

DIVERSITY OF COMPLEMENTARY FOOD AMONG INDONESIAN CHILDREN AGED 6-10 MONTHS: ANALYSIS OF THE DATA FROM THE 2017 INDONESIA DEMOGRAPHIC AND HEALTH SURVEY

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Abstract. Giving children diverse complementary food is one of the recommendations according to the Indonesian government's balanced-diet guidelines. The minimum dietary diversity (MDD) is an indicator for measuring a child's dietary patterns. The MDD of Indonesian children aged 6-11-months in 2017 was 33.8%, which was the lowest among other age groups and under the national rate. This study aimed to explore the dietary diversity of Indonesian children aged 6-11-months by using the data from the 2017 Indonesia Demographic and Health Survey. The final samples included in the analysis were 1,593 children. Descriptive and bivariate logistic regression analyses were performed. The proportion of MDD for the children was 35.2%, and Sumatra Province had the highest proportion (41.8%). Children were mostly fed with staple food (89.3%), breast milk (77.4%), and Vitamin-A-rich vegetables and fruit (61.0%). The likelihood of children in Papua, Bali and Nusa Tenggara, and Sulawesi to received appropriate complementary food decreased up to 45.6% (OR=0.545; 95% CI: 0.344-0.859, $p=0.009$), 54.8% (OR=0.452; 95% CI: 0.283-0.720, $p=0.001$), and 52.4% (OR=0.476; 95% CI: 0.300-0.686, $p<0.001$), respectively. In essence, Kalimantan, Sumatra, and Java exhibited the highest MDD proportion, yet children in these regions remained susceptible to obtaining a universal diet. It is imperative to take measures to mitigate the gaps in knowledge and economic disparities to guarantee that Indonesian children attain the necessary dietary diversity for their growth and development. Food taboos or

unfavorable culture related to child feeding practice that circulate among populations in each area should be debunked and explained by the health workers. Since the market price was volatile and sensitive in different geographical conditions, it is suggested that market price should be controlled by the government. Moreover, support and empowerment to create local-sourced complementary food that met the dietary diversity by the health offices in collaboration with stakeholders also suggested.

Keywords: minimum dietary diversity, complementary food, children, good health, wellbeing

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INTRODUCTION

The first 1,000 days of life start from the conception period until the children reach two years old. This is a critical period of the child's growth and development affecting a child's life and future (Solomons and Vossenaar, 2013). Hence, giving exclusive breastfeeding is important in this period until the child reaches six months old, and providing complementary nutritious food while breastfeeding must be done until the child reaches two years old (Dewey, 2003). Complementary food must be hygienic and fulfilling for the child's nutrient needs at the right time (Solomons and Vossenaar, 2013; Indonesian Pediatric Society, 2018).

There are eight core indicators of complementary feeding practices according to the World Health Organization (WHO), one of which is minimum dietary diversity (MDD) (WHO, 2008; WHO, 2010; WHO, 2017). Children are considered to meet the MDD when they receive at least five of

eight food categories, namely (1) grains, roots, and tubers, (2) legumes and nuts, (3) dairy products milk, yogurt, and cheese, (4) flesh food, (5) eggs, (6) Vitamin A-rich fruits and vegetables, (7) other fruits and vegetables, and (8) breast milk (WHO, 2017; WHO, 2021). According to the UNICEF Global database, the proportion of 6-11-month-old children who met the MDD in 2017 was 33.8% which was below the national proportion of 53.9%. This proportion decreased by 1.5% more than the previously conducted survey in 2012 (UNICEF, 2021).

A previous study by Zebadia *et al* (2021) found that more than half of 6-11-month-old children in Indonesia received adequate food, but only three of 10 children in Indonesia received a diverse diet. This suggests that most parents did not give a diverse diet to their children. Given five out of eight food categories, the child received at least animal protein, fruit or vegetables, staple food, and breast milk (WHO, 2017; Janmohamed *et al*, 2020). Previous research in Indonesia studied a population of children aged 6-23 months old (Ng *et al*, 2012; Ahmad *et al*, 2019; Halim *et al*, 2020; Limardi *et al*, 2020). Another study on MDD was conducted among Indonesian children aged 6-23 months old, and it found that wealth index, number of children, assets ownership, mother's working status, and place of residence were associated with MDD (Puspitasari and Gayatri, 2020). A previous study on the same group's age was done to find the association between the wealth index and the frequency of internet use (Zebadia and Atmaka, 2021). Meanwhile, this study aimed to explore the diet diversity among Indonesian children aged 6-11 months old and to find the association between geographic characteristics and food category received. Each island or region in Indonesia has its own culture, geographical conditions, and customs; thus, by acknowledging and exploring the vulnerability of each region to nutrition problems, we can conduct more specific interventions that can be customized accordingly.

