Economic and Consumption Variables and Their Associations with Stunting Prevalence: A Provincial Analysis of the Indonesian Child Nutritional Status Survey 2019

Aldiza Intan Randani, Yayuk Farida Baliwati*, Dadang Sukandar, Ikeu Tanziha

Department of Community Nutrition, Faculty of Human Ecology, IPB University, Bogor 16680, Indonesia

ABSTRACT

The study aims to analyze the relationship between economic and food consumption variables with stunting prevalence among Indonesian children. The unit of analysis for this cross-sectional study was secondary data set from 2019 for 34 provinces obtained from Statistics Indonesia, the Food Security Agency, and the Ministry of Health of the Republic of Indonesia. In the majority of provinces (88.24%) the stunting prevalence was still categorized as serious public health problem with the prevalence of 30% or higher. The economic outlook in 2019 showed an economic growth, decrease in Gini ratio and the unemployment rate in 34 provinces. However, the poverty rate was very diverse between provinces and concentrated in eastern Indonesia. There were 17 provinces that had higher food than non-food expenditures. There were 31 provinces with normal energy adequacy level and 28 with normal protein adequacy level. However, there was no provinces reached maximum score in Desirable Dietary Pattern (DDP) as the indicator for food diversity, signaling that none of the provinces achieved adequate diversity in food consumption in 2019. The multivariate linear regression with backward elimination technique showed that seven of independent variables were qualified for the final model with R2 of 0.7406. The three variables significantly correlated with stunting prevalence (p<0.05) were food expenditure, protein adequacy level, and DDP score. Hence, these variables can be categorized as causal factors for stunting at provincial level analysis which can feed the food and nutrition policy and its monitoring and evaluation strategy. However, further analysis is needed to determine the direct and indirect relationship between economic factors, food expenditure, and food consumption with the prevalence of stunting among children in Indonesia so that stunting prevention and alleviation programs can be more precise and optimal.

Keywords: economic variables, food consumption, stunting

INTRODUCTION

Indonesia is still struggling with stunting as public health problem. In 2018, the stunting prevalence in Indonesia reached 30.8% in 2018 (MoH RI 2018) where a prevalence of above 30% is considered as serious public health problem (De Onis *et al.* 2019). This high prevalence is far from achieving the target from the Sustainable Development Goals (SDGs) of zero hunger in 2025.

WHO (2013) stated that childhood stunting causes short term and long term negative consequences. Globally, around 0.9 million from 1.4 million deaths in children under five years old are associated with stunting. The lack of nutrient lead to weaker immune system which causes the body to be more susceptible to disease, both infectious and non-communicable disease (Reinhardt & Fanzo 2014). The growth retardation is not only limited to physical aspects, stunting causes decrease in intellectual and cognitive functions which lead to lower academic achievement and productivity. In addition, childhood stunting is also associated with increase prevalence of obesity both in children or adults. The risk of obesity increases 2.4 times in children with stunting as they get older (WHO 2013; De Onis & Branca 2016). The decrease of productivity in Indonesia that was caused by stunting lead to 0.15−0.67% economic losses of Gross Regional Domestic Product (GRDP) in 2013 (Renyeot *et al.* 2016).

There is a strong association between stunting prevalence and income per capita in a country (Fenta *et al.* 2020). The Indonesian Economic situation has been marked by positive economic growth. However, this growth should

also be assessed from other indicators such as the poverty rate, unemployment rate, and economic inequality to offer more comprehensive view.

Subramanyam *et al.* (2011) stated that good economic growth only benefits the high-income group and does not help people from the low-income quintile groups. This economic inequality is measured by Gini ratio. Gini ratio in Indonesia reached 0.38 in 2018 (BPS 2019) which shows an adequate equality. Black *et al.* (2013) stated that stunting prevalence in children under 5 years old in poor households is 2.47 times higher than stunting prevalence in rich households. In 2018, poverty rate in Indonesia, as one of developing countries, reached 9.66% (BPS 2019). Poor households in Indonesia are more vulnerable to stunting because of their limited access to food with adequate quantity and quality (Beal *et al.* 2018).

Increasing income without decreasing economic inequality and poverty rate is common in the developing countries and will influence the prevalence of stunting. (Rabbani *et al.* 2016). Low purchasing power will lead to consumption of cheap food with high energy density and lack of diversity for example, cereals and noodles. Long-term consumption of such food will cause micronutrient deficiency in children. While on the other hand, the proportion of nutrient rich food such as animal source foods, tend to decrease (DiSantis *et al.* 2013; Faradina *et al.* 2018).

Against these backgrounds, regarding the high stunting prevalence and its relationship to economic situation in various settings, it is important to fill the research gap on the assessment of economic situation and food consumption in Indonesia. This study also aims to analyze the economic variables associated with stunting based on the WHO stunting framework (2013).

