Journal of Nutrition and Food Security
Shahid Sadoughi University of Medical Sciences
School of Public Health
Department of Nutrition
Shahid Sadoughi University of Medical Sciences
School of Public Health
Nutrition Department

eISSN: 2476-7425 pISSN: 2476-7417 JNFS 2024; 9(3): 561-573 Website: jnfs.ssu.ac.ir

Household Food Expenditure and Stunting of Children under Five Years Old in Food Secure Area

Annis Catur Adi; PhD*[1], Rian DianaPhD[1], Dini Ririn Andrias; MPH[1], Deandra Ardya R. Sutoyo; MPH[2] & Wizara Salisa; PhD[2]

[1] Department of Nutrition, Faculty of Public Health, University of Airlangga, Surabaya, 60115, Indonesia; [2] Master of Public Health Program, Faculty of Medicine, Public Health, and Nursing, University of Gadjah Mada, Yogyakarta, Indonesia.

ARTICLE INFO

ORIGINAL ARTICLE

Article history:
Received: 5 Sep 2022
Revised: 8 Jan 2023
Accepted: 8 Jan 2023

Corresponding author:
annis_catur@fkm.unair.ac.id
Department of Nutrition, Faculty of Public Health, Universitas Airlangga, Surabaya, 60115, Indonesia.

Postal code: 60115
Tel: +62 31 5920948

ABSTRACT

Background: Indonesia retains a high stunting prevalence which varies between regions. The government preliminarily has specific and sensitive nutrition programs. However, few studies have investigated the prevalence of stunting in food-secure areas and its association with the nutrition program. Therefore, the current research aims to analyze the prevalence of stunting and its relationship with socioeconomic factors and nutritional intervention programs received by children or their families in food-secure areas. **Methods:** This cross-sectional study included 140 children under five and their parents/ caregivers. Chi-square and logistic regression were applied to examine the correlation of stunting prevalence with other variables. **Results:** The prevalence of stunting was 38.6%. The factors that were significantly correlated with stunting prevalence were maternal education level (P=0.01), household food expenditure in the animal-based foods group (P=0.009), ready-to-eat foods (P=0.002), total food expenditure (P=0.003), and information from health workers about the use of iodized salt (P=0.033). **Conclusions:** High stunting prevalence is present in food-secure areas. Therefore, increasing maternal education and improving household food access, particularly for animal protein and ready-to-eat food, can be potential strategies to reduce stunting problems in food-secure areas.

Keywords: *Child malnutrition; Expenditures; Food; Household.*

Introduction

Stunting is a crucial nutrition indicator for children under five years old. Globally, stunting affected 22.0% of children under five in 2020, and Asia has the highest stunting prevalence (Chowdhury *et al.*, 2022). Indonesia has a high prevalence of stunting, which places Indonesia in the top ten stunting cases among Asian countries (Chowdhury *et al.*, 2020). The prevalence of stunting in Indonesia currently stands at 37.8% in 2015, while in 2018 the prevalence decreased to 31% (Chowdhury *et al.*, 2018).

Stunting can be caused by suboptimal nutrition or prolonged nutrient deficiencies which appear in utero and during childhood (Chowdhury *et al.*, 2022, Das *et al.*, 2008). Short-term consequences of stunted growth consist of increased risk of

This paper should be cited as: Annis Catur Adi, Rian Diana, Dini Ririn Andrias, Deandra Ardya R. Sutoyo, Wizara Salisa. ***Household Food Expenditure and Stunting of Children under Five Years Old in Food Secure Area.*** *Journal of Nutrition and Food Security (JNFS)*, 2024; 9(3): 561-573.

[DOI: 10.18502/jnfs.v9i3.16165]

infection, reduced cognitive development, and increased morbidity (East Java Department of Agriculture and Food Security, 2016). Long-term effects of stunting include loss of height and lean body mass in adulthood, cognitive decline between ages 6 to 11, and decline in overall educational background (Beal *et al.*, 2018, Health Department of East Java Province, 2016). Food insecurity influences children's nutritional status by restricting the quantity and quality of dietary intake, as explained in UNICEF's conceptual framework for child malnutrition (Ministry of Health of The Republic Indonesia, 2018).

Furthermore, stunting is associated with the implementation of integrated nutrition-specific and sensitive interventions. The implementation of the stunting prevention program is expected to be supported by the readiness of the infrastructure, human resources, budget, community awareness and participation, and stakeholders (Zaleha and Idris, 2022).

There are still conflicting results regarding the connection between stunting and the nutritional intervention program. Several studies revealed no significant correlation between the provision of complementary food supplements and dietary counseling in China (Farebrother *et al.*, 2018) or the integrated interventions in Baitadi (enhanced homestead food production, promotion of good nutrition, and water, sanitation, and hygiene (WASH), women's empowerment, income generation, and advocacy) and stunting. However, one study discovered that the integration of regular home visits and nutrition education through classes by cadres in community health centers revealed considerable potential for acceptance (Effendy *et al.*, 2020). WASH programs significantly increased the mean height-for-age-z score in children under the age of five (Gizaw and Worku, 2019).

