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Children's dietary habit in food insecure area Madura island Indonesia

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Dietary habit, food habit, food-insecure area, food security

Objectives: Food insecurity and malnutrition are still a public health issue, particularly in developing countries. Household food security is a determinant factor of dietary quantity and quality. This study aims to analyse the correlation between household food security and children's dietary habit in food-insecure areas.
Methods: This cross-sectional study was conducted in Bangkalan District, Madura Island, Indonesia and included 89 households with children under five. The Food Insecurity Experience Scale (FIES) was administered to assess household food security status. The children's dietary habit was assessed using the Food Frequency Questionnaire (FFQ). Spearman's rank correlation was applied to analyse the correlation between children's dietary habits and household food security status in Madura Island, Indonesia.
Results: A high proportion of food-insecure households (71.9%) was found in this study. Children under five have low consumption of vegetables and fruits. There was no significant correlation between household food security status with children's dietary habits of staple food, and protein sources of food. There was a significant correlation between household food security status with children's dietary habits of vegetables and fruits.
Conclusion: Parents can provide food sources of carbohydrates and protein regardless of their household food security status. Nonetheless, parents need to encourage the consumption of vegetables and fruits for their children. Food insecure households can provide vegetables and fruits that were highly available and accessible such as water spinach, banana, and orange.

1. Introduction

Food insecurity and malnutrition are still a public health issue, particularly in developing countries such as Indonesia. Madura Island is one of the food insecure areas in Indonesia with a high poverty level and a high prevalence of stunting (Statistic Bureau of East Java, 2018). Household food security is a determinant factor of dietary quantity and quality (Agbadi et al., 2017; Kim & Oh, 2015). Studies in developing countries revealed that there was a correlation between a high poverty level and low access to nutritious food (McDonald et al., 2015). Food insecure households, particularly poor people, tend to have low dietary diversity (McDonald et al., 2015) and have lower consumption of healthy food (Araújo et al., 2018). Food availability is an important factor that influences dietary intake (Santiago-Torres et al., 2014). Low food availability in the food-insecure area can influence people's food habits. This habit is often hard to change until adulthood.

Several studies have explored the correlation between

household food security and children's nutritional status (Kandeepan et al., 2016; Mulu & Mengistie, 2017; Unisa et al., 2016). Nonetheless, a few studies discuss the correlation of household food security with children's food habits (Agbadi et al., 2017; Tomayko et al., 2017), particularly in food-insecure areas. Therefore, this study aims to analyse the correlation between household food security and children's dietary habit in food-insecure areas. The research hypothesis was that children in food-secure households would have healthier eating habits than food insecure ones. Understanding these food habits enable people to help children in food-insecure families to improve their diets and reduce the risk of malnutrition.

2. Materials and Methods

2.1. Study Participants

This cross-sectional study was conducted in Bangkalan District, Madura Island, Indonesia, in September-November 2018. The population was households with children under five years old in Bangkalan District. The sample size was determined by a formula to estimate the proportion in the population with absolute precision (Charan & Biswas, 2013). According to a previous study, moderate food-insecure households that received subsidised rice was 6% (Adi, Diana, & Andrias, 2018), confidence interval 95%, and absolute precision 0.05. A total of 89 samples were included in this study. The sampling procedure was conducted in two stages. The first stage was the selection of sub-districts and villages with the inclusion criteria of food-insecure areas. The second stage was the selection of the household who have children under five. A total of 89 samples were selected using simple random sampling. The ethical clearance was approved by the ethical committee of Faculty of Public Health, Universitas Airlangga, Indonesia (No 530/EA/KEPK/2018).

2.2. Measurements

A structured questionnaire obtained household and children characteristics. The Food Insecurity Experience Scale (FIES) was administered to assess the household food security status (Ballard et al., 2013). There were eight FIES questions, (1) Felt anxiety about having enough food at any time during the previous 12 months; (2) Not able to eat healthy and nutritious food because of lack of money or other resources to get food; (3) Consumed a diet based on only a few kinds of foods because of lack of money or other resources to get food; (4) Did not eat breakfast, lunch or dinner [or skipped a meal] because there was not enough money or other resources to get food; (5) Ate less than they thought they should because of lack of money or other resources to get food; (6) Household ran out of food because of lack of money or other resources to get food; (7) Felt hungry but didn't eat because there was not enough money or other resources for food; and (8) Went without eating for a whole day. The children's dietary habit was assessed using the Food Frequency Questionnaire (FFQ). The questionnaire surveyed food consumed during the previous 30 days. The FFQ consisted of 19 food items, categorised into five groups. Cereals and grains (4 items), fish, poultry, and eggs (3 items), legumes (2 items), vegetables (4 items), and fruits (4 items). There were seven options of food frequency consumption: more than once/day, once/day, 4-6 times/week, 3 times/week, once-twice/week, once in 2 weeks, and never. The food consumption then reclassified into three groups: never, seldom (>1-2/weeks), and often (>3-7/weeks).