METHODS

Design, location, and time

This study was a cross sectional analysis of secondary data set from 2019 regarding economic variables and food consumption at provincial level. Sources of data are Statistics Indonesia (BPS), Food Security Agency of the Ministry of Agriculture of the Republic of Indonesia (BKP), and Ministry of Health of the Republic of Indonesia. The data set used was from 2019 and provinces level (34) were chosen as the

units of analysis, this decision was based on the completeness and availability of data that can be accessed through official online publication.

Data collection

Dependent variable in this study was stunting prevalence among children aged 0−59 months based on data from the 2019 Child Health Status Survey (SSGBI). Stunting prevalence in this publication is calculated based on the result of integration survey between National Socioeconomic Survey and Child Health Status Survey that were conducted at provincial and district levels in Indonesia. Meanwhile, independent variables that were used in this study were economic growth, economic inequality, unemployment rate, poverty rate, total of food expenditure, and food consumption. Sources of data are the 2019 data collections from 34 provinces in Indonesia. The selection of these data collections was based on the availability of data in national publication with data in provincial level as the main unit.

Economic growth was measured by the value of Gross Regional Domestic Product (GRDP). This GRDP data were collected from the publication of Statistics Indonesia, namely, "The Gross Regional Domestic Product of The Provinces in Indonesia by Business Field from 2016−2020". The values of GRDP (IDR/cap/year) in that publication refer to the amount of added value produced by production units in part of a region in specified period of time (usually one year) and the production units are grouped into 17 categories of industry.

Economic inequality is measured by Gini ratio which collected from Statistics Indonesia publication, the Calculation and Analysis of Macro Poverty in Indonesia in 2019. Gini ratio's formula is described as follows (BPS 2019).

$$G = 1 - \sum_{k=1}^{n}(X_k - X_{k-1})(Y_k + Y_{k-1})$$

where G is Gini ratio; X_k is cumulative proportion of population for k=0, 1, 2, … n with X0=0 and X1=1; Y_k is cumulative proportion of expenditure for k = 0, 1, 2 … n with Y0=0 and Y1=1.

Other economic variable in the analysis was poverty rate (%). The data for each province were collected from Statistics Indonesia publication, the Calculation and Analysis of Macro Poverty in Indonesia in 2019. The poverty rate was calculated based on this formula (BPS 2019).

$$P_\alpha = \frac{1}{n} \sum_{i=1}^{q} \left[\frac{z - y_i}{z}\right]^\alpha$$

where, α=0; z=poverty line; yi= the average of monthly expenditure/capita of population below the poverty line (i=1,2,3,…,q), yi<z ; q=sum of population that lives below poverty line; n=population.

Other independent variables were unemployment rate and food expenditure. Those data were collected from Statistics Indonesia publication, namely, Key Indicators of Indonesia Labor Market 2019 and Executive Summary of Consumption and Expenditure of Indonesia 2019. Meanwhile, food consumption variables consisted of energy adequacy level, protein adequacy level, and Desirable Dietary Pattern (DDP) score. All data on food consumption variables were collected from publication of the Food Security Agency (BKP), the Food Consumption Development Directory 2020.

Energy and protein adequacy levels are the adequacy rate for each energy and protein consumption compared to the Indonesian Recommended Dietary Allowance (RDA). RDA for energy is 2,100 kkal/cap/day while RDA for protein is 57 gram/cap/day. The RDA is based on the average needs of Indonesia's population regardless of gender and age (MoH RI 2019). Desirable Dietary Pattern score is an indicator for assessing food intake diversity based on the energy balance obtained from various food groups in the diet. The food groups are divided into nine groups based on proportion of their energy consumption: 1) Cereals and grains 50%; 2) Tubers 6%; 3) Animal-source foods 12%; 4) Oils and fats 10%; 5) Fruit/seed oil 3%; 6) Nuts 5%; 7) Sugar 5%; 8) Vegetables and fruits 6%; 9) Others (seasoning and herbs) 3%.

The DDP score calculation is based on energy consumption at the population level. Energy proportion in food groups is multiplied by each rating of each food group, which is based on the function of food. The rating in each group is as follows: 1) The rating for cereals and grains, tubers, oils and fats, fruit/seed oil, as well as sugars is 0.5; 2) The rating for animal-source foods and nuts is 2; and 3) For vegetables and fruits the rating is five. The ideal score for DDP in each food group was obtained from multiplying the rating by energy proportion of each food group. If those DDP scores are summed, it will produce

the DDP score of the regions with maximum score of 100. This score means that the quality of population's food consumption reaches the ideal level. Higher DDP score indicates a more diverse and nutritionally balanced food consumption in the region. The details of ideal DDP score in each food groups are as follows: 1) Cereals and grains (25); 2) Tubers (2.5); 3) Animal source foods (24); 4) Oils and fats 5; 5) Fruit/seed oil (1); 6) Nuts (10); 7) Sugar (2.5); 8) Vegetables and fruits (30); 9) Others (0) (BKP 2015).