One study related to stunting has been conducted in an area with a high prevalence of stunting and low food security (Hagos *et al.*, 2017, Haselow *et al.*, 2016). However, few studies have examined the prevalence of stunting in food secure areas, particularly in Asia and its connection to specific and sensitive nutritional intervention programs. Therefore, the purpose of present article is to assess the frequency of stunting and its relationship to socio-economic factors and specific and sensitive nutritional intervention programs received by children under the age of five years and their families in food secure areas.

Materials and Methods

Study design

A cross-sectional investigation was conducted from July to August 2019 to establish the association between household socioeconomic and stunting in children under five years old.

Study location

The population of present study was children under five years old in the Jombang district, East Java Province, Indonesia. Jombang district was selected as the research location based on five indicators: A high proportion of food-secure sub-districts, high number of children under the age of five, high coverage of vitamin A, have a relatively lower prevalence of stunting difficulties compared to other districts, however there still exist nutritional challenges containing acute and chronic problems. The chosen district still reflects the various nutritional problems and can include all the characteristics of the children. In addition, the selection of sub-districts was purposively chosen with identical considerations (five indicators), and based on the recommendations of the Jombang District Health Office (Chowdhury *et al.*, 2018, Meshram *et al.*, 2012, Monteiro *et al.*, 2010).

Sample size

The samples were children under the age of five years who were randomly selected to participate as participants in this study. Globally, there is evidence that 70% of stunting occurs within a critical period from conception to the first two years of life (0–23 months). This linear developmental deficit can be exacerbated by age of five in spite of prolonged exposure to unpleasant environmentally modifiable factors associated to nutritional deficiencies, infections, and psychosocial care (Leroy *et al.*, 2014). Age under 5 years is a critical age in determining the quality of child development. As stunting occurs

[DOI: 10.18502/jnfs.v9i3.16165]

under the age of 5 years, it may lead to delayed physical maturation and have long-term consequences for mental growth, academic performance, economic productivity, and maternal reproductive outcomes (Stewart *et al.*, 2013).

Anthropometric evaluation was conducted to determine the children's nutritional status. The family members of the caregivers were interviewed regarding the children characteristics, household socio-economic, and their participation in nutrition intervention and education programs. The sample size was considered by the sample size formula outlined in (Lwanga and Lemeshow, 1991) with a 95% confidence interval and 10% margin of error, and an estimated 26.2% proportion of stunted children under five out of a total of 78,293 children under five in Jombang (Monteiro *et al.*, 2010, Perkins *et al.*, 2017). Additionally, with a design effect of 1.7 and a non-response rate of 10%, the required sample size was 140 children.

Sampling technique

The number of samples from each village was allocated proportionally. Meanwhile, samples in each village were selected using a simple random sampling method. Purposive sampling method was utilized to select the village with the identical criteria as city and sub-district selection, namely villages with the highest number of children under five years in each sub-district, however the number of stunting prevalence is relatively low which includes acute and chronic nutritional problems. The inclusion criteria were children aged between 0 and 59 months and in a healthy condition, and the family members or the caregivers who agreed to participate in the study by signing the informed consent form. The exclusion criteria were children suffering from a chronic disease or being under special care.

Ethical considerations

Written informed consent was obtained from the family member or the caregiver prior to the data collection period. Ethical clearance was obtained from Faculty of Public Health, Universitas Airlangga (Certificate No. 1725-KEPK 2019).

Measurements

Demographic and socioeconomic characteristics: The socioeconomic and demographic data were collected using a structured questionnaire. Data collection was accomplished by trained enumerators. The participants (the caregivers) were also interviewed regarding their participation in the intervention and education programs related to nutrition and health.

Anthropometric measurement: Body height was measured using a stadiometer with an accuracy level of 0.1 cm (for children over two years old), while body length was gauged using a length board for children under two years old. All measurements were performed twice (Ministry of Health of The Republic of Indonesia, 2020). Data on height and age were used to assess the nutritional status of children under five years using the WHO-Anthro software to compute the Height-for-Age z-score (HAZ). HAZ <-2 SD was classified as stunted, and ≥-2 SD as normal children (Semba *et al.*, 2008).

Secondary data: Data on birth weight and length were obtained from the maternal and child health book that each mother possessed, which was completed according to the records from health workers during pregnancy and at the time of the child's birth.

Food expenditure measurement: The family members or the caregivers were requested to report on consumption of food categories in the previous month. The participant was required to calculate the total monetary value (currency: Indonesia Rupiah or IDR) of all foods in each of the food group. In order to simplify entering costs for each food group, a food ingredient list form was developed based on the FFQ form, but with an additional column for price values. The exclusion criterion for this variable includes the cost of food purchases which is not incurred for the nuclear family (for instance due to food entrepreneurship, presenting to other individuals, or certain events).

