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## Cigarette Consumption and Nutrient Intake in Indonesia: Study of Cigarette-Consuming Households

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### Abstract

**Objective:** This study aims to investigate the impact of cigarette consumption on household's nutrition adequacy (NA). This study also examines the opportunity cost of cigarette expenditure to children's nutritional adequacy. **Methods:** We used an Indonesian cross-sectional household level nationwide data of 2018 National Socio-Economic Survey (SUSENAS). Using multivariate Ordinary Least Square (OLS) regression, we estimated the impact of cigarette consumption on household's NA as defined by household protein and energy intakes. With the same specification, we further ran a segregated OLS regression by household quintile expenditure. While the opportunity cost of cigarette consumption to children's nutrition adequacy defined the estimated forgone nutrition due to cigarette consumption by following the Ministry of Health (MOH) definition of Recommended Dietary Allowance (RDA) for children aged 4 – 6. **Results:** Cigarette consumption decreases household's protein and energy intakes. We found statistically significant correlation between household's cigarette consumption and household's per capita protein intake while no statistically significant correlation on energy intake. Furthermore, the segregated estimate is significant for both protein and energy intakes among 60% lowest household quintile expenditure groups. The lower the quintile expenditure, the higher the decline in household NA due to cigarette consumption. With the average cigarette expenditure of IDR12,956 per household per day, giving up daily cigarette spending could meet children's energy intake by 27% – 85,4% of RDA and protein intake by 180.12% – 300.48% of RDA. **Conclusion:** Household cigarette consumption has negative impact on household's daily energy and protein intakes. The poorest group is most vulnerable to nutrition inadequacy due to cigarette consumption. Giving up household's cigarette expenditure daily could result in a substantial nutrition gain for children at their critical growth stages.

**Keywords:** Cigarette consumption- nutrition adequacy- opportunity cost- cigarette expenditure

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### Introduction

Indonesia has been sitting as the country with highest male smoking prevalence in ASEAN region with the figure of 66% by 2018 (Lian and Dorotheo, 2018). Further, the 2018 National Socio-Economic Survey (SUSENAS/Survei Ekonomi Sosial Nasional) data shows that six out of ten households in Indonesia have at least one smoker household member. The same data also suggested that the share of household with smoker household member increases as the household income group decreases – signalling higher smoking prevalence among lower income group households. Given the budget constraints, older studies in various countries have documented that the phenomena of cigarette spending among lower income households dilutes household spending for other essentials necessities with (Efroymsen et al., 2005; Wang et al., 2006; John, 2008; Dartanto et

al., 2018b).

At the expense of food consumption, cigarette spending among poorer households lead to food insecurity (Cutler-Triggs et al., 2008; Iglesias-Rios et al., 2013; Jumrani and Birthal, 2017). This trend persists even after more than a decade of persistent tobacco control actions in various major tobacco-consuming countries (Sreeramareddy and Ramakrishnareddy, 2017; Nugent et al., 2018; Haq et al., 2019). Further, the study in Tanzania suggested that per capita cigarette consumption negatively affects daily calorie intake, suggesting detrimental effect of cigarette on household's nutritional status (Kidane et al., 2015). While this problem has been addressed in numbers of studies in different countries context, the study in Indonesia – where children's nutritional status is still concerning – remains limited.

Indonesia is still faced with the main challenge of considerably high prevalence of stunting – 30.8% by

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2018. This placed Indonesia as the third country with highest stunting prevalence in South-East Asia – behind Lao PDR and Cambodia (World Bank, 2021). Given this fact, a high smoking prevalence could be a double burden for the country’s health sector, as majority of previous studies have agreed on the negative impact of cigarette consumption on children’s nutritional status in Indonesia (Dartanto et al., 2018a; Wijaya-Erhardt, 2019). Further, children living in a household with a smoker household member also possessed a greater risk of food insecurity (Semba et al., 2011).

With both reducing smoking prevalence and stunting prevalence placed as the core concern of the country’s National Medium-Term Development Plans (RPJMN/ Rencana Pembangunan Jangka Menengah Nasional) of 2020 – 2024 (Bappenas, 2019), immediate policies to reduce smoking prevalence could accelerate the country’s ambitious target of achieving 19% stunting prevalence by 2024. While the negative impact of cigarette consumption on children’s nutritional status in Indonesia have been documented in few previous studies, limited studies directly computed the forgone household nutritional values due to household cigarette consumption. Further, to the best of our knowledge, none of the previous studies in Indonesian context evaluated the opportunity cost of cigarette consumption on children’s nutritional status. Therefore, our study seeks to fill this gap. This study investigates the impact of household cigarette consumption on household nutritional intake. Moreover, this study also estimated the opportunity cost of cigarette expenditure to nutritional adequacy (Semba et al., 2007; Block and Webb, 2009)