Data analysis

Data in this study were analyzed using multivariate linear regression with backward elimination technique. The selected independent variables which were included in the final model were based on p-value of each independent variable (p≤0.05). Below is the complete model for the multivariate linear regression.

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_8 X_8 + \varepsilon$$

where Yi: Stunting prevalence; β_0: Slope; β_1, β_2…, β8: Intercept/regression coefficient of stunting; X1: Gini ratio; X_2: GRDP of region (IDR/capita/year); X_3: Unemployment rate; X_4: Poverty rate; X_5: An average of food expenditure (IDR/capita/year); X_6: Energy consumption (energy adequacy level as a percentage); X_7: Protein consumption (protein adequacy level as a percentage); X_8: Desirable Dietary Pattern score; ε: Error.

RESULTS AND DISCUSSION

The stunting prevalence in each province in 2019 was varied. However, there were no provinces with low prevalence or very low prevalence (De Onis *et al.* 2019). Overall, the Indonesian economic growth was still in line with the plotted scenario with the GRDP in each province has been increasing through the years. Unemployment rate and Gini ratio also decrease in all provinces. On the other hand, similar to stunting poverty is varied in 34 provinces.

Referring to the WHO framework for child malnutrition, economic situation is one of the contextual causes of stunting, while household expenditure is one of the causal causes. Household expenditure in almost all provinces is dominated by expenditure on food. This is also followed by improvement in quantity of food consumed. The average of energy and protein adequacy levels in

34 provinces in 2019 was categorized normal. However, DDP score, which indicates diversity of food consumption was low none of the 34 provinces reached the ideal score of 100.

Multivariate linear regression showed that seven of independent variables are able to explain 74.06% of stunting prevalence in the model. Three of those variables, which are food expenditure, protein adequacy level, and DDP score, significantly associated with stunting prevalence in 34 provinces.

Stunting prevalence situation in Indonesia. The stunting prevalence in Indonesia in 2019 was varied (Figure 1). There were 14 provinces that stunting were categorized as serious public health problem. Those provinces were Aceh, West Nusa Tenggara, West Kalimantan, South Kalimantan, Central Sulawesi, South Sulawesi, Southeast Sulawesi, West Sulawesi, Gorontalo, Maluku, Papua, East Nusa Tenggara, Central Kalimantan, and North Sumatera.

Figure 1 showed that category of prevalence threshold for stunting distribution is divided into three categories, which are very high (≥30%), high (20−<30%), and medium (10−<20%) (De Onis *et al.* 2019). There were 16 provinces that were categorized as provinces with high prevalence, which were South Sumatera, North Maluku, East Kalimantan, North Kalimantan, Central Java, East Java, West Sumatera, Bengkulu, West Java, Lampung, West Papua, Riau, Banten, North Sulawesi, Special Region of Yogyakarta, and Jambi. Meanwhile, four provinces were categorized as provinces with medium prevalence. There were no provinces with low prevalence (2.5−<10%) or very low prevalence (<2.5%) according to prevalence threshold for stunting.

Economic situation in Indonesia. In Indonesia, 97.06% of provinces were having improvement of economic growth in 2019. Table 1 shows that the GRDP rate was increasing positively. Central Sulawesi was the province that had the highest GRDP rate in Indonesia (7.28%), while Papua Province experienced a slowdown of GRDP rate which was marked by a negative value. The province with the highest unemployment rate in Indonesia was Banten Province (8.11%) while the lowest was Bali Province (1.57%).

Papua had the highest poverty rate (26.55%), while Special Capital Region of Jakarta (3.42%) and Bali (3.61%) had the lowest poverty rate in 2019 (Table 1). Kementerian

PPN/Bappenas (2018) stated that poverty rate in Indonesia is influenced by topographic condition. The provinces that are located in the eastern part of Indonesia are bordered and separated by mountains and valleys and scattered as small island. This condition of isolation can hold up mobility of population, distribution of goods and services, as well as delivery of basic services to the community. Poverty rate in those several provinces can cause unequal income distribution that can lead to economic inequality.

The inequality of income distribution is measured by Gini ratio that ranges from 0, which represents perfect equality, to 1, which represents perfect inequality. Table 1 shows that the highest Gini ratio recorded in DI Yogyakarta (0.43) meanwhile, the lowest in Bangka Belitung (0.26).