MATERIALS AND METHODS

This study involved a secondary data analysis of the 2017 Indonesia Demographic and Health Survey (IDHS). The data set used in this study was IDKR71FL or children's records. The sub-population was all families in the dataset with 6-11-month-old children that met the inclusion criteria. The criteria were children still alive, aged 6-11 months old, and had complete data on dietary diversity, wealth index, and location. The dataset was obtained from the public website of the Demographic Health Survey, available on https://dhsprogram.com/data/dataset/Indonesia_Standard-DHS_2017.cfm?flag=0.

The dependent variable in this study was MDD which consist of eight food categories. The independent variables were location of big islands in Indonesia and wealth index. The location was divided into six big areas in Indonesia namely, Sumatra (SUM), Kalimantan (K), Java (J), Bali-East Nusa Tenggara-West Nusa Tenggara (BEW), Sulawesi (SUL), and Papua-Maluku (PM). Meanwhile, the wealth index was categorized accordingly to the available data with the categories of the poorest, poor, middle, rich, and the richest (DHS Program, 2016).

Data from IDHS ($n = 17,848$) were cleaned and analyzed on Statistical Package for the Social Sciences (SPSS) version 25 (IBM Corp, Armonk, NY). The number of 6-11-month-old children in the dataset was 1,961, but only 1,593 met the inclusion criteria. Statistical analyses, and descriptive and binary logistic regression were conducted.

This study was approved by the ethics committee of the Faculty of Medicine of Universitas Airlangga (KEPK FKUA with number 104/EC/KEPK/FKUA/2021).

RESULTS

Characteristics of 6-11-month-old children and their parents

This study included 1,593 children for analysis. The mean age of the children was 8.59 ± 1.7 months. Most of the children were male (54.4%) and lived in the Java regions (31.8%). Most of the children came from the poorest (23.4%) and poor (20.7%) households, and more than half (55.9%) of the households were distributed in the other wealth index quintiles (Table 1). Both mothers and fathers of the children mostly graduated from senior high school. No fathers were found to be uneducated, and 1.1% of the mothers were found to never receive any education. More than half of the mothers were unemployed, and 99.3% of the fathers had a job with 23.8% of work in the agricultural sector and 23.7% in industries.

Minimum diet diversity in each province in Indonesia

In this study, the proportion of MDD among the children was found to be 35.2% with the highest proportion in Kalimantan (46.3%), followed by Sumatra (23.7%) and Java (39.4%). Meanwhile, the least proportion was found in Bali and Nusa Tenggara at 20.7%. On average, the children of all regions received three to four categories, whereas the MDD for children is expected to be at least five out of eight categories (WHO, 2021). Children in Papua and Maluku were found to receive the lowest food categories with average of 3.28 ± 1.7 categories, while children in Kalimantan were found to receive the highest food category with an average of 4.08 ± 1.9 categories (Table 2)

Logistic regression test between minimum dietary diversity, place of residence, and wealth index

A binary logistic regression test was done between the MDD, place

Table 1
 Characteristics of children respondents

Variable	Frequency <i>n</i> (%)
Age	
6 months	256 (16.1)
7 months	227 (14.2)
8 months	266 (16.7)
9 months	297 (18.6)
10 months	264 (16.6)
11 months	283 (17.8)
Gender	
Male	867 (54.4)
Female	726 (45.6)
Place of residence	
Sumatra	427 (26.8)
Java	507 (31.8)
Bali, East Nusa Tenggara, and West Nusa Tenggara	140 (8.8)
Kalimantan	147 (9.2)
Sulawesi	237 (14.9)
Papua and Maluku	135 (8.5)
Wealth index¹	
Poorest (1 st quintile)	373 (23.4)
Poorer (2 nd quintile)	329 (20.6)
Middle (3 rd quintile)	288 (18.1)
Richer (4 th quintile)	293 (18.4)
Richest (5 th quintile)	310 (19.5)

Table 1 (cont)

Variable	Frequency <i>n</i> (%)
Minimum dietary diversity (MDD) ²	
Achieved	1032 (64.8)
Not achieved	561 (35.2)
Had this complementary food ³	
Eggs	464 (29.1)
Beans, peas, lentils	269 (16.9)
Staple food (grains, tubers, roots)	1423 (89.3)
Milk products	854 (53.6)
Flesh food (Meat, fish, meat organ)	549 (34.5)
Vitamin A-rich fruit and vegetable	971 (61.0)
Other fruit and vegetable	326 (20.5)
Breast milk	1233 (77.4)

¹The Demographic and Health Surveys (DHS) divides the factor scores into five equal parts (quintiles) and uses the appropriate wealth score to determine the weighted cumulative percentage distribution. It also identifies the wealth score values that correspond to the four cut-point values of the quintiles (<20%, <40%, <60%, <80%), and >80%). The first quintile (<20%) is classified as the poorest, and so on (Rutstein, 2004).

