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Original Article

Nutritional Status of Indonesian Children in Low-Income Households with Fathers that Smoke

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ABSTRACT

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Objectives: This study compared the nutritional status of children in low-income households in Indonesia whose fathers were either cigarette smokers or non-smokers.

Methods: A cross sectional study of 482 children aged 2-6 years was conducted, stratified by whether the fathers were non-smoking ($n = 138$) or smoking ($n = 340$). Mothers and smoking fathers were interviewed about socioeconomic status and cigarette expenditure, respectively. The nutritional status of children was defined by weight-for-age, height-for-age and weight-for-height.

Results: Both groups had similar income. Households with a father that smoked, spent 16.6% of their income on cigarettes. Children whose fathers did not smoke had higher height-for-age (-1.99 vs. -2.25 Z-score, $p = 0.02$) than children whose fathers smoked. Weight-for-age in children with fathers that did not smoke was greater (-1.49 vs. -1.64 Z-score) but not statistically significantly different to those children with fathers that smoked, nor was child weight-for-height (-0.46 vs. -0.45 Z-score). The prevalence of stunted growth was higher in the children with a father that smoked compared with those that had a father did not smoke (62.2 vs. 49.6%, $p = 0.07$, respectively). There were 28.3% of children underweight in homes where the fathers did not smoke, and 35.6% in households where the father smoked ($p = 0.11$). Wasting was observed in 4.4% children where fathers did not smoke and 4.7% where fathers did smoke.

Conclusion: With similar income constraints, the degree of height growth faltering was less in children whose fathers did not smoke, compared to those whose fathers did smoke.

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Introduction

In Indonesia, the prevalence of smoking among the male population from the age of 15 years remains very high and increased steeply from 53.4% in 1995 [1] to 76% in 2015 [2]. While smoking rates among the female population are low (4%) [3], they are expected to rise. The country has not yet signed the World Health Organization (WHO) Framework Convention on Tobacco Control, which would require implementation of a measuring price and tax to reduce the demand for tobacco. This would also protect the population from exposure to

tobacco smoke, and limit advertising of tobacco [4]. The habit of smoking is not evenly distributed across society. Rather, it is becoming increasingly common among individuals with the lowest levels of income, education, and occupational status [5]. The prevalence of smoking among those living in poverty or of low educational attainment is about double that observed in the general population of Indonesia [6]. The prevalence of smoking in the poorest quintile (35.8%) was observed to be higher than in the richest quintile (31.5%) [1]. Factors such as a relatively cheap cigarette price (the lowest in the South East Asian region) [1], weak public policies, coupled with a lack

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of access to information on living healthily, aggressive marketing by the tobacco industries and, ultimately, addiction to nicotine all contribute to people spending their income on tobacco rather than on essential requirements [6,7]. This creates a burden on the already scarce financial resources of low-income families where a significant portion of income needs to be devoted to food, expenditure on tobacco can mean the difference between an adequate diet and malnutrition [7].

From the perspective of food intake, child nutritional status is a function of both dietary quantity and quality [8]. A study conducted in rural Indonesia, where families reported the amount of money spent on quality foods (meat, vegetables and other foods) was less in households with a smoker compared to households where there was no smoking [9]. Hence, paternal smoking may exacerbate child malnutrition [8,9].

Prevalence of paternal smoking is rising in Indonesia and young children may be at risk of malnutrition. Therefore, this study assessed the nutritional status of children aged 2-6 years in low-income households where fathers smoked or did not smoke.

Materials and Methods

1. Participants

A cross-sectional study was conducted among non-smoking women between December 2010 and September 2011 in 2 provinces, Gorontalo and East Java, Indonesia. The areas were selected based on the wealth index and percentage of men smoking cigarettes according to the Indonesian Demographic Health Survey [10] and the 2010 provincial minimum wages [11]. In Gorontalo province, the study was conducted in 2 districts (Bone Bolango and Gorontalo) and 1 municipal (Kota Gorontalo) and in East Java province, it was carried out in 1 district (Jember).