2.3. Statistical Analysis

A descriptive analysis was presented in proportion, median, and interquartile range. Food security status categorised into food secure when the household did not experience one of the eight items of FIES, mild food insecurity (experience condition 1-3), moderate food security (experience condition 4-6), and severe food insecurity (experience condition 7-8) (Ballard et al., 2013). Spearman's rank correlation was applied to analyse the correlation between children's dietary habits and household food security status.

3. Results

In general, the age of the parents was categorised as a productive age. Most of the fathers were 31-50 years old. Meanwhile, mothers were 20-40 years old. Father's age was slightly older than the mothers. On the other hand, the parents had similar education levels. Most of them had a low education level (≤9 years). More than 70% of parents graduated from elementary school, and less than 15% graduated from junior high school. The low education level was closely related to the prosperity of the people. Children's age and sex were almost equally distributed in all categories. Most

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of the children were 2-4 years old, which consist of 38.2% 24-36 months and 37.1% 37-48 months. Meanwhile, there were higher female children (55.1%) involved than male children (44.9%) (Table 1).

The most popular job among men was a seller (31%) and for women (21.3%). Other occupations such as labourers (29.8%) and service providers (23.8%) were also common for men. Meanwhile, a housewife occupation (68.5%) was dominant among Madurese women. Based on the number of household members, most of the families were classified as a small and medium-sized family (Table 1). The median household income was 420,000 IDR/cap/month or equal to 30 USD/cap/month (1 USD = 14,000 IDR).
Household food security status was determined by the

Table 1. Household characteristics

Characteristics	**n=89**	**%**
Father's age		
20-30 years	21	25.0
31-40 years	33	39.3
41-50 years	24	28.6
>50 years	6	7.1
Mother's age		
20-30 years	42	47.2
31-40 years	36	40.4
41-50 years	11	12.4
Father's education		
Not enrolled in school	1	1.2
Elementary school	64	76.1
Junior high school	12	14.3
High school	4	4.8
Undergraduate school	3	3.6
Mother's education		
Not enrolled in school	6	6.7
Elementary school	68	76.4
Junior high school	13	14.6
High school	2	2.2
Father's occupation		
Jobless	2	2.4
Seller	26	31.0
Employee	11	13.1
Laborer	25	29.8
Service provider	20	23.8
Mother's occupation		
Housewives	61	68.5
Seller	19	21.3
Employee	3	3.4
Laborer	4	4.5
Service provider	2	2.2
Family size		
Small(≤4 people)	35	39.3
Medium (5-6 people)	32	36.0
Big (>6 people)	22	24.7

Table 1 Cont.

Characteristics	n=89	%
Food secure	25	28.1
Mild food insecurity	40	44.9
Moderate food insecurity	20	22.5
Severe food insecurity	4	4.5
Children's age		
24-36 months	34	38.2
37-48 months	33	37.1
49-60 months	22	24.7
Sex		
Male	40	44.9
Female	49	55.1
Household income (IDR/cap/month)		
Median	420,000	
Interquartile range (IQR)	386,429	

food insecurity experience scale (FIES) survey module. About 28.1% of households were food secure. Most of the households were food insecure (71.9%) at various levels, that consisted of 44.9% mildly food insecure, 22.5% moderately food insecure, and 4.5% severely food insecure.

Children's dietary habits were collected through the FFQ questionnaire. These food habits were divided into consumption patterns of food sources of carbohydrates, protein, vitamins, and minerals. Almost all children consume rice and rice corn, regardless of their household food security status (Table 2). Rice is an Indonesian staple food; therefore, most of them consume it daily. Rice corn is also a popular staple food in Madura Island. Many households provided and consumed rice corn more than three times a week. Another popular staple food is noodles. More than half of children who had food secure status consumed noodles 1-2 times/week. Another wheat-based food source of carbohydrate was bread. Nevertheless, bread was not consumed as a staple food in Madura Island but as a snack. Therefore, a lot of children seldom or never consumed it. The present study found no significant correlation between food sources of carbohydrate consumption with food security status ($p>0.05$).