²Minimum dietary diversity (MDD) is one of the indicators used to assess feeding practices among children aged 6-23 months. Children who meet the MDD are those who receive at least five or more food groups daily and are therefore considered to have achieved it. Children who do not meet the MDD are referred to as not having achieved it. (International Dietary Data Expansion Project, 2023)

³Each child had more than one kind of complementary foods.

Table 2
Result of logistic regression test between MDD, place of residence, and wealth index

Variable	Number of food categories received Mean \pm SD	Minimum dietary diversity (MDD) ¹		OR (95% CI)	p-value
		MDD achieved n (%)	MDD not achieved n (%)		
Area					
J	4.02 \pm 1.8	307 (60.6)	200 (39.4)	0.801 (0.611-1.050)	0.123
BEW	3.38 \pm 1.7	111 (79.3)	29 (20.7)	0.452 (0.283-0.720)	0.001
K	4.08 \pm 1.9	79 (53.7)	68 (46.3)	1.228 (0.836-1.804)	0.297
SUL	3.33 \pm 1.6	182 (76.8)	55 (23.2)	0.476 (0.330-0.686)	<0.001
PM	3.28 \pm 1.7	103 (76.3)	32 (23.7)	0.544 (0.344-0.859)	0.009
SUM	4.06 \pm 1.8	249 (58.3)	178 (41.8)	(Reference)	-

Table 2 (cont)

Variable	Number of food categories received Mean \pm SD	Minimum dietary diversity (MDD) ¹ MDD achieved n (%)	MDD not achieved n (%)	OR (95% CI)	p-value
Wealth index²					
Poorest (1st quintile)		286 (76.7)	87 (23.3)	0.348 (0.244-0.493)	<0.001
Poorer (2nd quintile)		231 (70.2)	98 (29.8)	0.420 (0.301-0.585)	<0.001
Middle (3rd quintile)		196 (68.1)	92 (31.9)	0.420 (0.295-0.579)	<0.001
Richer (4th quintile)		171 (58.4)	122 (41.6)	0.669 (0.484-0.927)	0.016
Richest (5th quintile)		147 (47.4)	163 (52.6)	(Reference)	-

¹MDD is one of the indicators used to assess feeding practices among children aged 6-23 months. Children who meet the MDD are those who receive at least five or more food groups daily and are therefore considered to have achieved it. Children who do not meet the MDD are referred to as not having achieved it. (International Dietary Data Expansion Project, 2023)

²The Demographic and Health Surveys (DHS) divides the factor scores into five equal parts (quintiles) and uses the appropriate wealth score to determine the weighted cumulative percentage distribution. It also identifies the wealth score values that correspond to the four cut-point values of the quintiles (<20%, <40%, <60%, <80%), and >80%). The first quintile (<20%) is classified as the poorest, and so on (Rutstein, 2004).

BEW: Bali, East Nusa Tenggara, and West Nusa Tenggara; J: Java; K: Kalimantan; PM: Papua and Maluku; SUL: Sulawesi; SUM: Sumatera

CI: confidence interval; OR: odds ratio; SD: standard deviation

of residence, and wealth index variables. In this study, Sumatra was used as a reference. The number of children in Papua, Bali and Nusa Tenggara, and Sulawesi who received complementary food based on the MDD decreased up to 45.6% (OR=0.545; 95% CI: 0.344-0.859, $p=0.009$), 54.8% (OR=0.452; 95% CI: 0.283-0.720, $p=0.001$), and 52.4% (OR=0.476; 95% CI: 0.300-0.686, $p<0.001$), respectively. No association was found between the Java and Kalimantan regions with the MDD (Table 2). There were associations between all wealth index quintiles and the MDD. Compared to children in the fifth quintile (the richest), the number of children receiving a diverse diet from the poorest households decreased by 65.2% (OR=0.348; 95% CI: 0.244-0.493, $p<0.001$). The proportion of MDD in the second (OR=0.420; 95% CI: 0.301-0.585, $p<0.001$) and third (OR=0.420; 95% CI: 0.295-0.579, $p<0.001$) quintiles also decreased (Table 2).

Food categories received by 6-11-month-old children in Indonesia

The children mostly received staple food (89.3%) followed by breast milk (77.4%), Vitamin A-rich vegetables and fruit (61%), milk products (53.6%), meat (34.5%), eggs (29.2%), other fruits and vegetables (20.5%), and beans or lentils (16.9%). More than 80% of children in six different regions received staple food (Table 3).