The study power calculation was based on the original study objective to compare 2 means of homocysteine concentrations. Non-smoking women, aged 19-44 years, were purposely selected and recruited from poor households in the community for screening through questionnaires. Poor households were defined by a monthly income below provincial minimum wages of Indonesian rupiah (IDR) 710,000 ($\approx$ US\$ 80.7) for Gorontalo province and IDR 630,000 ($\approx$ US\$ 71.6) for East Java province [11]. The study was approved by the Ethics Committee of the Faculty of Medicine at University of Indonesia (No. 243/PT02.FK/ETIK/2010) and from the Faculty of Medicine at University of Giessen (AZ.: 165/10). Permission was solicited from local government, and each participating mother gave written consent before data collection was started. Participation was voluntary. During data collection, the women received

socioeconomic, biochemical, anthropometric, and dietary assessments. A further analysis of biochemical indicators of the women in this study is in progress.

Assessments included measuring the children's weight and height which were collected once by enumerators. If a family had more than 1 child that fulfilled the study requirements, 1 child was randomly selected for anthropometry. For the purpose of the present study, 482 children aged 2-6 years who had complete anthropometric measurements were included in the analysis. The children were categorized into 2 groups where the father was a smoker or the father was not a smoker.

2. Data Collection

Two enumerators in each study area interviewed all the mothers in their homes that had children aged 2 to 6 years. A structured questionnaire was used to obtain information on socioeconomic indicators, household income, other cash resources (such as direct cash assistance) and food expenditure. For smoking habits and cigarette expenditure, a separated questionnaire was administered to each father that smoked. Household income, other cash resources, and expenditure variables were collected by recall of the average daily or weekly cash resources and expenses for the last 3 months. All cash resources and expenses were recalculated by the enumerators in IDR as monthly household income, food and cigarette expenditure.

3. Anthropometry

The enumerators were rigorously trained to perform anthropometry. Software for Emergency Nutrition Assessment was used to calculate the precision and accuracy of the training measurement. The average results of all the measurements from the investigator were taken as a 'gold standard,' to evaluate all anthropometry results from each enumerator.

Child body weight was recorded to the nearest 0.1 kg with electronic scales (Soehnle 63166) that were kept on a solid horizontal surface. Height was recorded using a roll-up measuring tape to the nearest 0.1 cm. Three indices were used in assessing the nutritional status of children: weight-for-age Z-score (WAZ), height-for-age Z-score (HAZ), and weight-for-height Z-score (WHZ), which were calculated by using the WHO growth reference standard [12].

4. Statistical Analysis

Descriptive data from socioeconomic status of participants were compared between fathers that did not smoke and fathers that did smoke with use of the independent *t* test for continuous distributed variables and was expressed as mean (SD). The Pearson's chi-square test examined differences in proportions. Descriptive statistics were also used for children's

age, gender, weight, and height.

The study outcome was the nutritional status of the children. The ANCOVA was used as the main analysis for all outcomes of continuous variables as the dependent variable (the child Z-scores: WAZ, HAZ, and WHZ). The independent variable included 2 groups of fathers: non-smoking and smoking. Preliminary checks were carried out to ensure that there was no violation of the assumption of normality, homogeneity of variances, homogeneity of regression slopes, and reliable measurement of the covariate. The plot of regression standardized residual was used to check for meeting the assumption that the residuals are approximately normally distributed. Covariates were retained or dropped based on p value (< 0.2). Adjusted mean and 95th Confidence Interval (CI) were calculated for retained variables. The observed mean was provided in the table of results. In addition to main effects, interactions between fathers' smoking status and covariates were assessed to determine whether the effect of covariates appeared to differ between fathers that were non-smoking or smoking. The analysis controlled for potential covariates that might affect the child Z-scores and these were the age of mothers married, schooling and occupation of fathers, age of the children, and study area. These potential covariates gave a $p < 0.05$. The procedure generalized linear models with robust standard errors was used to run the Linear Probability Model, comparing the likelihood of the prevalence of child malnutrition (dichotomous outcomes: underweight, stunted growth, and wasting) as the dependent variables [13].