Situation of food expenditure and food consumption in Indonesia. The positive economic growth in majority of provinces in Indonesia can lead to an increase in food expenditure at household level (Sekhampu 2012). Indonesia monthly expenditure per capita on food was IDR 593,450/capita/month in 2019. If monthly food expenditure per capita in each province was compared to national expenditure, 19 provinces
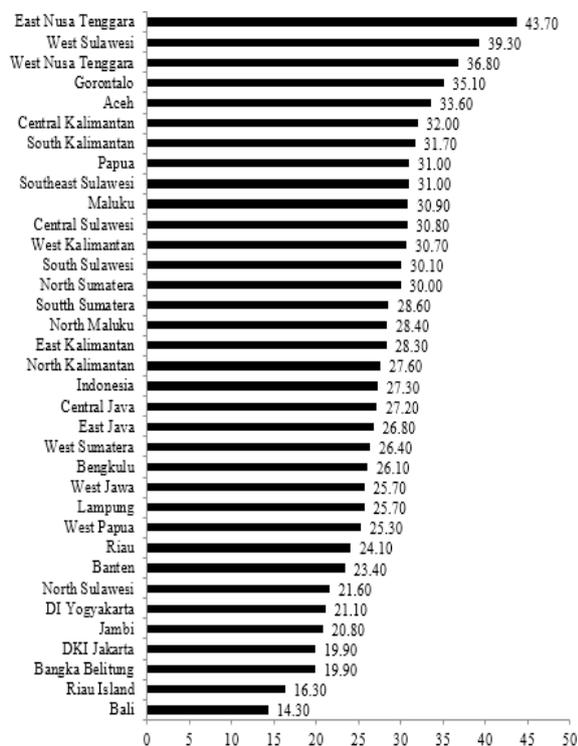

Figure 1. Stunting prevalence in 34 provinces in Indonesia in 2019

Table 1. Economic situation in 34 provinces in 2019

Name of province	Gini Ratio	GDRP Rate (%)	Poverty Rate (%)	Unemployment Rate (%)
Aceh	0.32	2.39	15.01	6.17
North Sumatera	0.32	4.15	8.63	5.39
West Sumatera	0.31	3.87	6.29	5.38
Riau	0.33	0.49	6.90	5.76
Jambi	0.32	2.80	7.51	4.06
South Sumatera	0.34	4.44	12.56	4.53
Bengkulu	0.33	3.44	14.91	3.26
Lampung	0.33	4.30	12.30	4.03
Bangka Belitung	0.26	1.31	4.50	3.58
Riau Islands	0.34	2.30	5.80	7.50
Special Capital Region of Jakarta	0.39	4.92	3.42	6.54
West Java	0.40	3.72	6.82	8.04
Central Java	0.36	4.71	10.58	4.44
Special Region of Yogyakarta	0.43	5.48	11.44	3.18
East Java	0.36	5.00	10.20	3.82
Banten	0.36	3.36	4.94	8.11
Bali	0.37	4.51	3.61	1.57
West Nusa Tenggara	0.37	2.73	13.88	3.28
East Nusa Tenggara	0.36	3.61	20.62	3.14
West Kalimantan	0.32	3.69	7.28	4.35
Central Kalimantan	0.34	3.99	4.81	4.04
South Kalimantan	0.33	2.57	4.47	4.18
East Kalimantan	0.34	2.70	5.91	5.94
North Kalimantan	0.29	3.18	6.49	4.49
North Sulawesi	0.38	4.70	7.51	6.01
Central Sulawesi	0.33	7.28	13.18	3.11
South Sulawesi	0.39	5.95	8.56	4.62
Southeast Sulawesi	0.39	4.49	11.04	3.52
Gorontalo	0.41	4.88	15.31	3.76
West Sulawesi	0.37	3.78	10.95	2.98
Maluku	0.32	3.70	17.65	6.69
North Maluku	0.31	4.15	6.91	4.81
West Papua	0.38	0.29	21.51	6.43
Papua	0.39	-17.16	26.55	3.51

Statistics Indonesia 2019; GDRP: Gross Regional Domestic Product

had a monthly expenditure lower than the national average. The largest monthly food expenditure per capita was found in DKI Jakarta (IDR 979,228/capita/month), while the lowest was in West Sulawesi (IDR 435,527/capita/month) (Table 2).

Based on the proportion of expenditure, 22 provinces in Indonesia had a food expenditure proportion more than the national proportion which was 49.21% (Table 1). If it is viewed by food and nonfood expenditure category, there are 50% of provinces in Indonesia that had higher food expenditure than nonfood expenditure in their households. The highest proportion of food expenditure was East Nusa Tenggara (59.25%), while the lowest proportion of food expenditure was Special Region of Yogyakarta (38.62%).