Egg and fish were popular food sources of animal protein for children under five in all households with food-secure status (Table 3). More than 60% of children often consumed eggs (>3-7 times per week). Fish and chicken were also liked and consumed by children; however, their consumption was not as frequent as eggs. Children often consumed fish in mild and severe food-insecure households. Meanwhile, chicken was seldom consumed by children, particularly among children from severe food-insecure households. There was no significant correlation between food sources of protein and household food security status. Tempeh and tofu are soy-based foods that are very popular in Indonesia and often consumed by the people. Most of the children often consumed tempeh and tofu (Table 3).

In general, the consumption of vegetables and fruits were relatively low compared to animal and plant protein. Food sources of vitamin and mineral from vegetables that were often consumed by children were spinach and carrot (Table 4). Water spinach was seldom or never consumed by most of the children in the food-secure household. Meanwhile, there was a higher proportion of children who consumed water spinach in food-insecure households ($p=0.032$; $r=0.227$). On the other hand, fruits were seldom consumed by children. Fruits that were highly available (non-seasonal) with low prices were consumed by children regardless of their household food security status. On the contrary, fruits (watermelon and apple) with higher prices were more rarely consumed by children

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Table 2. Percentage of children who consume food sources of carbohydrate by food security status

Food sources of carbohydrate	Food secure	Mild food insecurity	Moderate food insecurity	Severe food insecurity	p-value
Rice					
Never	1 (4)	0 (0)	0 (0)	0 (0)	0.886
Seldom (>1-2x/weeks)	1 (4)	1 (2.5)	1 (5)	1 (25)	
Often (>3-7x/weeks)	23 (92)	39 (97.5)	19 (95)	3 (75)	
Rice corn					
Never	7 (28)	8 (20)	4 (20)	1 (25)	0.728
Seldom (>1-2x/weeks)	2 (8)	5 (12,5)	3 (15)	0 (0)	
Often (>3-7x/weeks)	16 (64)	27 (67.5)	13 (65)	3 (75)	
Noodles					
Never	1 (4)	2 (5)	2 (10)	0 (0)	0.571
Seldom (>1-2x/weeks)	15 (60)	27 (67.5)	13 (65)	2 (50)	
Often (>3-7x/weeks)	9 (36)	11 (27.5)	5 (25)	2 (50)	
Bread					
Never	6 (24)	20 (50)	8 (40)	3 (75)	0.087
Seldom (>1-2x/weeks)	14 (56)	17 (42.5)	9 (45)	1 (25)	
Often (>3-7x/weeks)	5 (20)	3 (7.5)	3 (15)	0 (0)	

Table 3. Percentage of children who consume food sources of protein by food security status

Food sources of protein	Food secure	Mild food insecurity	Moderate food insecurity	Severe food insecurity	p-value
Eggs					
Never	2 (8)	2 (5)	1 (5)	0 (0)	0.946
Seldom (>1-2x/weeks)	7 (28)	6 (15)	7 (35)	1 (25)	
Often (>3-7x/weeks)	16 (64)	32 (80)	12 (60)	3 (75)	
Chicken meat					
Never	2 (8)	4 (10)	6 (30)	1 (25)	0.076
Seldom (>1-2x/weeks)	17 (68)	23 (57.5)	11 (55)	3 (75)	
Often (>3-7x/weeks)	6 (24)	13 (32.5)	3 (15)	0 (0)	
Fish					
Never	4 (16)	1 (2.5)	1 (5)	0 (0)	0.254
Seldom (>1-2x/weeks)	11 (44)	14 (35)	10 (50)	1 (25)	
Often (>3-7x/weeks)	10 (40)	25 (62.5)	9 (45)	3 (75)	
Tempeh					
Never	0 (0)	1 (2.5)	1 (5)	0 (0)	0.280
Seldom (>1-2x/weeks)	6 (24)	1 (2.5)	1 (5)	1 (25)	
Often (>3-7x/weeks)	19 (76)	38 (95)	18 (90)	3 (75)	
Tofu					
Never	2 (8)	2 (5)	0 (0)	0 (0)	0.266
Seldom (>1-2x/weeks)	3 (12)	0 (0)	0 (0)	2 (50)	
Often (>3-7x/weeks)	20 (80)	38 (95)	20 (100)	2 (50)	

in food-insecure households than food-secure households. Spearman correlation showed that there was a significant correlation between watermelon (p=0.045; r=-0.266) and apple (p=0.012; r=-0.213) consumption with household food security status. This study revealed that a lower proportion of children in food-insecure households consumed watermelon and apples.