## Materials and Methods

### Data source, sampling, and sample

We used a cross-sectional data of 2018 National Socio-Economic Survey (SUSENAS/Survei Sosial Ekonomi Nasional), a nation-wide sociodemographic household survey collected by Central Board of Statistics (BPS/Badan Pusat Statistik). The dataset corresponds to the sampling survey of 2010 National Census. The sampling method used in the survey was a multi-stage stratified Probability Proportional to Size (PPS) sampling (Badan Pusat Statistik, 2018). Of 295,155 total households interviewed, we successfully identified 170,959 (60%) households with cigarette expenditure for our observations. Our study uses the unit of analysis at the household level.

### Measures and Empirical Strategy

#### Nutrition Adequacy and Cigarette Consumption

The following equation (1) describes our econometric specification.

$$NA_n = \gamma_0 + \gamma_1 \ln C_n + \gamma_2 \ln E_n + \sum_{k=1}^K \gamma_3 HH_{kn} + \varepsilon_n \quad (1)$$

whereby  $NA_n$  denoted Nutrition Adequacy (NA) which is set of dependent variables consisting of energy adequacy and protein adequacy. Following Amrullah et al., (2019), energy adequacy is calculated as the percentage of the total

of household energy consumption (kcal/household/day) to Recommended Daily Energy Allowance ( $RDA_{kal}$ ). While protein adequacy total household protein consumption (gr/household/day) to Recommended Daily Protein Allowance ( $RDA_{pro}$ ). Both  $RDA_{kal}$  and  $RDA_{pro}$  follows Indonesian Ministry of Health (MOH) Regulation No. 75/2013 on Indonesian Recommended Dietary Allowance (RDA) by age and sex. We calculated the  $RDA_{kal}$  and  $RDA_{pro}$  for each household member corresponding to their age and sex and aggregating the total  $RDA_{kal}$  and  $RDA_{pro}$  per household.

Our main independent variable is  $\ln C$ , which is the household cigarette consumption is measured as the natural log (ln) of total household monthly cigarette spending in Indonesian Rupiah (IDR).  $\gamma_1$  is our parameter of interest capturing the possible relationship between cigarette consumption and nutrition adequacy. While the increase of household spending allocated for cigarette reduces the allocation of expenditure for remaining essential food items (Djutaharta et al., 2021), we expected that cigarette consumption would subsequently reduce household nutrition adequacy. Therefore, we expected the sign of  $\gamma_1$  to be negative.

We also included additional socioeconomic status (SES) controls as denoted by  $\ln E$  (ln of total monthly household expenditure) and  $HH_{kn}$  which is a set of SES consisting of education level of HHH, occupational sector of HHH (formal/informal), the number of householders by age group and sex, and household place of residence (urban/rural). To estimate equation (1), we employed Ordinary Least Square (OLS) regression. For further robustness check, we also ran a segregated OLS regression by household expenditure quintile.

### Opportunity Cost of Household Cigarette Expenditure

To calculate the opportunity cost of cigarette expenditure to children’s protein and energy intakes, we follow the model illustrated in the study in Bangladesh (Husain et al., 2017). To demonstrate the opportunity cost, we carefully selected five food items containing high protein including broiler egg, broiler chicken meat, tilapia (mujair), mackerel (banyara/lema), and milk powder. In addition, we specifically refer to the recommended protein and energy by MoH’s RDA for children aged 4 – 6 years old, as children at this age group are highly vulnerable to experience undernutrition problem due to parents’ cigarette consumption.

## Results

### Household’s protein and energy sources

Table 1 presented the summary of descriptive statistics, comparing key variables for overall households and households with cigarette consumption. On average, household spent IDR 15,458.6 for a pack of cigarette per month. In addition, as shown by table 1, the average of daily per capita energy intake of the Indonesian population is 2,235.6 kcal for overall households. This number is slightly lower – 2,198.2 kcal/capita/day – for household with cigarette consumption. Similarly, the average daily per capita protein intake for household with cigarette

Table 1. Summary of Descriptive Statistics

Variable	All Households		Household with Cigarette Consumption	
	Mean (SD)	Obs	Mean (SD)	Obs
<b>Nutritional Consumption</b>				
Energy Consumption (kcal/capita/day)	2,235.6 (667.5)	295.155	2,198.2 (639)	170.959
Protein Consumption (gr/capita/day)	64.2 (24.6)	295.155	62.3 (22.7)	170.959
<b>Cigarette Consumption</b>				
Unit Value of Cigarette (IDR/pack)	N/A	N/A	15,458.6 N/A	N/A
Household Cigarette Consumption (IDR/day)	N/A	N/A	12.956 (6,170.1)	170.959
Ln of Cigarette Consumption (pack/month)	N/A	N/A	2.99	170.959

Source, SUSENAS (BPS) September, 2018

consumption is only 62.3 grams – lower than average of Indonesian households at 64.2 grams. While the number is still higher as compared to MoH’s RDA, the protein and energy consumed by household with cigarette consumption is dominated by lower-quality food as presented by Table 2.