The SPSS 18.0 software package (SPSS Inc., Chicago, IL, USA) was used for all statistical analyses. A result was considered significant when $p < 0.05$ (2-tailed).

Results

Table 1 showed the parental socioeconomic status according to the study areas. Mean ages of the mothers and fathers were 29.7 years and 34.4 years, respectively. Compared to children whose fathers did not smoke, those with fathers that smoke were more likely to have a less educated mother (6.9 vs. 6.4 years in education, $p = 0.09$) as well as having mothers who married at a younger age (20.1 vs. 18.9 years, $p < 0.001$). They also had a father in education for fewer years (7.5 vs. 6.3 years) and a higher percentage of these fathers that smoked worked as fishermen or farmers (both $p < 0.05$). Fathers that smoked spent an average of 16.6% of their monthly incomes on cigarettes. There were no significant differences in average household size (5 persons; range: 3-18), with more than one-third of both groups living as part of an extended family. The mean total monthly household income of 65.7 US\$ was similar in the 2 groups. Households with fathers that did not smoke

spent an average of 51.1% of their total incomes on food per month, while households with a father that smoked spent an average of 49.6% per month.

Of the 482 children whose anthropometric measurements were taken, 4 were excluded (3 with extreme data of WHZ < -5.00 or a WHZ $> +3.00$ [14] and 1 with low-birth-weight history), leaving 478 children whose data were included in the analysis. Table 2 showed the characteristics of children aged 2-6 years. The proportion of boys was 52.5% and girls was 47.5%. The average age of children whose fathers smoked (4 years), were older by 2.6 months on average ($p = 0.03$), than the average age of children whose fathers did not smoke (3.7 years). There were no significant differences between the groups for results of children's weight and height.

Adjusted for maternal marriage age and study area, both groups of children had similar normal value of mean WAZ (-1.61), even though the WAZ in the non-smoking group was 0.20 greater than in the smoking group. The mean HAZ (-1.96) of children with fathers that did not smoke showed a normal value, whereas those with fathers that smoked (-2.27) was below the cut-off value for normal HAZ.

Adjusted for maternal marriage age, paternal schooling, children's age, and study area, the HAZ of children with fathers that smoked was -0.25 Z-scores lower (adjusted mean; 95% CI: -0.47, -0.04 Z-scores; $p = 0.02$) than that of children with fathers that did not smoke. There was no significant difference in WHZ between the 2 groups of children, with a mean WHZ (-0.45), which was within the normal range (Table 3).

About 28.3% and 35.6% of children were underweight in the non-smoking and smoking groups respectively. Stunted growth was high in both groups. Nearly half (49.6%) of children in the non-smoking group, and two-thirds (62.2%) of the children in the smoking group had stunted growth. There were 17.5% of children that had severely stunted growth in the group where fathers did not smoke compared with 20.4% in the smoking group.

Less than 5% of children showed signs of wasting, whereas none were overweight (WHZ $> +2$ SD; Figure 1). Linear Probability Model revealed that prevalence of a child being underweight did not differ by the fathers' smoking status ($p = 0.11$). Adjusted for maternal marriage age, paternal schooling, children's age, and smoking groups*the maternal marriage age ($p = 0.11$ for tests of interaction); prevalence of stunted growth in children whose fathers did not smoke, was marginally lower than those whose fathers were smokers ($p = 0.07$). For children who showed signs of wasting (WHZ < -2 SD), the Linear Probability Model was not performed because the number of cases were small.

Table 1. Characteristics of study participants in each group.