4. Discussion

A high prevalence of food-insecure households (71.9%) and low education levels were found in this study. Madura Island, particularly Bangkalan District, is a food-insecure area. Therefore, the prevalence of food-insecure households was high. Low food availability, food access, education level, and access to water,

Table 4. Percentage of children who consume food sources of vitamin and mineral by food security status

Food sources of vitamin and mineral	Food secure	Mild food insecurity	Moderate food insecurity	Severe food insecurity	p-value
Water spinach					
Never	12 (48)	19 (47.5)	4 (20)	2 (50)	0.032
Seldom (>1-2x/weeks)	12 (48)	16 (40)	10 (50)	1 (25)	
Often (>3-7x/weeks)	1 (4)	5 (12.5)	6 (30)	1 (25)	
Spinach					
Never	5 (20)	9 (22.5)	3 (15)	1 (25)	0.292
Seldom (>1-2x/weeks)	14 (56)	16 (40)	9 (45)	1 (25)	
Often (>3-7x/weeks)	6 (24)	15 (37.5)	8 (40)	2 (50)	
Cabbage					
Never	14 (56)	26 (65)	11 (55)	2 (50)	0.907
Seldom (>1-2x/weeks)	7 (28)	12 (30)	7 (35)	2 (50)	
Often (>3-7x/weeks)	4 (16)	2 (5)	2 (10)	0 (0)	
Carrot					
Never	5 (20)	3 (7.5)	2 (10)	0 (0)	0.377
Seldom (>1-2x/weeks)	12 (48)	20 (50)	11 (55)	2 (50)	
Often (>3-7x/weeks)	8 (32)	17 (42.5)	7 (35)	2 (50)	
Orange					
Never	6 (24)	7 (17.5)	5 (25)	4 (100)	0.175
Seldom (>1-2x/weeks)	15 (60)	24 (60)	13 (65)	0 (0)	
Often (>3-7x/weeks)	4 (16)	9 (22.5)	2 (10)	0 (0)	
Banana					
Never	16 (64)	19 (47.5)	13 (65)	3 (75)	0.310
Seldom (>1-2x/weeks)	8 (32)	15 (37.5)	7 (35)	0 (0)	
Often (>3-7x/weeks)	1 (4)	6 (15)	0 (0)	1 (25)	
Watermelon					
Never	10 (40)	20 (50)	14 (70)	3 (75)	0.045
Seldom (>1-2x/weeks)	13 (52)	16 (40)	6 (30)	0 (0)	
Often (>3-7x/weeks)	2 (8)	4 (10)	0 (0)	1 (25)	
Apple					
Never	14 (56)	37 (92.5)	16 (80)	4 (100)	0.012
Seldom (>1-2x/weeks)	11 (44)	3 (7.5)	4 (20)	0 (0)	
Often (>3-7x/weeks)	0 (0)	0 (0)	0 (0)	0 (0)	

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especially in the dry season, cause this region to become a food-insecure area (East Java Province Food Security Bureau, 2016). A study by Mulu and Mengistie (2017) in Western Ethiopia also found a high prevalence of food-insecure households with children under five. Smith et al. (2017) found that low levels of education, weak social network, less social capital, low household income, and being unemployed were determinant factors for food insecurity.

Spearman's analysis showed that children's food consumption habits of staple foods and animal and plant protein foods were not correlated with household food security status. Rice was a staple food and the highest source of protein intake among Indonesian people (Statistic Bureau, 2016). Rice contains a high amount of carbohydrate and enough protein (approximately 77.1 g carbohydrate and 8.4 g protein per 100 g edible portion) (Ministry of Health, 2018). A national socio-economic survey in 2016, showed that the most significant proportion of protein intake was rice (Statistic Bureau, 2016). Furthermore, rice also has a good quality of protein because it has a higher amino acid score (AAS=66%) than other staple foods (wheat AAS=38%; corn AAS=41%; sorghum AAS=40%) (Juliano, 1999). Rice corn, quite popular as a staple food in Madura Island, has high fibre content (Ministry of Health, 2018). On the other hand, food-based wheat flour (noodles and bread) can be a good source of iron and folic acid because of mandatory fortification of wheat flour in Indonesian (Minister of Health, 2003; Minister of Industry and Trade, 2001).