Data analysis

Participants' attributes were displayed using descriptive statistics (means and standard deviations or frequencies). Shapiro-Wilk test

[DOI: 10.18502/jnfs.v9i3.16165]

was utilized to test the data normality distribution. Mean and Standard Deviation were utilized to present normally distributed data, while median was used to present data that were not normally distributed. Data analysis was conducted with STATA 15.1. Data were analyzed using chi square and logistic regression. Results were deemed to be statistically significant for P-values <0.05.

Results

Characteristics of participants

A total of 140 children aged 0–59 months were involved in the study. Stunting prevalence in this research area was 39% (**Figure 1**). The background characteristics of the studied children are presented in **Table 1**. Overall, the proportion between boys and girls are evenly distributed with a percentage of 50% each, with a higher stunting prevalence in females.

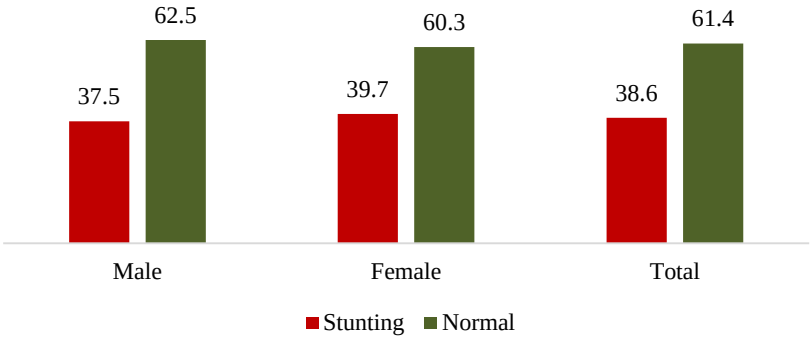

Figure 1. Stunting prevalence in food-secure areas.

Table 1. Children characteristics.

Variables	Stunting		Total
	Yes	No	
Age (months)			
≤24	13 (24.0)[a]	30 (35.0)	43 (31.0)
>24	41 (76.0)	56 (65.0)	97 (69.0)
Mean±SD	35.3±13.7	34.2±15.5	34.6±14.8
Birth weight (g)			
<2500	6 (11.0)	12 (14.0)	18 (13.0)
≥2500	48 (89.0)	74 (86.0)	122 (87.0)
Mean (SD)	3049.5±510.6	3110.2±480.7	3086.0±491.5
Birth length (cm)			
<48	11 (20.0)	16 (19.0)	27 (19.0)
≥48	43 (80.0)	70 (81.0)	113 (81.0)
Mean±SD	48.4±2.8	49.0±2.6	48.8±2.7
Weight (kg)			
≤24 months	9.9±2.8	10.4±2.3	10.2±2.4
>24 months	12.7±2.6	13.0±2.3	12.9±2.5
Total (12-59 months)	12.0±2.9	12.0±2.6	12.0±2.7
Length / height (cm)			
≤24 months	80.6±11.1	81.2±9.9	81.1±10.2
>24 months	92.0±8.6	92.5±8.3	92.3±8.4
Total (12-59 months)	89.3±10.4	88.6±10.4	88.8±10.3

[a]: n(%)

[DOI: 10.18502/jnfs.v9i3.16165]

The average age of all children in the sample was in the range of 35 months, with an average weight of about 12 kg and height of 88.8 cm, in both the stunting and non-stunting groups. According to the average birth weight and length, more than 80% of the children were born with normal birth weight (≥2500 g) (World Health Organization, 1995) and birth length (≥48 cm), in which based on (Lukman *et al.*, 2021), children with birth length of less than 48 cm have a 15 times higher risk of stunting.

Table 2 demonstrated the socio-demographic characteristics of the household, including parental education level and household size. Maternal education level was significantly associated with stunting, with the highest prevalence of stunting at 44% in the category of mothers with a secondary education. In addition, the table illustrates that mothers who are highly educated (graduated from university) donate more stunted children than those who are not. This happens since some mothers who graduated from university became workers, resulting in their children being looked after by caregivers who may have less knowledge. The family size was divided into 3 categories, with the highest prevalence of stunting in children under the age of five with a family of <4 members, at a prevalence rate of 57%.

Table 2. Household socio-demographic characteristics.