Food administration to children in six different regions of Indonesia

Place of residence is also associated with the food categories received by the children. Association was found between living in Java and consumption of eggs and milk products. Receiving eggs, beans, flesh food, vitamin A-rich fruits and vegetables, and other fruit and vegetables was also associated with living in Sumatra (Table 3). All associations were found to have an OR less than 1, except for children who lived in Bali-East Nusa Tenggara-West Nusa Tenggara (BEW) and received breast

Table 3
Food distribution among provinces

Food category	Province	Food reception		OR (95% CI)	p-value
		Not received, n (%)	Received, n (%)		
Egg	J	367 (72.5)	139 (27.5)	0.729 (0.551-0.964)	0.027
	BEW	101 (72.7)	38 (27.3)	0.724 (0.474-1.106)	0.135
	K	95 (64.6)	52 (35.4)	1.053 (0.711-1.560)	0.795
	SUL	18 (75.9)	57 (24.1)	0.609 (0.426-0.873)	0.007
	PM	103 (76.3)	32 (23.7)	0.598 (0.383-0.932)	0.023
	Sumatra	281 (65.8)	146 (34.2)	(Reference)	-
Staple food (grains, tubers, roots)	J	45 (8.9)	462 (91.1)	1.150 (0.741-1.784)	0.543
	BEW	14 (10.0)	126 (90.0)	1.008 (0.534-1.903)	0.981
	K	11 (7.5)	136 (92.5)	1.384 (0.694-2.762)	0.356
	SUL	31 (13.1)	206 (86.9)	0.744 (0.455-1.217)	0.239
	PM	26 (19.3)	109 (80.7)	0.469 (0.276-0.799)	0.005
	Sumatra	43 (10.1)	384 (89.9)	(Reference)	-
Beans, peas, lentils, nuts	J	391 (77.3)	115 (22.7)	1.237 (0.900-1.701)	0.196
	BEW	123 (87.9)	17 (12.1)	0.581 (0.332-1.019)	0.057
	K	123 (83.7)	24 (16.3)	0.821 (0.498-1.353)	0.432
	SUL	219 (92.4)	18 (7.6)	0.346 (0.202-0.592)	<0.001
	PM	122 (90.4)	13 (9.6)	0.448 (0.241-0.834)	0.011
	Sumatra	344 (80.8)	82 (19.2)	(Reference)	-

Table 3 (cont)

Food category	Province	Food reception		OR (95% CI)	p-value
		Not received, n (%)	Received, n (%)		
Milk products	J	252 (49.7)	255 (50.3)	0.723 (0.558-0.938)	0.014
	BEW	88 (62.9)	52 (37.1)	0.422 (0.285-0.626)	<0.001
	K	50 (34.0)	97 (66.0)	1.387 (0.937-2.052)	0.102
	SUL	106 (44.7)	131 (55.3)	0.883 (0.641-1.217)	0.448
	PM	65 (48.1)	70 (51.9)	0.770 (0.522-1.135)	0.187
	Sumatra	178 (41.7)	249 (58.3)	(Reference)	-
Flesh food (Meat, fish, meat organ)	J	319 (62.9)	188 (37.1)	0.865 (0.664-1.127)	0.283
	BEW	110 (78.6)	30 (21.4)	0.400 (0.256-0.626)	<0.001
	K	85 (57.8)	62 (42.2)	1.071 (0.732-1.566)	0.724
	SUL	177 (74.7)	60 (25.3)	0.498 (0.350-0.707)	<0.001
	PM	99 (73.3)	36 (26.7)	0.534 (0.348-0.819)	0.004
	Sumatra	254 (59.5)	173 (40.5)	(Reference)	-
Vitamin A-rich fruit and vegetable	J	152 (30.0)	355 (70.0)	1.265 (0.961-1.665)	0.094
	BEW	68 (48.6)	72 (51.4)	0.573 (0.390-0.844)	0.005
	K	66 (44.9)	81 (55.1)	0.665 (0.454-0.973)	0.036
	SUL	116 (48.9)	121 (51.1)	0.565 (0.409-0.780)	0.001
	PM	70 (51.9)	65 (48.1)	0.503 (0.340-0.744)	0.001
	Sumatra	150 (35.1)	277 (64.9)	(Reference)	-

Table 3 (cont)

Food category	Province	Food reception		OR (95% CI)	p-value
		Not received, n (%)	Received, n (%)		
Other fruit and vegetable	J	380 (75.1)	126 (24.9)	1.099 (0.812-1.486)	0.542
	BEW	124 (88.6)	16 (11.4)	0.428 (0.242-0.754)	0.003
	K	110 (74.8)	37 (25.2)	1.114 (0.721-1.722)	0.626
	SUL	210 (89.0)	26 (11.0)	0.410 (0.258-0.653)	<0.001
	PM	113 (83.7)	22 (16.3)	0.645 (0.388-1.073)	0.091
	Sumatra	328 (76.8)	99 (23.2)	(Reference)	-
Breast milk	J	106 (20.9)	401 (79.1)	1.142 (0.837-1.557)	0.402
	BEW	15 (10.7)	125 (89.3)	2.515 (1.407-4.496)	<0.001
	K	36 (24.5)	111 (75.5)	0.931 (0.601-1.442)	0.748
	SUL	65 (27.4)	172 (72.6)	0.799 (0.555-1.149)	0.225
	PM	39 (28.9)	96 (71.1)	0.743 (0.481-1.148)	0.180
	Sumatra	99 (23.2)	328 (76.8)	(Reference)	-