Table 2 also presents the energy adequacy level, protein adequacy level, Desirable Dietary Pattern score (DDP) of each province. Province that had the highest energy adequacy level was South Kalimantan (113.50%) and the lowest was in North Maluku (84.00%). As for protein adequacy level, province that had the highest protein adequacy level was West Nusa Tenggara (133.30%) and the lowest protein adequacy level was Papua (79.10%). Based on the energy adequacy, 31 provinces had reached the normal category (90−120%). However, three provinces were still categorized as province with mild energy deficit (80−89%) which were Maluku, North Maluku, and Papua. As protein adequacy level, there were 28 provinces that were categorized as province with normal protein adequacy level. Meanwhile, one province experienced moderate protein deficit (Papua) and two provinces (Maluku and North Maluku) had mild protein deficit. Other three provinces were categorized as province with excess of protein intake with the percentages of more than 120%. Those provinces were Special Capital Region of Jakarta (123.90%), Special Region of Yogyakarta (124.00%), and West Nusa Tenggara (133.30%). Further, for DDP score. all provinces in Indonesia had not reached the ideal score, which is 100. The highest DDP score was found in Special Region of Yogyakarta, which was 94.40, and the lowest score, which was 65.90 in Papua.

Association of economic factors, food expenditure, and food consumption with stunting prevalence. There was one variable from the eight independent variables that was eliminated from the regression model, it was unemployment rate. The R2 value in the final regression model was 0.7406. This means that 74.06% of the variance of stunting prevalence was able to be explained by those independent variables that included in final model while 24.43% was presented by other independent variables outside this study. The final model of regression analysis is stated below.

$$Y = 100.56859 - 8.16721X_1 + 0.00000219X_2 + 0.11342X_4 - 0.00003835X_5 - 0.16428X_6 + 0.50819X_7 - 1.05468X_8$$

According to the final model, there were seven independent variables that were included but only three of them were significantly associated with stunting prevalence ($p \leq 0.05$). They were food expenditure ($p < 0.0001$), protein adequacy level ($p = 0.0017$), and DDP score ($p < 0.0001$) (Table 3). An increase of one Indonesian Rupiah (IDR) in food expenditure would have decreased a 0.000039% in stunting prevalence. Similarly, Breisinger and Ecker (2014) found that 0.9% improvement in food expenditure per capita can decrease 0.07% in child stunting.

Not only will food consumption be increasing in quantity because of the increasing food expenditure, it may also indicate better dietary diversity. Food diversity will fulfill nutrition needs optimally (Bloem *et al.* 2013). This is supported by the analysis where DDP score also had a significant association with stunting prevalence in 34 provinces in Indonesia in 2019. An increase of one point of DDP score would have decreased 1.06% prevalence of stunting. This is in line with Mahmudiono *et al.* (2017) study, which stated that diverse diet prevents stunting cases in East Java Province.

However, despite the positive association between DDP and decreasing stunting prevalence, Table 2 shows that DDP scores in 34 provinces had not reached the ideal score of consumption diversity. It indicates that the increase in income which increases the total food expenditure does not have the same impact on the diversity of food consumed. Improper allocation for food expenditure would decrease health and nutritional status, especially in children (Titaley *et al.* 2019). Such as shown a study in Egypt, where increase in food expenditure was spent more on consumption of junk food than nutritious food, especially for animal-source foods (Rashad & Sharaf 2018).

This study also found that an increase of 1% in protein adequacy level will increase