	Children with fathers that do not smoke	Children with fathers that smoke	<i>p</i> *
Mothers			
Age (y)	29 ± 5.8 (<i>n</i> = 138)	30 ± 6.1 (<i>n</i> = 340)	0.30
Schooling (y)	6.9 ± 3.1 (<i>n</i> = 137)	6.4 ± 2.7 (<i>n</i> = 338)	0.09
Age of marriage (y)	20.1 ± 3.2 (<i>n</i> = 137)	18.9 ± 3.0 (<i>n</i> = 339)	< 0.001
Fathers			
Age (y)	34 ± 6.1 (<i>n</i> = 138)	35 ± 6.9 (<i>n</i> = 337)	0.58
Schooling (y)	7.5 ± 3.3 (<i>n</i> = 137)	6.3 ± 2.7 (<i>n</i> = 339)	< 0.001
Occupation (%)	<i>n</i> = 138	<i>n</i> = 340	0.001
Fisherman	5 (3.6)	25 (7.4)	
Farming	26 (19.0)	116 (34.2)	
Waged labor	66 (48.2)	126 (37.2)	
Salaried	15 (10.9)	38 (11.2)	
Entrepreneur	25 (18.2)	34 (10.0)	
Proportion cigarette expenditure per month	-	16.6 ± 13.1 (<i>n</i> = 339)	-
Households			
Family size	5.0 ± 2.0 (<i>n</i> = 137)	5.1 ± 1.9 (<i>n</i> = 339)	0.66
Family type	<i>n</i> = 138	<i>n</i> = 340	0.07
Nuclear	76 (55.5)	218 (64.3)	
Extended	61 (44.5)	121 (35.7)	
Total income per month (US\$)	63.4 ± 20.7 (<i>n</i> = 137)	66.5 ± 26.5 (<i>n</i> = 338)	0.17
Proportion food expenditure per month	51.1 ± 20.7 (<i>n</i> = 137)	49.6 ± 23.5 (<i>n</i> = 339)	0.53
Study area			
	<i>n</i> = 138	<i>n</i> = 340	
Gorontalo (coastal)	64 (46.4)	184 (54.1)	
Jember (inland)	74 (53.6)	156 (45.9)	0.13

Data are presented as Mean ± SD or *n* (%).

*Calculated using the chi-square test for categorical variables and the *t* test for continuous variables.

Table 2. Characteristics of children aged 2-6 years according to fathers' smoking status.

Characteristics	Children with fathers that do not smoke (<i>n</i> = 138)	Children with fathers that smoke (<i>n</i> = 340)	<i>p</i> *
Boy	73 (52.9)	178 (52.4)	0.91
Age (y)	3.7 ± 1.2	4.0 ± 1.1	0.03
Weight (kg)	13.1 ± 2.7	13.1 ± 2.4	0.87
Height (cm)	92.6 ± 9.1 (<i>n</i> = 137)	92.9 ± 8.8 (<i>n</i> = 339)	0.75

Data are presented as Mean ± SD or *n* (%).

*Calculated using the chi-square test for categorical variables and the *t* test for continuous variables.

Table 3. Nutritional status of children aged 2-6 years according to fathers' smoking status.

Anthropometric measures	Children with fathers that do not smoke (n = 138)		Children with fathers that smoke (n = 340)		p [†]
	Mean ± SD	Adjusted mean* (95% CI)	Mean ± SD	Adjusted mean (95% CI)	
Weight-for-age Z-score	-1.46 ± 1.05	-1.49 (-1.65, -1.33)	-1.66 ± 0.92	-1.64 (-1.74, -1.54)	0.13
Height-for-age Z-score	-1.96 ± 1.14 (n = 137)	-1.99 (-2.17, -1.81)	-2.27 ± 1.05 (n = 339)	-2.25 (-2.36, -2.13)	0.02
Weight-for-height Z-score	-0.46 ± 0.95 (n = 137)	-0.46 (-0.61, -0.30)	-0.45 ± 0.93 (n = 339)	-0.45 (-0.55, -0.35)	0.93

*Adjusted mean: adjusted for covariates.
[†]Calculated using ANCOVA.