BEW: Bali, East Nusa Tenggara, and West Nusa Tenggara; J: Java; K: Kalimantan; PM: Papua and Maluku; SUL: Sulawesi; SUM: Sumatera

CI: confidence interval; OR: odds ratio

milk with an OR 2.5 times higher than children in Sumatra (OR=2.515; 95% CI: 1.407-4.496, $p<0.001$).

DISCUSSION

This study showed that the proportion of minimum dietary diversity (MDD) among 6-11-month-old children in Indonesia was 35.2% with Kalimantan having the highest proportion among the other five regions. A previous study showed a consistent result with our study that children living in rural areas of Sulawesi and Eastern Indonesia were less likely to eat a diverse diet (Paramashanti and Benita, 2020). In this study, the number of associations between the place of residence and consumption of food category was more found in middle (Bali-East Nusa Tenggara-West Nusa Tenggara) and Eastern Indonesia (Sulawesi and Papua-Maluku) than in the western part of Indonesia.

MDD is one of the indicators to assess the feeding practice among children aged 6-23 months old. Children who meet the MDD are those who receive at least five or more food groups daily (International Dietary Data Expansion Project, 2023). This study showed that, in all regions, children received 3-4 food categories with a threshold of five or more food categories. This could indicate that, despite their place of residence, children in Indonesia were vulnerable to not meeting the MDD. A previous study found that wealth index and frequency of internet use were associated with MDD in 6-11-month-old children in Indonesia (Zebadia and Atmaka, 2021).

A previous study showed the first to fourth highest food categories given to 6-11-month-old children nationally were staple food (89.3%), breast milk (77.4%), Vitamin-A rich fruits and vegetables (61%), and milk products (53.6%), while the consumption of animal protein food category was low (Zebadia and Atmaka, 2021). This study only assessed children

aged 6-11 months old. Generally, children who are still in this age period should receive breast milk until they are two years old (Dewey, 2003; Ministry of Health, 2014). Within the period, they also should consume four other food categories other than breast milk to add the nutrient intake that meets the MDD. However, this study showed that children were more likely to receive three food categories, which are protein from breast milk and milk products, fiber from vegetables and fruit, and carbohydrates from staple food. A previous study in Indonesia showed a significant association between parents' perceptions of milk and the frequency and amount of milk consumed by the children (Syahlani and Muzzayanah, 2017). The previous Indonesian nutrition guidelines called "*Empat Sehat Lima Sempurna*" or "four healthy foods plus one" recommend milk to perfectly complete the meal. Although the guidelines have been changed into balanced nutrition guidelines, most Indonesian parents are more familiar with *Empat Sehat Lima Sempurna* than the concept of balanced nutrition.

In terms of staple food, this study found that, in all regions, the highest consumption of staple food covered 80-90% of children in six regions. However, compared to Sumatra, Children in Papua faced a decrease in the consumption of staple food by 53.1%. Papua is one of the areas where people mainly consume sago or sweet potatoes as alternatives to staple food (Saidah *et al*, 2014). A previous study reported that the consumption of sago declined due to the decrease in forested landscape in Papua (Purwestri *et al*, 2019). Another study also found a significant rise in the consumption of rice and a decrease in the other staple food in 2008-2017 among Papuans since rice was widely distributed and the government subsidizes rice program (Raskin) contributing to lower the rice price instead of sago (Saidah *et al*, 2014). However, according to the Statistic Indonesia, the price for rice in Papua ranged from IDR 12,400-12,900 per kilogram, while in Sumatra it started from IDR 9,000 per kilogram (Central Bureau of Statistics, 2016). This could be due to

the distribution cost that arises due to geographical problem. Sending rice from West Indonesia to East Indonesia is high in the distribution cost causing the rice price in Papua is more expensive than in Sumatra. In response to the transition from sago to rice in Papua that causes high demand of rice, opening agricultural land in Papua to response that demand might help reducing the distribution cost.