Variables	Stunting		Total	P-value[b]
	Yes	No		
Father's education level				
Graduated from university	2 (3.7)[a]	2 (2.0)	4 (3.0)	0.50
Graduated from high school	18 (33.4)	30 (35.0)	48 (34.0)	
Graduated from middle school	23 (42.5)	42 (49.0)	65 (46.0)	
Graduated from elementary school	10 (18.6)	12 (14.0)	22 (16.0)	
Did not graduate from elementary school	1 (1.8)	0(0.0)	1 (1.0)	
Mother's education level				
Graduated from university	4 (7.4)	1 (1.2)	5 (3.6)	0.01
Graduated from high school	12 (22.2)	31 (36.0)	43 (30.7)	
Graduated from middle school	24 (44.4)	45 (52.3)	69 (49.3)	
Graduated from elementary school	14 (26.0)	8 (9.3)	22 (15.7)	
Did not graduate from elementary school	0(0.0)	1 (1.2)	1 (0.7)	
Household size				
Large (>6 people)	6 (11.2)	3 (4.0)	9 (6.0)	0.59
Medium (5-6 people)	17 (31.4)	25 (29.0)	42 (30.0)	
Small (≤4 people)	31 (57.4)	58 (67.0)	89 (64.0)	
Total	54 (39.0)	86 (61.0)	140 (100)	

[a]: n(%); [b]: x^2 test.

Household food expenditure

Nine food groups were included in the study, namely starches, grains and cereals group, animal-based food group, plant-based food group, vegetables, fruits, fats, beverage ingredients, ready-to-eat food group, and other food groups. According to the information provided in **Table 3**, the expenditure disparity for food and beverages is quite high, with a minimum spending value of Rp 258,000/month and the highest spending value is Rp 2,313,000. Several participants confessed to not purchasing the food groups including cereals, vegetables, fruits, oils and fats, and ready-to-eat food and beverages. Some participants have their own paddy fields and only harvest once annually, which is the primary explanation. Therefore, they possess their personal stock of rice at home without the need to purchase it.

[DOI: 10.18502/jnfs.v9i3.16165]

Table 3. Household food expenditure each month (Indonesia Rupiah).

Food groups	Median	Min	Max
Starches, grains and cereals	150.000	0	405.000
Animal-based foods	219.000	6.000	900.000
Plant-based foods	90.000	4.000	300.000
Vegetables	60.000	0	476.000
Fruits	40.000	0	600.000
Fats	48.000	0	320.000
Beverages ingredients	52.000	0	450.000
Ready-to-eat foods	90.000	0	900.000
Other foods groups	72.000	0	1.630.000
Total food expenditure	1.054.500	258.000	2.313.000

Through logistic regression analysis, it was determined that only two out of the nine food group expenditures are significantly related to stunting status of the children, which are animal-based food expenditures (P=0.009) and ready-to-eat foods (P=0.002). **Figure 2** depicts the box plot of animal-based food expenditure values for stunted and non-stunted children. Non-stunted children have a higher median of the animal-based food expenditure compared to stunted children. The median values of the animal-based food group expenditure in stunted and non-stunted child are 168,000 and 336,000.

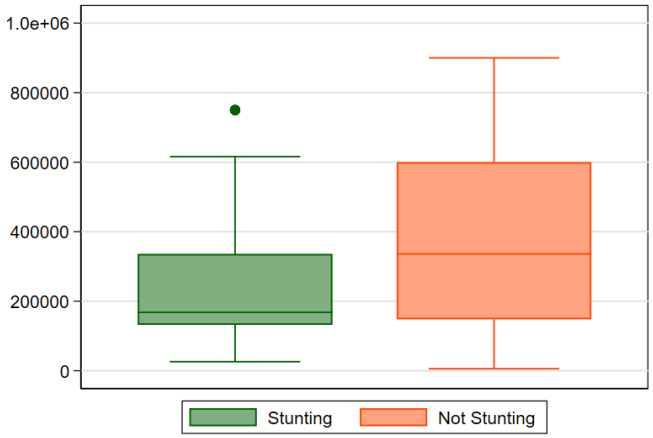

Figure 2. Animal-based food expenditure based on stunting status.

Figure 3 presents the box plot of ready-to-eat food expenditure values for stunted and non-stunted children. Moreover, non-stunted children have a higher median of the ready-to-eat expenditure compared to stunted children. The median expenditure on ready-to-eat food for stunted and non-stunted children is 53,000 and 120,000, respectively.

[DOI: 10.18502/jnfs.v9i3.16165]

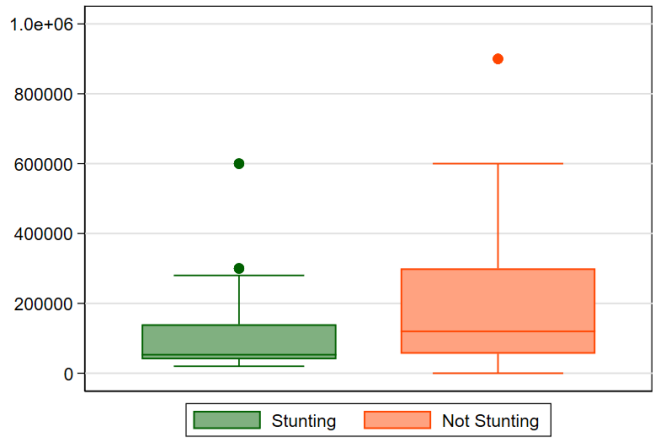

Figure 3. Ready-to-eat food expenditure based on stunting status.