Table 2. Food expenditure and food cnsumption situation in 34 provinces in 2019

Name of province	Food expenditure*		Food consumption**		
	(IDR /cap/month)	%	Energy adequacy level (%)	Protein adequacy level (%)	DDP score
Aceh	576,093	55.35	98.10	103.40	72.40
North Sumatera	585,134	54.32	103.80	111.40	86.10
West Sumatera	635,738	51.77	101.50	102.80	81.40
Riau	618,112	48.76	98.60	102.40	84.00
Jambi	601,608	53.07	98.10	101.70	84.30
South Sumatera	517,928	52.05	101.10	105.30	84.40
Bengkulu	552,579	49.98	99.50	102.70	80.10
Lampung	498,535	51.81	97.80	100.90	86.90
Bangka Belitung	733,471	48.96	102.30	117.00	83.80
Riau Islands	805,732	46.58	101.50	114.90	84.60
Special Capital Region of Jakarta	979,228	42.17	104.40	123.90	88.20
West Java	635,623	49.13	104.70	113.80	86.10
Central Java	492,077	49.16	100.40	105.10	88.40
Special Region of Yogyakarta	557,239	38.62	104.90	124.00	94.40
East Java	523,677	49.44	101.60	106.80	88.40
Banten	735,398	50.42	107.10	117.60	86.20
Bali	650,604	43.14	107.60	115.80	89.10
West Nusa Tenggara	582,461	52.54	111.00	133.30	86.80
East Nusa Tenggara	474,377	59.25	93.70	96.40	69.20
West Kalimantan	587,654	52.78	91.10	98.20	76.30
Central Kalimantan	608,949	50.08	102.40	111.40	83.70
South Kalimantan	645,091	49.85	113.50	119.60	84.90
East Kalimantan	734,705	42.36	96.30	111.40	85.80
North Kalimantan	804,422	51.39	95.60	113.30	81.10
North Sulawesi	586,304	46.23	102.10	111.60	85.30
Central Sulawesi	490,256	49.57	96.10	99.90	82.20
South Sulawesi	520,889	49.82	102.10	111.70	84.80
Southeast Sulawesi	488,733	47.09	99.50	108.50	83.40
Gorontalo	485,745	46.77	100.30	109.40	80.50
West Sulawesi	435,527	51.4	101.20	104.00	78.80
Maluku	528,603	50.54	89.10	88.40	71.10
North Maluku	524,906	50.55	84.00	84.20	76.70
West Papua	695,602	51.57	95.90	98.00	80.80
Papua	686,431	54.14	88.80	79.10	65.90

*Statistics Indonesia 2019; IDR: Indonesian Rupiah; DDP: Desirable Dietary Pattern

Table 3. Results of multiple linear regression analysis

Variable	B	SE	p
Intercept	100.56859	17.30855	<.0001
Gini ratio	-8.16721	21.69622	0.7096
GRDP	0.00000219	0.00000112	0.0615
Poverty rate	0.11342	0.19309	0.5620
Food expenditure	-0.00003835	0.00000678	<.0001
Energy adequacy level	-0.16428	0.22007	0.4621
Protein adequacy level	0.50819	0.14528	0.0017
DDP score	-1.05468	0.19159	<.0001

B: Parameter Estimation; SE: Standard Error; p≤0.05; GRDP: Gross Regional Domestic Product ; DDP: Desirable Dietary Pattern

stunting prevalence by 0.51% in children aged 0−59 months in 34 provinces. This can be seen as a counter intuitive finding. However, it can be interpreted as an indicator of wealth inequality. The increase of animal-source food consumption as good quality protein only happened among upper middle and high-income groups. These groups can consume animal source food repeatedly with the maximum amount, which is 36.76% from total daily food consumption (Weatherspoon *et al.* 2017). In addition, data also shows that the distribution of protein consumption in Indonesia is dominated by grains (47.08%), the domination of grains to fulfill protein adequacy level with limited consumption of animal-source foods can cause the lack of micronutrient intake such as amino acid, iron, and other micronutrient which can lead to stunting (Ernawati *et al.* 2021). Similar paradox also shown in Mahmudiono *et al.* (2017) who stated that increased in fish consumption in East Java Province has 1.83 times risk of causing stunting in children. This is caused by the type of fish that is consumed is dried salted fish which is cheap but lack in nutrition. Headey *et al.* (2018) stated that consuming multiple animal-source foods is more advantageous than consuming any single animal-source food. Thus, food diversity and the quality of the food source of the nutrient is an important information to be gathered along with the quantitative calculation of nutrient adequacy alone, such as for energy or protein.

Vollmer *et al.* (2014) stated that stunting in children in developing country can be influenced by economic inequality which cause inequal food expenditure among the population. People living under the poverty line are unable to access quality food while on the other hand due to increasing income happening in the developing country, household expenditure is shifted toward non-food expenditure (Ghosh 2018). This phenomenon is described in Table 2 where 50% of provinces in Indonesia had greater proportion of non-food expenditure than food expenditure. These results supported the logic on the relationship between the causal factors such as food expenditure and food consumption with stunting (WHO 2013).

Rizal and van Doorslaer (2019) and Wicaksono and Harsanti (2020) stated that the economic growth and poverty reduction can reduce stunting prevalence among children in Indonesia. Economic equality will improve the access of poor mothers and children to effective health service and quality food consumption. In this study, the relationship directions between economic variables still cannot be identified. This becomes the limitation of this study where the path of direct or indirect relationship of economic and food consumption variables to stunting are unable to be evaluated further. The researchers suggest the use of path analysis to clarify the relation between economic variable and food consumption variable and stunting in Indonesia. Another limitation in this study is the use of provincial data as unit analysis which make generalization more difficult.

CONCLUSION

The 34 provinces had positive value of GRDP rate and decrease in unemployment rate in 2019. However, the poverty level varies with provinces in the eastern part of Indonesia had higher rate. This economic inequality was characterized by the Gini ratio ranged between 0.26−0.43.