Animal proteins that are often consumed by children were eggs and fish. Meanwhile, plant proteins consumed daily were tempeh and tofu. These sources of protein are highly available and accessible by the household in this food insecure area. Eggs and fish are loaded with high-quality protein, whereas tempeh and tofu (soybean products) contain a good source of plant protein besides rice and peanuts (Brody, 1999). These soy-based foods have an essential role in providing protein for Indonesians (Statistic Bureau, 2016). Based on the national socio-economic survey in 2016, the primary source of protein of Indonesian people was rice, fish, tempeh, and tofu (Statistic Bureau, 2016). Indonesian balance nutrition guidelines suggested that children under five should consume 3-4 portions of animal protein daily (Ministry of Health, 2014).

This study revealed that the consumption of animal- and plant-based protein were not correlated with household food security status. High availability and many options of food sources of protein with affordable prices enabled the households to choose and provide any kind of protein food source for their children. Low consumption of vegetables and fruits were found in this study. The result of this study is in line with the study from de Araujo et al. (2018) which revealed a negative effect of food insecurity with healthy food such as fruit and vegetable consumption. Food sources of vitamin and mineral from vegetables that are often consumed by children were spinach and carrot (regardless of their household food security status). Water spinach was more prevalent in food-insecure households than food-secure ones. There was a higher proportion of children who consumed water spinach in food-insecure households ($p=0.032$; $r=0.227$). Water spinach contains 17 mg vitamin C, 5542 mcg carotene, and 2.3 mg of iron. Meanwhile, spinach contains 41 mg vitamin C, 2293 mcg carotene, and 3.5 mg of iron (Ministry of Health, 2018). Although water spinach has a lower content of vitamin C and iron than spinach, due to the high availability and low price of water spinach, it can be a good alternative for vitamins and minerals for children in food-insecure households.

Fruits that were often consumed by children regardless of household food security status were banana and oranges. A lower proportion of children in food-insecure households consumed watermelon and apples. Banana and orange have an adequate amount of vitamins. Banana contains 9 mg vitamin C and 37 mcg carotenes, and orange has 49 mg vitamin C and 190 mcg carotenes. Meanwhile, watermelon contains 6 mg vitamin C, 590 mcg carotenes, and apples have 5 mg vitamin C and 90 mcg carotenes (Ministry of Health, 2018). Therefore orange and banana can be a healthy choice of fruits for the children in food-insecure households. Non-seasonal fruit such as papaya and seasonal fruits such as jack fruit, snack fruit, sugar apple or sweetsop, rose apple, mango, and other inexpensive fruits which are highly available can be an alternative to orange and banana. Knowledge about the nutrient content in various fruits can be an advantage for the household so they can provide healthy

and cheap fruits for the children.

The present study revealed no significant correlation between children's food habits (food sources of carbohydrate and protein) with household food insecurity. Meanwhile, a higher proportion of water spinach consumption and lower consumption of watermelon and apples was significantly correlated with household food insecurity. Contrary to the research hypothesis, it seems that young children are protected from hunger and have a good and healthy food habit even in food-insecure households. A review by Berti (2012) revealed that children less than six years old in Ethiopia, Nigeria, Bangladesh, China, Nepal, Philippines, Ecuador, Guatemala, and Peru have an equal intrahousehold food distribution. A study of intrahousehold food distribution in China showed that young children tend to have a higher proportion of meat, dairy products, and fruits than another age group (Luo et al., 2001). In this study, more than half of the households were mild and moderate food insecure, and only 4.4% had severe food insecurity. Therefore, these results cannot represent children's food habits in families with severe food insecurity. Additional research is needed to explore the intrahousehold consumption and children's eating habits in families with severe food insecurity.

5. Conclusion

Households with food insecurity and low consumption of vegetables and fruits among children were prevalent in this study. There was no significant correlation between household food security status with children's dietary habits of staple foods, and protein sources of food. Parents can provide food sources of carbohydrates and protein regardless of their household food security status. Nonetheless, parents need to encourage the consumption of vegetables and fruits for their children. There was a significant correlation between household food security status with children's dietary habits of vegetables and fruits. The food insecure household can provide vegetables and fruit that were highly available and accessible such as water spinach, banana, and orange.

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7. Conflict of interest

The authors declare no conflict of interest. In addition, the funder had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, and in the decision to publish the results.

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