Table 2 described the share of protein and energy intakes by food category and household quintile expenditure for household with cigarette consumption. Grains/tubers – relatively lower-quality food – accounted for 30.8% and 40.1% for protein and energy, respectively. The figure is higher for lower household quintile. While animal proteins – which is a better source of protein containing essentials amino acids – only shares for 25.8% of overall household protein intake. This number is substantially lower for lowest household quintile – 18.6%.

While the number for the highest quintile is 31.1%, this indicated the unaffordability of animal proteins by poorer household.

*Impact of Cigarette Consumption on Household’s Nutrition Adequacy*

Table 3 below presented Ordinary Least Square (OLS) estimates of the impact of cigarette consumption on household’s nutrition adequacy. While the parameter of cigarette consumption indicated negative impact for both household’s protein and energy intakes, we only found statistically significant evidence on protein intake with 1% increase in household’s cigarette consumption reduces 0.32% household’s protein intake. Further, our household expenditure quintile segregated OLS estimate presented in table 4 shows that for the three lowest

Table 2. Protein and Energy Sources by Food Category and Expenditure Quintile, 2018

	Q1	Q2	Q3	Q4	Q5	Full Sample
<b>Protein</b>						
<b>Protein Sources (%)</b>						
Cereal/tubers	421	363	327	287	214	308
Fish/shrimp/squid/clams/meat/egg/milk	186	222	251	277	311	257
Vegetables/fruit	5	46	45	43	39	44
Beans and nuts	97	94	9	88	81	89
Other food sources	42	42	42	42	37	41
Prepared food and beverage	204	233	245	263	318	261
Total (%)	100	100	100	100	100	100
<b>Energy</b>						
<b>Energy Sources (%)</b>						
Cereal/tubers	501	446	415	377	307	401
Fish/shrimp/squid/clams/meat/egg/milk	5	65	78	92	117	83
Vegetables/fruit	34	36	38	4	45	38
Beans and nuts	27	26	26	27	27	27
Other	184	194	198	204	199	197
Prepared food and beverage	204	233	245	26	305	254
Total (%)	100	100	100	100	100	100

Source, SUSENAS (BPS) September, 2018

Table 3. OLS Estimate of Cigarette Consumption Impact on Household's Nutrition Adequacy

Independent Variable	Energy	Proten
Cigarette consumption (ln)	-0.13 (1.61)	-0.32*** (2.97)
Total monthly household expenditure (ln)	238.48*** (172.81)	350.32*** (182.25)
constant	-216.23*** (113.8)	-369.84*** (140.82)
Additional SES Controls	Y	Y
Observations	170.959	170.959
R <sup>2</sup>	0.29	0.32

Notes: (1) Additional socioeconomic status (SES) controls include Household Head Age, Household Head Occupational Sector, Household Head Education Level, Household Place of Residence (Urban/Rural), and Number of Householders by Age Group and Sex (2) \*p<01, \*\*p<005, \*\*\*p<001

quintiles (60% lowest income group), the increase in the number of cigarettes consumed statistically significant in decreasing the household's protein and energy intakes. In addition, both coefficients were highest for the lowest quintile. While table 2 shows that the average protein and energy intakes for lowest quintile are far below the MoH's RDA, this signifies that increasing cigarette consumption will further attenuate poorest households in meeting the recommended dietary allowance. This is consistent with the previous study finding in Indonesian context that the increase in cigarette consumption decreases household's allocation for food spending (Djutaharta et al., 2021).