Improvement in economic situation was followed by increasing household expenditures in 34 provinces. There were 50% provinces that displayed greater food than non-food expenditure in 2019. There were 91.2% provinces that were categorized as having normal energy adequacy level and 82.4% provinces that were categorized as having normal protein adequacy level. However, there were no provinces that had reached maximum score of DDP.

Multivariate regression analysis showed that total food expenditure, protein adequacy

levels, and DDP score had a significant association with stunting prevalence. An increase of one rupiah in food expenditure will decrease stunting prevalence about 0.000039% and 1 point of DDP score will decrease stunting prevalence about 1.06%. However, an increase of 1% in protein adequacy level will increase the stunting prevalence about 0.51%.

Further analysis should be done to determine the path of relationship between economic variables, as contextual factor of stunting, and food expenditure and food consumption, as the causal factor of stunting prevalence in Indonesia. Path analysis will be able to categorize direct and indirect variables associated with stunting prevalence. The results of path analysis can feed into more precise and optimal stunting prevention and alleviation programs.

ACKNOWLEDGEMENT

DECLARATION OF INTERESTS

The authors have no conflict of interest to declare.

REFERENCES

[BKP] Badan Ketahanan Pangan. 2015. Panduan Penghitungan Pola Pangan Harapan (PPH). Jakarta (ID): BKP Kementerian Pertanian.

[BPS] Badan Pusat Statistik. 2019. Penghitungan dan Analisis Kemiskinan Makro Indonesia Tahun 2019. Jakarta (ID): BPS Indonesia.

Beal T, Tumilowicz A, Sutrisna A, Izwardy D, Neufeld LM. 2018. A review of child stunting determinants in Indonesia. Maternal & Child Nutr 14(4):e12617. https://doi.org/10.1111/mcn.12617

Black RE, Victora CG, Walker SP, Bhutta ZA, Christian P, de Onis M, Ezzati M, Grantham-McGregor S, Katz J, Martorell R *et al.* 2013. Maternal and child undernutrition and overweight in low-income and middle-income countries. Lancet 382(9890):427−451. https://doi.org/10.1016/S0140-6736(13)60937-X

Bloem MW, de Pee S, Le Hop T, Khan NC, Laillou A, Minarto, Moench-Pfanner R, Soekarjo D, Soekirman, Solon JA *et al.* 2013. Key strategies to further reduce stunting in Southeast Asia: Lessons from the ASEAN countries workshop. Food Nutr Bull 34(2_suppl1):8−16. https://doi.org/10.1177/15648265130342S103

Breisinger C, Ecker O. 2014. Simulating economic growth effects on food and nutrition security in Yemen: A new macro-micro modeling approach. Econ Model 43:100−113. https://doi.org/10.1016/j.econmod.2014.07.029

De Onis M, Branca F. 2016. Childhood stunting: A global perspective. Matern Child Nutr 12(1):12−26. https://doi.org/10.1111/mcn.12231

De Onis M, Borghi E, Arimond M, Webb P, Croft T, Saha K, De-Ragil LM, Thuita F, Heidkamp R, Krasevec J *et al.* 2019. Prevalence thresholds for wasting, overweight, and stunting in children under 5 years old. Public Health Nutr 22(1):175−179. https://doi.org/10.1017/S1368980018002434

DiSantis KI, Grier SA, Odoms-Young A, Baskin ML, Carter-Edwards L, Young DR, Lassiter V, Kumanyika SK. 2013. What "price" means when buying food: Insight from a multisite qualitative study with black americans. Am J Public Health 103(3):516−522. https://doi.org/10.2105/AJPH.2012.301149

Ernawati F, Syauqy A, Arifin AY, Soekatri MYE, Sandjaja S. 2021. Micronutrient deficiencies and stunting were associated with socioeconomic status in Indonesia chidren aged 6−59 months. Nutrients 13(6):1802. https://doi.org/10.3390/nu13061802

Faradina R, Iskandarini I, Lubis SN. 2018. Analisis faktor-faktor yang yang mempengaruhi pengeluaran konsumsi pangan rumah tangga (Studi kasus: Desa Karang Gading, Kecamatan Secanggang, Kabupaten Langkat). Talenta Conference Series 1(1):284−295. https://doi.org/10.32734/lwsa.v1i1.178

Fenta HM, Workie DL, Zike DT, Taye BW, Swain PK. 2020. Determinants of stunting among under-five years children in Ethiopia from the 2016 Ethiopia demographic and health

survey: Application of ordinal logistic regression model using complex sampling designs. Clin Epidemiol Glob Health 8(2):404−413. https://doi.org/10.1016/j.cegh.2019.09.011

Ghosh S. 2018. India: Nutrition intake and economic growth, a causality analysis. Dev Stud Res 5(1):69−82. https://doi.org/10.1080/21665095.2018.1468791

Headey D, Hirvonen K, Hoddinott J. 2018. Animal sourced foods and child stunting. Amer J Agr Econ 100(5):1302−1319. https://doi.org/10.1093/ajae/aay053

Kementerian PPN/Bappenas. 2018. Analisis Wilayah Dengan Kemiskinan Tinggi. Jakarta (ID): Kedeputian Bidang Ekonomi, Kementerian PPN/Bappenas.