Furthermore, total food expenditure is significantly associated with stunting in children under the age of five. **Figure 4** displays the box plot of total food expenditure values for stunted and non-stunted children. Non-stunted children also have a higher median of the total food expenditure compared to stunted children. The median values of the total food group expenditure in stunted and non-stunted child are 785,500 and 1,213,500 respectively.

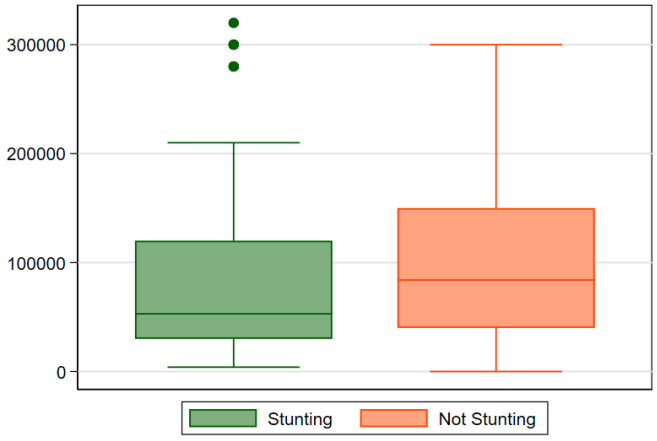

Figure 4. Total food expenditure based on stunting status.

Participation in nutrition intervention and education programs

Various nutrition intervention and education programs targeted at children under the age of five are a government strategy to inhibit health and nutrition problems in children under five. **Table 4** revealed the association of nutrition intervention and education programs with stunting.

[DOI: 10.18502/jnfs.v9i3.16165]

Table 4. The Association of nutrition intervention and education programs with stunting.

Nutrition programs	Stunting		Total	P-value[b]
	Yes	No		
Iron and folic supplements during pregnancy				
Yes	49 (91)[a]	79 (92)	128 (91)	0.82
No	5 (9)	7 (8)	12 (9)	
Iron and folic supplements during lactation				
Yes	28 (52)	47 (55)	75 (54)	0.75
No	26 (48)	39 (45)	65 (46)	
Supplementary feeding program during pregnancy				
Yes	18 (33)	26 (30)	44 (31)	0.70
No	36 (67)	60 (70)	96 (69)	
Supplementary feeding program during lactation				
Yes	5 (9)	14 (16)	19 (14)	0.24
No	49 (91)	72 (84)	121 (86)	
Complementary feeding program for children under five				
Yes	21 (39.0)	46 (53.5)	67 (47.9)	0.092
No	33 (61.0)	40 (46.5)	73 (52.1)	
Information from health workers about exclusive breastfeeding				
Yes	43 (80)	77 (90)	120 (86)	0.103
No	11 (20)	9 (10)	20 (14)	
Information from health workers about infant and young child feeding practice				
Yes	42 (78)	78 (91)	120 (86)	**0.033***
No	12 (22)	8 (9)	20 (14)	
Received information from health workers about the use of iodized salt				
Yes	38 (70)	72 (84)	110 (79)	0.061
No	16 (30)	14 (16)	30 (21)	
Vitamin A supplementation for children under five				
Yes	53 (98)	85 (99)	138 (99)	0.74
No	1 (2)	1 (1)	2 (1)	
Clean water assistance program				
Yes	1 (2)	2 (2)	3 (2)	0.85
No	53 (98)	84 (98)	137 (98)	
Direct cash transfer				
Yes	5 (9)	10 (12)	15 (11)	0.66
No	49 (91)	76 (88)	125 (89)	
Conditional cash transfer program				
Yes	5 (9)	11 (13)	16 (11)	0.52
No	49 (91)	75 (87)	124 (89)	
Food-Reserved Garden for Sustainable Agriculture (KRPL)				
Yes	2 (4)	1 (1)	3 (2)	0.31
No	52 (96)	85 (99)	137 (98)	
Family members registered in insurance and social security (BPJS)				
Yes	31 (57)	52 (61)	83 (59)	0.72
No	23 (43)	34 (39)	57 (41)	
Regularly visit the integrated health posts (*Posyandu*) every month for the last 6 months				
Yes	38 (70)	63 (73)	101 (72)	0.71
No	16 (30)	23 (27)	39 (28)	

[a]: n(%); [b]: x^2 test; ***Posyandu*** *(Pos Layanan Terpadu)* = Integrated health posts; ***BPJS*** *(Badan Penyelenggara Jaminan Sosial)* = Insurance and social security; ***KRPL*** *(Kawasan Rumah Pangan Lestari)* = Food-Reserved Garden for Sustainable Agriculture.