In terms of animal protein food other than milk, the consumption of eggs and flesh food (meat, poultry, fish, and meat organs) was below 40% in six regions. Significant associations and decreased intake of eggs were also found in children who lived in Sulawesi, Papua, and Maluku. A previous study in Nepal reported that the low consumption of eggs was due to the mother's perception that cereal-based food was enough to fulfill the child's nutrient needs (Baek and Chitekwe, 2019). The low consumption of eggs also occurs because of the mother's fear of allergy (Fiocchi *et al*, 2006). A decreased number of children receiving flesh food were also found in Bali-East Nusa Tenggara-West Nusa Tenggara, Sulawesi, Papua, and Maluku.

Animal protein is known to be the most expensive protein among plant proteins, and the demand for the protein also determines the consumption of protein by children. From the perspective of consumer price, the price for a whole chicken in Sumatra ranged from IDR 37,271-111,245, while it ranged from IDR 33,250-187,583 in Middle and Eastern Indonesia (Central Bureau of Statistics, 2018a). The price for sea fish in Sumatra was around IDR 56,441-73,336, while it was from 36,093-100,923 in Middle and Eastern Indonesia (Central Bureau of Statistics, 2018a). This showed a higher trend in the consumer price in the Eastern part which is also influenced by the provincial minimum wages (Finansialku, 2017). From the perspective of consumption expenditure, the expenditure for eggs, meat, and seafood in Eastern Indonesia were higher than in Sumatra possibly due to higher price (Central Bureau of

Statistics, 2018b). Interestingly, the expenditure on cigarettes was also higher in east Indonesia than in West Indonesia. A previous study found that parental smoking contributed to the decline in the quantity and quality of consumed food and an increase in child malnutrition due to its displacement effect on food consumption (Block and Webb, 2009). This current study also revealed that wealth index was also associated with a decrease in the number of received food categories. Children from higher-economic households had the better privilege of accessing broader and more diverse choices of food. In this study, among children who came from fifth-quintile households, 49% consumed meat, and 33.5% received eggs. Meanwhile, in the first quintile, children who received meat and eggs were only 24.9% and 26%, respectively.

In the context of socio-cultural perspective. There are circulating food taboos among Indonesian, especially in animal protein that inflict with children's nutrition fulfilment. In Sulawesi, it is taboo to eat squid because it is considered to cause the children to be sluggish (Jayadi *et al*, 2020). In Kalimantan, children who consume fish are considered likely to get sick, and consuming eggs is also one of the taboos, especially in girls (Sukandar, 2007). Many food taboos do not seem sensible, but they continue to grow in society (Nurbiah *et al*, 2019). Although food taboos among children are not as many as in pregnant or lactating women, they still can restrict the diet diversity during the period of complementary food intake (McNamara and Wood, 2019).

The discrepancy in knowledge, especially in food taboos and unfavorable culture related to children's complementary feeding, needs to be minimized by improving the quality of content and frequency of exposure to related information. A partnership is needed between the medical workers such as pediatrics, midwives, nutritionist, and the government. It is worth noting that education should not only occur in a health facility but also be provided to the community through other

channels, such as integrated service posts (Posyandu) and family welfare environment. The government, especially the Indonesian Ministry of Health, also suggests that health-related parties renew their public service advertisements on complementary feeding (Zebadia *et al*, 2021).

The geographical condition in Indonesia affects the market price. Thus, support from multi-sectoral stakeholders on equitable infrastructure development is required to increase transportation access to reduce the distribution cost and minimize the price discrepancy between each island. Additionally, the Indonesian government also must monitor and control the price in the market and make sure of the accessibility of foods. Opening a new employment or course to increase people's workability is another way to increase and help people's financial status to afford more various food.

Data from Indonesia's Demographic and Health Survey provided a large sample size that is representative enough for the population studied. Limitations arise based on how the primary data in this study were obtained. First, the indicator of MDD did not give a clear minimum amount of consumed food or drink. The WHO's guidelines stated the data collection should be done through a 24-h recall. However, data were collected by asking "Did your child eat/drink [food category] yesterday?". Future research on MDD may use new additional standards where the minimum amount of food should be 10 grams (WHO, 2017).

In summary, Kalimantan, Sumatra, and Java regions had the highest proportion of MDD although the children in the areas were still vulnerable to receiving a universal diet. Children who lived in the Middle and Eastern Indonesia were more likely to experience a reduced diverse diet. Action to minimize the knowledge and economic discrepancy should be addressed to ensure that Indonesian children receive the minimum dietary diversity to support their growth and development. However, it is worth noting that this study used data gathered in 2017, and they could not reflect the condition in the future during the COVID-19 pandemic.