[MoH RI] Ministry of Health of Republic of Indonesia. 2018. Riset Kesehatan Dasar Tahun 2018. Jakarta (ID): MoH RI.

[MoH RI] Ministry of Health of Republic of Indonesia. 2019. Peraturan Menteri Kesehatan Republik Indonesia Nomor 28 Tahun 2019 Tentang Angka Kecukupan Gizi yang Dianjurkan untuk Masyarakat Indonesia. Jakarta (ID): MoH RI.

Mahmudiono T, Sumarmi S, Rosenkranz RR. 2017. Household dietary diversity and child stunting in East Java, Indonesia. Asia Pac J Clin Nutr 26(2):317−325.

Mazumdar S. 2010. Determinant of inequality in child malnutrition in India: The poverty-undernutrition linkage. Asian Popul Stud 6(3):307−333. https://doi.org/10.1080/17441730.2010.512763

Rabbani A. Khan A, Yusuf S, Adams A. 2016. Trends and determinants of inequities in childhood stunting in Bangladesh from 1996/7 to 2014. Int J Equity Health 15(1):1−14. https://doi.org/10.1186/s12939-016-0477-7

Rashad AS, Sharaf MF. 2018. Economic growth and child malnutrition in Egypt: New evidence from national demographic and health survey. Soc Indic Res 135(2):769−795. https://doi.org/10.1007/s11205-016-1515-y

Reinhardt K, Fanzo J. 2014. Addressing chronic malnutrition through multi-sectoral, sustainable approaches: A review of the causes and consequences. Front Nutr 1(13):1−11. https://doi.org/10.3389/fnut.2014.00013

Renyeot BS, Martianto D, Sukandar D. 2016. Potensi kerugian ekonomi karena stunting pada balita di Indonesia tahun 2013. J Gizi Pangan 11(3):247−254. https://doi.org/10.25182/jgp.2016.11.3.%p

Rizal MF, van Doorslaer E. 2019. Explaining the fall of socioeconomic inequality in childhood stunting in Indonesia. SSM-Population Health 9:100469. https://doi.org/10.1016/j.ssmph.2019.100469

Sekhampu TJ. 2012. Socio-economic determinant of household food expenditure in low income township in South Africa. Mediterr J Soc Sci 3(3):449−453. https://doi.org/10.5901/mjss.2012.v3n3p449

Subramanyam MA, Kawachi I, Berkman LF, Subramanian SV. 2011. Is economic growth associated with reduction in child undernutrition in India?. Plos Medicine 8(3):e1000424. https://doi.org/10.1371/journal.pmed.1000424

Titaley CR, Ariawan I, Hapsari D, Muasyaroh A, Dibley MJ. 2019. Determinants of the stunting of children under two years old in Indonesia: A multilevel analysis of the 2013 Indonesia basic health survey. Nutrients 11(5):1106. https://doi.org/10.3390/nu11051106

Vollmer S, Harttgen K, Subramanyam MA, Finlay J, Klasen S, Subramanian SV. 2014. Association between economic growth and early childhood undernutrition: evidence from 121 demographic and health surveys from 36 low-income and middle-income countries. Lancet Glob Health 2(4):225−234. https://doi.org/10.1016/S2214-109X(14)70025-7

Weatherspoon DD, Steele-Adjognon M, Niyitanga F, Dushimumuremyi JP, Naseem A, Oehmke J. 2017. Food expenditure patterns, preferences, policy, and access of Rwandan households. Br Food J 119(6). https://doi.org/10.1108/BFJ-09-2016-0408

[WHO] World Health Organization. 2013. Childhood Stunting: Challenges and Opportunities: Report of A Webcast Colloquium on The Operational Issues Around Setting and Implementing National Stunting Reduction Agendas. Geneva (CH): WHO Press.

Wicaksono F, Harsanti T. 2020. Determinants of stunted children in Indonesia: A multilevel analysis at the individual, household, and community levels. Kesmas: Jurnal Kesehatan Masyarakat Nasional (National Public Health Journal)15(1):48−53. https://doi.org/10.21109/kesmas.v15i1.2771