84.4	30	66.7	
Diplome/ bachelor	4	8.9	12	26.7	
<b>Income of the head of HH (IDR)</b>					
<1,846,000	28	62.2	26	57.8	0.66
>1,846.000	17	37.8	19	42.2	

\*HH= household; IDR= Indonesian Rupiah

From Table 2, it can be seen that there was two third of both cases (66.7%) and controls (64.4%) had family members who were smoking. The majority of the smokers were the children's fathers, 70.0% among cases and 55.2% among control. Most of the smokers were reported smoking outside the house, not smoking while holding the children, and smoking kretek cigarettes among both groups. For spending on cigarettes, a higher proportion of spending above IDR 400,000 among cases (40.0%) compared to the controls (24.1%).

**Table 2. Smoking behavior among family members of children who participated in this study**

Smoking behavior	Nutritional status				p
	Cases		Controls		
	n	%	n	%	
Smoking among family members					
Yes	30	66.7	29	64.4	0.82
No	15	33.3	16	35.6	
Relationship with the smoker*					
Father	21	70.0	16	55.2	0.20
Grandfather	6	20.0	3	10.3	
Sibling	0	0	2	6.9	
Uncle	3	10.0	8	27.6	
Smoking location*					
Inside the house	4	13.3	3	11.4	0.91
Outside the house	26	86.7	26	89.6	
Type of cigarette*					
Kretek	2	6.7	1	4.5	0.78
Filter	28	93.3	28	96.5	
Cigarette spending/month (IDR)*					
<400,000	18	60.0	22	75.9	0.59
400,000-800,000	11	36.7	6	20.7	
>800,000	1	3.3	1	3.4	
Smoking while holding a child*					
Yes	0	0.0	0	0.0	1.00
No	30	100.0	29	100.0	

\*Only for children with smoking family members; n=30 for cases, n=29 for controls

The association and risk comparison in Table 3 shows no statistically significant association or difference in the odds of stunting between groups based on their characteristics, which partially can be due to the small sample size. The proportion of stunting between children with smoking and without smoking family members did not significantly differ either. However, the analysis among children with smoking family members shows some variables with relatively strong odd ratios (almost double the odd); although it was not statistically significant, it should not be ignored. If the smokers were the child's father (OR=1.9; 95%CI: 0.65-5.53), smoking kretek (OR=2.00; 95%CI: 0.17-23.34) and cigarette spending above IDR 400,000 (OR=2.10; 95%CI: 0.60-7.62).

**Table 3. The association between children, mothers' characteristics, and smoking behavior with stunting**

Characteristics	Nutritional status				OR	95%CI	p
	Cases		Controls				
	n	%	n	%			
<b>Age of children</b>							
<36 months	26	57.8	23	51.1	1.3	0.57-3.01	0.525
≥36 months	19	42.2	22	48.9			
<b>Sex</b>							
Male	24	53.3	21	46.7	0.77	0.33-1.75	0.527
Female	21	46.7	24	53.3			
<b>Exclusive breastfeeding</b>							
Yes	38	84.4	40	88.9	1.47	0.43-5.04	0.535
No	7	15.6	5	11.1			
<b>Main Caregiver</b>							
Mother	37	82.2	42	93.3	0.33	0.08-1.34	0.108
Not Mother	8	17.8	3	6.7			
<b>Education of Mother</b>							
Low	3	6.7	3	6.7	1.00	0.19-5.24	1.000
High	42	93.3	42	93.3			
<b>Head of HH income (IDR)</b>							
<IDR 1,846,000	28	62.2	26	57.8	1.20	0.52-2.80	0.667
≥IDR 1,846,000	17	37.8	19	42.2			
<b>Smoking behaviour*</b>							
Yes	30	66.7	29	64.4	1.10	0.46-2.63	0.824
No	15	33.3	16	35.6			
<b>Relationship with smokers*</b>							
Father	21	70.0	16	55.2	1.90	0.65-5.53	0.239
Other	9	30.0	13	44.8			
<b>Smoking location*</b>							
Inside the house	4	13.3	3	10.3	1.33	0.27-6.56	1.000
Outside the house	26	86.7	26	89.7			
<b>Type of cigarette*</b>							
Kretek	2	6.7	1	3.4	2.00	0.17-23.34	1.000
Filter	28	93.3	28	96.6			
<b>Cigarette spending/month (IDR)*</b>							
≥IDR 400,000	12	40.0	7	24.1	2.10	0.60-7.62	0.192
<IDR 400,000	18	60.0	22	75.9			

HH=household; \*only for children with smoking family members

## DISCUSSION

Studies showed parental smoking is directly and indirectly associated with the risk of stunting among children due to secondhand exposure to cigarette smoke and reduced access to nutritional food. We found no statistically significant association which is probably due to the small sample size. However, we found a sign of increased odds of stunting among children whose fathers were smoking, smoking cigarettes, having higher spending on cigarettes, and smoking inside the house. The smoking behavior of family members in this study



was dominated by the fathers which were similar to the research conducted by Wahyuningsih, et al (2016) at Wonosari Hospital, Gunungkidul on the smoking status of family members who smoke in the house, showing that household smokers are dominated by husbands or head of the household.<sup>14</sup> We found there was an increased odd of stunting when the smokers were the children's fathers compared to other family members. The main reason for this is the intensity of contact with the children and also its association with family income and spending.