Figure 1. Prevalence of children who are underweight, have stunted growth or are wasting according to the smoking status of the father.
WAZ = weight-for-age; HAZ = height-for-age; WHZ = weight-for-height.

Discussion

The results of this study revealed that the degree of height growth faltering was less in children with non-smoking fathers compared with children whose fathers smoked. The differences observed between the two weight dependent indicators (WAZ and WHZ) did not reach statistical significance indicating that paternal smoking was only associated with low height-for-age suggestive of “chronic malnutrition” rather than “general malnutrition” where low weight-for-age is present. A previous study showed that paternal smoking was associated with both general and chronic malnutrition among children aged 0-59 months [9].

It has been reported that food costs are prohibitive of

consumption of nutritionally-rich foods by the lower income groups [15], and this may be compounded by the financial cost of smoking where income may be diverted from buying food to the purchase of cigarettes. The inclusion criteria of participants was restricted to poor households since it represented the comparable poverty line between the 2 groups, with each having a similar restricted monthly income (US\$ 67.50), it might be assumed that the household where the fathers do not smoke would not have a much better opportunity of buying nutritionally-rich foods such as meat, dairy, and fruits which are expensive. In addition to economic pressure, there was a relatively long median duration of time (≥ 13 years, n = 336 [data not shown]) when expenditures for cigarettes may have diverted finances away from buying food. This chronic smoking

habit could be contributory to the long-term effects of child malnutrition.

Even though stunted growth was marginally lower among children whose father did not smoke (12.6% lower), stunted growth (average rate of > 58%) was the most prevalent outcome of child malnutrition observed. This very high prevalence of stunted growth is of concern, suggesting that the majority of children have had a history of poor nutritional health or growth failure. This continues to be the major nutritional problem in Indonesia compared to being underweight, and wasting [16]. Moreover, stunted growth has been related to poverty because protein, especially animal sources of protein are relatively expensive [16]. Children being underweight (33.6%) for their age in families where the father smoked was also observed to be high. These findings are higher than those reported in a study of nationally representative data for children 2.0-4.9 years old who lived in rural areas (47.3% stunted growth, 26.9% underweight) [16]. One explanation for these differences could be the different study target populations. The present study was conducted among low-income households rather than the general population nationwide. In this study, the low prevalence of wasting (2.3%) was the expected prevalence as indicated by WHO guidelines which state that, provided there is no severe food shortage, the prevalence of wasting is usually below 5%, even in poor countries [17]. The use of -2 Z-scores as a cut-off implies that 2.3% of the reference population will be classified as malnourished even if they are truly "healthy" individuals without growth impairment [17].

The quality of the anthropometric data was assessed by observing the SD of the Z-score distribution. Any SD of the Z-scores above 1.3 suggests inaccurate data due to measurement error or incorrect age reporting [17]. The expected ranges for SD of the Z-score distribution for the 3 anthropometric indicators were WAZ-score 1.00 to 1.20, HAZ-score 1.10 to 1.30, and WHZ-score 0.85 to 1.10 [17]. In this study, the SD values were either lower than, or within those considered to be acceptable internationally (SD within groups was 0.92-1.05 for the weight-for-age, 1.05-1.14 for the height-for-age, and 0.93-0.95 for the weight-for-height Z-score).