[DOI: 10.18502/jnfs.v9i3.16165]

The iron supplementation program was received by 91% of the children's mothers during pregnancy, whereas the iron supplementation acceptance for mothers reduced to 54% during lactation. The particular nutrition intervention program is the provision of supplementary feeding during pregnancy, lactation, and for infants. Of all three supplementary feeding programs, stunting prevalence was detected to be the highest among mothers who did not receive supplementary feeding during lactation (91%), followed by mothers who did not receive supplementary feeding during pregnancy (67%) and for their infants (61%). The study discovered $P>0.05$ for the relationship between supplementary feeding programs and stunting prevalence.

This investigation ascertained that education program from healthcare workers regarding infant and young child feeding (IYCF) practice was significantly associated with stunting prevalence ($P=0.03$), with a prevalence of stunting in children under five of 78%, the highest in the group of mothers who received the education. Vitamin A, assistance in providing clean water, indirect or direct cash food assistance, to routine visits and *Badan Penyelenggara Jaminan Sosial Kesehatan (BPJS)* or Social Health Insurance Administration membership, had no significant relationships between the two groups.

Discussions

The current work discovered that 39% of children in food-secure areas were stunted. Moreover, it was detected that stunting was prevalent in regions with ample food availability. Further, this high prevalence of stunting was observed in Ugandan regions with restricted food access and low animal protein consumption (Lwanga and Lemeshow, 1991).

The findings indicated that mother's education level, household spending on animal-based foods (beef, chicken, fish, eggs, dairy), ready-to-eat foods (bread, pastry, cake, bakso, gado-gado), total food spending, and participation in a nutrition intervention program with health workers about infant and young child feeding (IYCF) practice were notably linked to stunting incidence.

The results of this study demonstrated an association between animal-based food expenditure and stunting. Animal-based food expenditure in stunted children was lower than in non-stunted children. In addition, the results are identical to ready-to-eat food expenditure. High-quality foods, such as the nutritional content contained in animal-based food, is an important factor and source of protein and other micronutrients for children's dietary requirements. The low consumption of this food source is one of the essential factors for stunting (Senbanjo *et al.*, 2011, Smith and Subandoro, 2007, Soekatri *et al.*, 2020). A study conducted by (Sari *et al.*, 2010) proved that the households with a lower proportion of total expenditure on animal and plant sources and higher proportion expenditure on cereals were at a higher risk of stunting (Stanhope and Lancaster, 2019). Spending in proportion to animal-based diets decreased the probability of stunting (Indonesia Ministry of Health, 2022, Tur *et al.*, 2005).

Maternal education level was determined to be significantly associated with the incidence of stunting in children under five. This finding is consistent with the results of other studies in Indonesia, Bangladesh, India, and Brazil, which explain that maternal education is related to the increased growth and health status of children, (Utami *et al.*, 2019, Victora *et al.*, 2010, World Health Organization, 2020). Higher education is also assumed to assist in improving the financial status which contributes to the total family income (Van Strien *et al.*, 1986, World Health Organization, 2007). In addition, mothers with higher educational status may also possess more knowledge about stunting prevention, namely exclusive breastfeeding, immunization, regular visits to health facilities, as well as optimal nutritional adequacy for their children, containing supplementation (World Health Organization, 1995, Zhang *et al.*, 2016). Furthermore, the results of the study expressed that the educational level of mothers was a protective factor against stunting, with the finding that stunting in children under five

[DOI: 10.18502/jnfs.v9i3.16165]

detected to be 20% higher in the group of children whose mothers had no education compared to mothers with higher education (World Health Organization, 1995). This demonstrates that the mothers' knowledge influences their attitudes and actions towards parenting method. Therefore, education is required in order to prevent stunting. This is prioritized for mothers with low levels of education.

Additionally, the present study displayed a significant relationship between information from health workers about IYCF practices and stunting. Infant and young child feeding is a critical factor in promoting and improving child growth and development. Optimal nutrition intake during the first two years of a child's life is the key to reduce morbidity and mortality. It can also decrease the risk of chronic diseases, support better development, and lower the risk of stunting (Zimmermann, 2012). Early breastfeeding initiation is the first step in the IYCF process. Exclusive breastfeeding is followed by complementary feeding (Victora *et al.*, 2008). Inadequate and inappropriate infant and young child feeding practice can influence children's nutritional status and contribute to the high prevalence of stunting due to lack of understanding, knowledge, and practical skills (Murphy and Allen, 2003, Shrimpton *et al.*, 2001). It is also recognized that the implementation of IYCF counseling will indirectly improve children's nutritional health by, for example, lowering the prevalence of stunting and malnutrition in children (Grillenberger *et al.*, 2003). IYCF promotion and counseling by healthcare workers are known to improve IYCF implementation success and lower the number of malnutrition cases. However, the delivery of information regarding IYCF practice is regarded ineffective and inadequate. therefore, this also affects the caregivers or mothers or family members lack of knowledge (Neumann *et al.*, 2007).