Parental smoking behavior can affect stunting in toddlers in two ways. Firstly, through parental cigarette smoke which interferes with the absorption of nutrition in children and then interferes with the child's growth and development. should be diverted for spending on nutritional needs for cigarettes.<sup>15</sup> Secondly, the expenditure on buying cigarettes also will have an impact on other expenditures such as family food needs, especially the consumption of protein, which is very much needed to overcome the stunting problem since protein and various micronutrients are important for the growth and development of toddlers such as iron, vitamin B12, and zinc.<sup>16</sup>

The description above is also supported by the analysis from this study that the likelihood of stunting was twofold among the families who spend more than IDR 400,000 on cigarettes. The district minimum wage of Sleman in 2020 is IDR 1,846,000,<sup>17</sup> the majority of the heads of families in this study earned less than the minimum wage. Children from low-income families are at risk of 7.8 times having stunting children compared to high-income families, this is because families with low economic status will affect the quantity and quality of food consumed, especially foods that function for children's growth.<sup>18,19</sup>

We found the majority of smoking family members in both groups smoked white cigarettes, while also found kretek cigarettes increased the odds of stunting by two times, although it is not statistically significant. Further exploration with an adequate number of samples should be conducted. Kretek cigarettes contain 1.2-4.5 mg of nicotine, 46.8 mg of tar, and 28.3 mg of CO, while filter cigarettes contain 1.1 mg of nicotine, 16.3 mg of tar and 15.5 mg of CO. Kretek cigarettes have cloves, the mixture of tobacco and cloves will increase the temperature of the cigarette when burned, making CO<sub>2</sub> and nicotine levels rise 3 times and tar will increase to 5 times.<sup>20</sup>

In our analysis, the insignificant association between smoking and stunting is also likely due to the high prevalence of smoking among adult males in the community which makes no distinct smoking behavior among cases and control family. The 2018 Basic Health Research (Riskesdas 2018) data shows two-thirds of the adult males in Indonesia were smoking. Similarly, among cases and controls in our study, two-thirds of them have family members who were smoking. Similar findings were also found in previous research conducted in Yogyakarta showing that there is no relationship between parental cigarette consumption and the incidence of stunting in toddlers aged 6-24 months.<sup>21</sup> Another study also concluded the same, possibly because most of the samples were smoking outside the house, thereby reducing the frequency of their children's exposure to cigarette smoke.<sup>7</sup> In our analysis, we also found slightly increased odds of stunting if the smokers were smoking inside the house compared to those outside the house. Better exploration of smoking behavior and length of exposure should be conducted in the future.

There are other risk factors for stunting such as maternal factors which were not explored in this study. Maternal factors such as maternal stature and teenage pregnancy, are associated with low birth weight which

can lead to stunting.<sup>22-25</sup> Premature birth is also associated with impaired child growth and development because babies do not have good body functions such as blood circulation, immunity, and respiration.<sup>26</sup> Previous studies showed that there was a relationship between a history of premature birth and the incidence of stunting.<sup>27</sup> Future studies should include maternal and history of birth to better understand the risk factor of stunting.

Children under five were more common to experience stunting at the age of 24-35 months. This is in line with research conducted by Lusita, et al (2017), which shows that toddlers tend to experience a slowdown in growth so that it is lower than in the age of 0-2 years. This is because at the age of 24-35 months, toddlers experience a fairly high development in cognitive and motor skills so that they require more attention in feeding and energy needs.<sup>28</sup> In our study, slightly more girls experience stunting than boys. In line with research conducted by Hidayat, et al (2017), stunting is more common to occur in female toddlers.<sup>29</sup>

Toddlers who are exclusively breastfed have a lower risk of stunting because breast milk contains antibodies and high calcium that functions in bone formation.<sup>30</sup> In this study, most toddlers received exclusive breastfeeding and were taken care of by their mothers. Exclusive breastfeeding can reduce the risk of infectious diseases. Infection can cause energy for growth to be diverted to the body's resistance to infection so that nutrients are difficult to absorb by the body and ultimately stunt growth. Meanwhile, maternal care was considered a protective factor against stunting among toddlers.<sup>31</sup>

Mothers' education and knowledge regarding nutrition and stunting are positive aspects that prevent stunting. The level of mother's education affects the behavior of the mother in managing the household, especially the family's food pattern.<sup>32</sup> Mothers with higher education are more aware of nutrition, especially in processing nutritious food so that the nutritional needs of the family are fulfilled.<sup>32</sup> The education of mothers in this study was relatively good, however, we did not explore their knowledge.

Our study has several limitations. Our sample size was small, hence we were not able to conduct a multivariable analysis nor statistically prove the association between all the variables. Future studies should include more samples by extending the study area or increasing the number of controls. Selection of controls should be properly conducted and matching by age and gender should be considered. There were other factors such as maternal and environmental factors which were not explored in this study.

## CONCLUSION

We found no statistically significant association between smoking behavior and stunting; however, we found a sign of association between the father's smoking status, smoking kretek cigarette, and higher spending on cigarettes. Most of the household has family income below the minimum wage in the area, which has been associated with both smoking behavior and stunting from previous studies. Health promotion strategies to reduce smoking habits among family members especially those with pregnant women and children should be implemented. Smoke-free home innovations can be one solution to protect infants and mothers from exposure to cigarette smoke. Establishing cessation services to support smokers to quit is also essential to prevent future stunting incidents and to improve the family's health. Future studies should explore smoking behavior more thoroughly and other factors such as maternal and environmental factors covering the broader area to have bigger samples and a better understanding.



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## AUTHOR CONTRIBUTION

ERP: collecting data and writing the study's results; EDT: reviewing the research design and results; HY: analysing data and reviewing discussion; HT: reviewing the study's results, writing the results, finalizing the paper and corresponding author.

## CONFLICT OF INTEREST

There is no conflict of interest in this study

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