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CONFLICT OF INTEREST DISCLOSURE

We declare no conflict of interest

REFERENCES

- Ahmad A, Madanijah S, Dwiriani CM, Kolopaking R. Mother's knowledge, attitudes, motivation, and practice of giving complementary feeding to children aged 6-23 months: a formative study in Aceh, 2019 [cited 2022 Aug 03]. Available from: URL: <https://jurnal.ugm.ac.id/jgki/article/download/34560/26323> [in Indonesian]
- Baek Y, Chitekwe S. Sociodemographic factors associated with inadequate food group consumption and dietary diversity among infants and young children in Nepal. *PLoS One* 2019; 14: e0213610.
- Block S, Webb P. Up in smoke: tobacco use, expenditure on food, and child malnutrition in developing countries. *Econ Dev Cult Change* 2009; 58: 1-23.
- Central Bureau of Statistics. Average retail price of rice in traditional markets in 33 cities (Rupiah/Kg) 2014-2016, 2016 [cited 2022 Aug 27]. Available from: URL: <https://www.bps.go.id/id/statistics-table/2/NzkjMg==/rata-rata-harga-eceran-beras-di-pasar-tradisional-di-33-kota.html>
- Central Bureau of Statistics. Consumer prices of some food group goods 82 cities in Indonesia 2017, 2018a [cited 2022 Aug 03]. Available from: URL: <https://www.bps.go.id/publication/2018/04/05/1d3277756885628c8236343c/>

[harga-konsumen-beberapa-barang-kelompok-makanan-di-82-kota-di-indonesia-2017.html](https://www.bps.go.id/publication/2018/06/11/a7580c3adc46cf92278ece58/pengeluaran-untuk-konsumsi-penduduk-indonesia-per-provinsi-september-2017.html)

Central Bureau of Statistics. Expenditure for Indonesian population consumption by province September 2017, 2018b [cited 2022 Aug 03]. Available from: URL: <https://www.bps.go.id/publication/2018/06/11/a7580c3adc46cf92278ece58/pengeluaran-untuk-konsumsi-penduduk-indonesia-per-provinsi-september-2017.html> [in Indonesian]

Demographic and Health Surveys Program (DHS Program). Wealth Index, 2016 [cited 2022 Aug 03]. Available from: URL: <https://dhsprogram.com/topics/wealth-index/>

Dewey K. Guiding principles for complimentary feeding of the breastfed child, 2003 [cited 2022 Aug 03]. Available from: URL: https://iris.paho.org/bitstream/handle/10665.2/752/OP_194.pdf?sequence=1&isAllowed=y

Finansialku. Infographic: provincial minimum wage (UMP) 34 provinces of Indonesia Year 2017, 2017 [cited 2022 Aug 29]. Available from: URL: <https://www.finansialku.com/infografis-upah-minimum-provinsi-ump-34-provinsi-indonesia-tahun-2017/>

Fiocchi A, Assa'ad A, Bahna S. Food allergy and the introduction of solid foods to infants: a consensus document. Adverse Reactions to Foods Committee, American College of Allergy, Asthma and Immunology. *Ann Allergy Asthma Immunol* 2006; 97: 10-20.

Halim K, Sartika RAD, Sudiarti T, Putri PN, Rahmawati ND. Associations of dietary diversity and other factors with prevalence of stunting among children aged 6-35 months. *Indones J Public Health Nutr* 2020; 1: 41-8.

Indonesian Pediatric Society. Provision of complementary foods for mother's milk (MPASI), 2018 [cited 2022 Aug 03]. Available from: URL: <https://www.idai.or.id/artikel/klinik/asi/pemberian-makanan-pendamping-air-susu-ibu-mpasi> [in Indonesian]

- International Dietary Data Expansion Project. Data4Diets: Building blocks for diet-related food security analysis, 2023 [cited 2023 Feb 03]. Available from: URL: <https://index.nutrition.tufts.edu/data4diets>
- Janmohamed A, Luvsanjamba M, Norov B, Batsaikhan E, Jamiyan B, Blankenship JL. Complementary feeding practices and associated factors among Mongolian children 6-23 months of age. *Matern Child Nutr* 2020;16 (Suppl 2): e12838.
- Jayadi YI, Dewi NU, Rahmawati, Hermiyanty, Herman, Syahrir S. Food taboo among pregnant women and children in the Kaili tribe Palu City, Indonesia. *Enferm Clin* 2020; 30 (Suppl 4): 109-13.
- Limardi S, Hasanah DM, Utami NMD, Sidiartha IGL. Investigating the effect of unachieved minimum acceptable diet and low infant and child feeding index as risk factors of stunting in children aged 6-23 months. *Paediatr Indones* 2020; 60: 259-68.
- McNamara K, Wood E. Food taboos, health beliefs, and gender: understanding household food choice and nutrition in rural Tajikistan. *J Health Popul Nutr* 2019; 38: 17.
- Ministry of Health. Regulation of the Minister of Health of the Republic of Indonesia Number 41 of 2014 concerning guidelines for balanced nutrition, 2014 [cited 2022 Aug 03]. Available from: URL: <https://peraturan.bpk.go.id/Home/Download/109856/Permenkes%20Nomor%2041%20Tahun%202014.pdf> [in Indonesian]
- Ng CS, Dibley MJ, Agho KE. Complementary feeding indicators and determinants of poor feeding practices in Indonesia: a secondary analysis of 2007 Demographic and Health Survey data. *Public Health Nutr* 2012; 15: 827-39.
- Nurbiah, Rosidi A, Margawati A. The potency of socio-economic family and cultural factor in affecting stunting of Muna ethnic in Batalaiworu, Southeast Sulawesi. *IOP Conf Ser Earth Environ Sci* 2019; 292: 012015.