A study proved that healthcare workers with a lack of IYCF knowledge were 5.7 times more likely to provide poor counseling practice regarding IYCF with more than half of the healthcare workers have not received IYCF training which is considered as an essential requirement to provide appropriate counseling to the community and to assist the caregivers provide nutritious and good food for infants and children (Quamme and Iversen, 2022, Sari *et al.*, 2010).

The limitation of this study was the possible bias of the data reported in food expenditure that relies on participants' memory. However, bias control was performed by confirming participant's answers through trained enumerators. The strength of this study was no indication of selection bias, as well as determining the stunting status of children under the age of five using a valid and reliable tool, which was measured in real time instead of using secondary data.

Conclusion

In conclusion, the main finding of this study is that a high prevalence of stunting is still found in food secure areas, with factors that significantly influence are mother's education level, food expenditure (animal protein and ready-to-eat food groups), and nutrition intervention program in receiving information from health workers about (IYCF) practice.

Acknowledgments

We would like to thank University of Airlangga for funding this research (Grant No 1408/UN3/2019).

Authors' contributions

Annis Catur Adi, Rian Diana, and Dini Ririn Andrias designed research; Deandra Ardya R. Sutoyo, and Wizara Salisa conducted research; Deandra Ardya R. Sutoyo and Wizara Salisa analyzed data; Deandra Ardya R. Sutoyo, Rian Diana, and Wizara Salisa wrote the paper; Annis Catur Adi had primary responsibility for final content. All authors read and approved the final manuscript.

Conflict of interest

The authors declare no conflict of interest

Funding

University of Airlangga as a source of funding plays a role in meeting the needs of data collection

[DOI: 10.18502/jnfs.v9i3.16165]

tools and materials, including accommodation and enumerator services.

References

Beal T, Tumilowicz A, Sutrisna A, Izwardy D & Neufeld LM 2018. A review of child stunting determinants in Indonesia. *Maternal & child nutrition.* **14 (4)**: e12617.

Chowdhury TR, et al. 2020. Factors associated with stunting and wasting in children under 2 years in Bangladesh. *Heliyon.* **6 (9)**: e04849.

Chowdhury TR, Chakrabarty S, Rakib M, Saltmarsh S & Davis KA 2018. Socio-economic risk factors for early childhood underweight in Bangladesh. *Globalization and health.* **14 (1)**: 1-12.

Chowdhury TR, Chakrabarty S, Rakib M, Winn S & Bennie J 2022. Risk factors for child stunting in Bangladesh: an analysis using MICS 2019 data. *Archives of public health.* **80 (1)**: 1-12.

Das S, Hossain M & Islam M 2008. Predictors of child chronic malnutrition in Bangladesh. *Pakistan academy of sciences.* **45 (3)**: 137-155.

East Java Department of Agriculture and Food Security 2016. A Food Security and Vulnerability Atlas of East Java (FSVA). East Java Department of Agriculture and Food Security.

Effendy DS, Prangthip P, Soonthornworasiri N, Winichagoon P & Kwanbunjan K 2020. Nutrition education in Southeast Sulawesi Province, Indonesia: A cluster randomized controlled study. *Journal of maternal child nutrition.* **16 (4)**: e13030.

Farebrother J, et al. 2018. Effects of iodized salt and iodine supplements on prenatal and postnatal growth: a systematic review. *Advances in nutrition.* **9 (3)**: 219-237.

Gizaw Z & Worku A 2019. Effects of single and combined water, sanitation and hygiene (WASH) interventions on nutritional status of children: a systematic review and meta-analysis. *Italian journal of pediatrics.* **45 (1)**: 1-14.

Grillenberger M, et al. 2003. Food supplements have a positive impact on weight gain and the addition of animal source foods increases lean body mass of Kenyan schoolchildren. *Journal of nutrition.* **133 (11)**: 3957S-3964S.

Hagos S, Hailemariam D, WoldeHanna T & Lindtjørn B 2017. Spatial heterogeneity and risk factors for stunting among children under age five in Ethiopia: A Bayesian geo-statistical model. *PLoS One.* **12 (2)**: e0170785.

Haselow NJ, Stormer A & Pries A 2016. Evidence-based evolution of an integrated nutrition-focused agriculture approach to address the underlying determinants of stunting. *Maternal child nutrition.* **12**: 155-168.

Health Department of East Java Province 2016. Health Profile of East Java Province in 2016. Health Department of East Java Province

Indonesia Ministry of Health 2022. Complete Explanation of Food to Prevent Stunting. https://www.kemkes.go.id/id/rilis-kesehatan/penjelasan-lengkap-soal-pangan-cegah-stunting. Indonesia.

Leroy JL, Ruel M, Habicht J-P & Frongillo EA 2014. Linear growth deficit continues to accumulate beyond the first 1000 days in low-and middle-income countries: global evidence from 51 national surveys. *Journal of nutrition.* **144 (9)**: 1460-1466.

Lukman TNE, et al. 2021. Birth weight and length associated with stunting among children under-five in Indonesia. *Indonesian journal of nutrition and food.* **16 (1)**: 99-108.