Besides the nutritional status of the child, the study also hypothesized that children whose fathers smoked were likely to have a lower reported proportion of food expenditure in the households. Unexpectedly, there were no differences in the percent of monthly food expenditure between the smoking and non-smoking groups. Several reasons could explain this observation, firstly, difficulties of mothers knowing the average household income were observed during data collection because 64.6% of households did not have a regular daily income (data not shown). Monthly food expenditure may be a precision measure rather than spending on food, as a proportion of monthly income. Moreover, the interviewers

tried to fully account for total cash income from all sources (such as extra income, debt, cash transfers from government). However, the sub-sample analysis of the households where the father smoked revealed that there was not an inverse relationship between (%) food expenditures which were disclosed by the mothers, and (%) cigarette expenditure as reported by the fathers. It should be noted that household food expenditures are those which were described by the mothers; therefore, the unit of analysis in this study is household; whereas tobacco expenditure was determined by surveying individual fathers. Secondly, 44.5% in households where the father did not smoke and 35.7% in households where the father did smoke, had extended family members living in the same household. Extended family members may be sharing food among household members. Thus, it is possible that food expenditures were not exclusively the responsibility of the respondent's nuclear family. Thirdly, more detailed interviews regarding expenditures on food items (staples, meat, eggs, vegetables, milk, oil and sugar) may help to identify a greater difference. For example, a study in rural India showed that even though the difference in budget for food was not significant between tobacco-consuming and non-consuming households, it was observed that tobacco consumers allocated more of their budget to cereal/cereal substitutes compared to non-tobacco consumers and the milk/milk products (items mostly consumed by children) were highly compromised [18].

Cigarette expenditure (16.6% of the total monthly household income) in this study was higher than that reported in rural Indonesia (13% of weekly per capita cigarette expenditure) [9] and the national survey (11.5% on tobacco products) [6]. These differences in results may be due to the target population. The first 2 studies were conducted among a low socioeconomic population with different inclusion criteria for poverty (the low-income households for this study were purposely selected vs. the rural households in an earlier study were randomly selected [9]), while national survey represented the entire adult population of the country. In agreement with previous findings, households with a smoker have distinguished socioeconomic characteristics, such as lower levels of parental education [9] and more fathers in manual work as farmers, fishermen or laborers [19].

The national strategy in Indonesia is to reduce stunted growth as a matter of urgency. The programme uses 5 key services for health, early childhood education and development, nutrition, water and sanitation, and social protection [20]. The associated risk of parental smoking with child stunted growth indicates a need to include anti-smoking counselling in this program.

In an effort to eradicate poverty, the government of Indonesia has implemented a conditional cash transfer program (CCT). Still, the CCT might be ineffective in its targeting; i.e., providing

greater spending power for cigarettes instead of on household food purchases. Accordingly, the program also requires that poor households receive money in return for fulfilling specific behavioral practices [21] i.e., fathers quit smoking, which may lead to increased quality of the children's diet. In conjunction with cash transfers, it is essential to improve interactions with health workers to prevent child malnutrition and health correlates for parents.

1. Limitations

Firstly, the mothers were not asked for expenditures other than food which could possibly alter household income. Best et al [9] found that households where there were smokers, spent proportionally less of their income on food, education, medical care, and other commodities in comparison with households that did not have a smoker. Secondly, child malnutrition has a multifactorial aetiology, which was not fully examined in this study. For example, the immediate causes of malnutrition involve inadequate dietary intake and frequent illness. Thirdly, questionnaires and interviews were used to identify the “true” socioeconomic conditions of participants. “Socially desirable responding” is a tendency among participants to present a favorable image of themselves and is most likely to occur in response to socially sensitive questions, which may affect the validity of the questionnaire [22]. Fourthly, the fact that total income, and food and cigarette expenditures were used as a measure of poverty was more likely to be affected by the current situation and short-term influences which may not represent the development of child growth, and may not reveal the long-term behavior of a fathers smoking habit.

Conclusion

The present study observed low-income households where the father smoked, were not spending less of their earnings on food compared to fathers that did not smoke. Nevertheless, the economic hardship due to the fathers' tobacco expenditure was adversely affected linear growth in their children.

Political will at the highest levels of government is needed to enforce effective legislation, and to counter the inevitable opposition from the tobacco industry [4]. Joining and full implementation of the tobacco control movement (Framework Convention on Tobacco Control) is warranted in Indonesia.

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Conflicts of Interest

The author has no conflicts of interest to declare.

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