- Paramashanti BA, Benita S. Early introduction of complementary food and childhood stunting were linked among children aged 6-23 months, 2020 [cited 2022 Aug 03]. Available from: URL: <https://journal.ugm.ac.id/jgki/article/view/53788/28241>
- Purwestri RC, Powell B, Rowland D, *et al.* From growing food to growing cash: Understanding the drivers of food choice in the context of rapid agrarian change in Indonesia, 2019 [cited 2022 Aug 03]. Available from: URL: https://www.jstor.org/stable/pdf/resrep22275.pdf?refreqid=excelsior%3Ae59e7977e2dc087ac3d81097c4c28112&ab_segments=&origin=&initiator=&acceptTC=1
- Puspitasari MD, Gayatri M. Indonesia infant and young child feeding practice: the role of women's empowerment in household domain. *Glob J Health Sci* 2020; 12: 129-44.
- Rutstein S. Steps to constructing the new DHS wealth index, 2004 [cited 2022 Aug 03]. Available from: URL: https://dhsprogram.com/programming/wealth%20index/Steps_to_constructing_the_new_DHS_Wealth_Index.pdf
- Saidah N, Hartoyo S, Mulatsih S. Impact of Raskin policy to consumption pattern local staple food in Papua, 2014 [cited 2022 Aug 03]. Available from: URL: <https://repository.ipb.ac.id/handle/123456789/69046> [in Indonesian]
- Solomons NW, Vossenaar M. Nutrient density in complementary feeding of infants and toddlers. *Eur J Clin Nutr* 2013; 67: 501-6.
- Sukandar D. Taboo food in Barito Kuala, South Kalimantan, 2007 [cited 2022 Aug 03]. Available from: URL: <https://repository.ipb.ac.id/jspui/bitstream/123456789/52705/1/makanan%20tabu%20di%20barito%20kuala%20kalimantan%20selatan.pdf> [in Indonesian]
- Syahlani SP, Muzzayanah MA. Evaluation of perception and preference of milk consumption among elementary school age children in low income household, 2017 [cited 2022 Aug 03]. Available from: URL: <https://journal.ugm.ac.id/istaproceeding/article/viewFile/30166/18228>

United Nations International Children's Emergency Fund (UNICEF). Infant and young child feeding: Optimal feeding practices are fundamental to a child's survival, growth and development, but too few children benefit, 2021 [cited 2022 Aug 03]. Available from: URL: <https://data.unicef.org/topic/nutrition/infant-and-young-child-feeding/>

World Health Organization (WHO). Global nutrition monitoring framework: operational guidance for tracking progress in meeting targets for 2025, 2017 [cited 2022 Aug 03]. Available from: URL: <https://apps.who.int/iris/rest/bitstreams/1093537/retrieve>

World Health Organization (WHO). Indicators for assessing infant and young child feeding practices. Part 1: definitions, 2008 [cited 2022 Aug 03]. Available from: URL: https://apps.who.int/iris/bitstream/handle/10665/43895/9789241596664_eng.pdf;jsessionid=CBDAD81BB6B-343D7D46D0ADA3A109A4B?sequence=1

World Health Organization (WHO). Indicators for assessing infant and young child feeding practices. Part 2: measurement, 2010 [cited 2022 Aug 03]. Available from: URL: https://apps.who.int/iris/bitstream/handle/10665/44306/9789241599290_eng.pdf?sequence=1&isAllowed=y

World Health Organization (WHO). Indicators for assessing infant and young child feeding practices: definitions and measurement methods, 2021 [cited 2022 Aug 03]. Available from: URL: <https://apps.who.int/iris/rest/bitstreams/1341846/retrieve>

Zebadia E, Atmaka DR. Factors associated with minimum dietary diversity among 6-11-month-old children in Indonesia: analysis of the 2017 Indonesian Demographic and Health Survey. *Public Health Prev Med Arch* 2021; 9: 132-8.

Zebadia E, Mahmudiono T, Atmaka DR, Dewi M, Helmyati S, Yuniar CT. Factors associated with minimum acceptable diet in 6–11-month-old Indonesian children using the 2017 IDHS. *Open Access Maced J Med Sci* 2021; 9(E): 1403-12.