*Opportunity Cost of Cigarette Consumption to Children's Nutrition Adequacy*

Table 5 below presented the opportunity cost of cigarette consumption to children's nutrition adequacy based on five selected high-protein food items. Under the assumption that household spent on average of IDR 12,956/day for cigarettes (Table 1), if a household reallocate this spending to buy the five food items, it could meet the RDA energy intake by 48.93% – 300.48%

Table 5 Opportunity Cost of Cigarette Consumption to Children's (Aged 4 – 6) Nutrition Adequacy by HH Quintile Expenditure (%)

Food Category	Full Sample	Q1	Q2	Q3	Q4	Q5
<b>Protein</b>						
Broiler egg	18,012	7,489	11,953	16,123	2,095	28,273
Banyara/mackerel/lema	26,362	14,393	20,462	259	31,353	38,168
Tilapia	30,048	19,386	25,989	28,923	35,309	39,027
Broiler chicken meat	23,525	10,513	16,268	21,816	28,015	36,501
Milk powder	10,018	6,134	9,128	11,121	12,917	14,946
<b>Energy</b>						
Broiler egg	4,893	2,034	3,247	438	5,692	7,681
Banyara/mackerel/lema	27	1,474	2,096	2,653	3,211	3,909
Tilapia	3,128	2,018	2,706	3,011	3,676	4,063
Broiler chicken meat	8,539	3,816	5,905	7,919	10,169	13,249
Milk powder	4,534	2,776	4,132	5,034	5,847	6,765

Source: Author's calculation Note: MoH's RDA for children 4 – 6 years old is 1,600/kcal/day for energy and 35 grams/day for protein

Table 4. OLS Estimate of Cigarette Consumption Impact on Household's Nutrition Adequacy by HH Quintile Expenditure

Dependent Variable	Q1	Q2	Q3	Q4	Q5
Energy	-2.06*** (11.24)	-1.64*** (9.94)	-0.95*** (5.62)	0.15 (0.83)	1.73*** (8.65)
Protein	-1.62*** (7.38)	-2.01*** (9.84)	-0.94*** (4.26)	0.23 (0.95)	1.49*** (4.98)
Additional SES Controls	Y	Y	Y	Y	Y
Observations	21.571	34.645	38.85	39.824	36.069
R <sup>2</sup>	0.39	0.32	0.27	0.23	0.18

Notes: (1) Additional socioeconomic status (SES) controls include Household Head Age, Household Head Occupational Sector, Household Head Education Level, Household Place of Residence (Urban/Rural), and Number of Householders by Age Group and Sex (2) \*p<01, \*\*p<005, \*\*\*p<001

and protein intake by 27% – 85.39% (for children aged 4 – 6), respectively. This signified that the reallocation of daily expenditure spent for cigarette could meet RDA energy sources for up to three children aged 4 – 6 years old per household per day. Table 5 further presents that the higher household quintile expenditure, the higher is the opportunity cost to meet the children's RDA for protein and energy. This is due to the higher average daily cigarette spending among higher household quintile expenditure.

**Discussion**

Our findings suggest that households with cigarette consumption will have lower nutrition adequacy as the implication of negative impact of cigarette consumption on household's protein and energy intakes. The largest decline of protein and energy intakes due to cigarette consumption is faced by the 20% lowest household expenditure group. This is consistent with the previous studies finding on cigarette consumption to food insecurity (Semba et al., 2011; Mayer et al., 2019). Due to income

constraints, poorer households will face higher difficulties to meet sufficient amount of protein and energy intakes.

Our findings also implied that cigarette consumption has a very high opportunity cost to household's food consumption. Due to budget constraints, higher spending on cigarette will decrease food consumption, especially among poorer households (Nugent et al., 2018; Djutaharta et al., 2021). While poorer households are more sensitive to food insecurity (Yaktiwo et al., 2017), a small decrease of food expenditure could have a substantial impact on poor household nutrition adequacy. Households with smoking parents have a higher risk of having malnourished children under five (Best et al., 2008; Semba et al., 2007a). This study supports previous studies that increasing cigarette consumption will decrease NA of the households.

Furthermore, our finding on the high opportunity cost of cigarette consumption on children's nutrition adequacy confirms the previous study in Bangladesh (Husain et al., 2017). While the study in Bangladesh found that a household giving up cigarette consumption could 269 – 497 kcal daily, our finding suggested that in Indonesian context, household could gain substantially higher calories amount. Referring to 1,600 kcal (MoH's RDA on children aged 4 – 6), a household giving up IDR 12,956 spending on cigarette daily could gain 27% – 85.39% of 1,600 kcal/day (432 – 1,366 kcal/day).

### Author Contribution Statement

TD, NW, YM conceptualize the study design, process, and analyze the data; AA, DK, NA, prepare the draft and proofread. All authors agreed on the manuscript

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### Ethics

Not applicable. The data is obtained from secondary resources, the ethical issue was handled by the third party

### Data Availability Statement

The data that support the findings of this study are available upon request to Badan Pusat Statistik (BPS).

### Statement Conflict of Interest

No potential conflict of interest was reported by the authors.

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