Lwanga SK & Lemeshow S 1991. Sample size determination in health studies: a practical manual. World Health Organization.

Meshram II, et al. 2012. Trends in the prevalence of undernutrition, nutrient and food intake and predictors of undernutrition among under five year tribal children in India. *Asia Pacific journal of clinical nutrition.* **21 (4)**: 568-576.

Ministry of Health of The Republic Indonesia 2018. Results of Nutrition Status Monitoring in 2017 Ministry of Health of Republic Indonesia.

Ministry of Health of The Republic of Indonesia 2020. Child Anthropometry Standards. Regulation of The Minister of Health of The Republic of Indonesia Indonesia

Monteiro CA, et al. 2010. Narrowing socioeconomic inequality in child stunting: the

[DOI: 10.18502/jnfs.v9i3.16165]

Brazilian experience, 1974-2007. *Bulletin of the World Health Organization.* **88 (4)**: 305-311.

Murphy SP & Allen LH 2003. Nutritional importance of animal source foods. *Journal of nutrition.* **133 (11)**: 3932S-3935S.

Neumann CG, Murphy SP, Gewa C, Grillenberger M & Bwibo NO 2007. Meat supplementation improves growth, cognitive, and behavioral outcomes in Kenyan children. *Journal of nutrition.* **137 (4)**: 1119-1123.

Perkins JM, et al. 2017. Understanding the association between stunting and child development in low-and middle-income countries: Next steps for research and intervention. *Journal of social science medicine.* **193**: 101-109.

Quamme SH & Iversen PO 2022. Prevalence of child stunting in Sub-Saharan Africa and its risk factors. *Journal of clinical nutrition open science.* **42**: 49-61.

Sari M, et al. 2010. Higher household expenditure on animal-source and nongrain foods lowers the risk of stunting among children 0–59 months old in Indonesia: implications of rising food prices. *Journal of nutrition.* **140 (1)**: 195S-200S.

Semba RD, et al. 2008. Effect of parental formal education on risk of child stunting in Indonesia and Bangladesh: a cross-sectional study. *Lancet.* **371 (9609)**: 322-328.

Senbanjo IO, Oshikoya KA, Odusanya OO & Njokanma OF 2011. Prevalence of and risk factors for stunting among school children and adolescents in Abeokuta, Southwest Nigeria. *Journal of health, population, and nutrition.* **29 (4)**: 364.

Shrimpton R, et al. 2001. Worldwide timing of growth faltering: implications for nutritional interventions. *Journal of pediatrics.* **107 (5)**: e75-e75.

Smith LC & Subandoro A 2007. Measuring food security using household expenditure surveys. Intl Food Policy Res Inst.

Soekatri MY, Sandjaja S & Syauqy A 2020. Stunting was associated with reported morbidity, parental education and socioeconomic status in 0.5–12-year-old Indonesian children. *International journal of environmental research and public health.* **17 (17)**: 6204.

Stanhope M & Lancaster J 2019. Public health nursing e-book: Population-centered health care in the community. Elsevier Health Sciences.

Stewart CP, Iannotti L, Dewey KG, Michaelsen KF & Onyango AW 2013. Contextualising complementary feeding in a broader framework for stunting prevention. *Journal of maternal child nutrition.* **9**: 27-45.

Tur JA, Romaguera D & Pons A 2005. The Diet Quality Index-International (DQI-I): is it a useful tool to evaluate the quality of the Mediterranean diet? *British journal of nutrition.* **93 (3)**: 369-376.

Utami RA, Setiawan A & Fitriyani P 2019. Identifying causal risk factors for stunting in children under five years of age in South Jakarta, Indonesia. *Journal of enfermeria clinica.* **29**: 606-611.

Van Strien T, Frijters JE, Bergers GP & Defares PB 1986. The Dutch Eating Behavior Questionnaire (DEBQ) for assessment of restrained, emotional, and external eating behavior. *International journal of eating disorders.* **5 (2)**: 295-315.

Victora CG, et al. 2008. Maternal and child undernutrition: consequences for adult health and human capital. *Lancet.* **371 (9609)**: 340-357.

Victora CG, De Onis M, Hallal PC, Blössner M & Shrimpton R 2010. Worldwide timing of growth faltering: revisiting implications for interventions. *Journal of pediatrics.* **125 (3)**: e473-e480.

World Health Organization 1995. Physical status: The use of and interpretation of anthropometry, Report of a WHO Expert Committee. World Health Organization.

World Health Organization 2007. Assessment of iodine deficiency disorders and monitoring their elimination: a guide for programme managers.

World Health Organization 2020. Levels and trends in child malnutrition: UNICEF.

Zaleha S & Idris H 2022. Implementation of stunting program in Indonesia: A narrative review. *Indonesian journal of health administration.* **10 (2)**: 9.

Zhang Y, et al. 2016. Effectiveness of

[DOI: 10.18502/jnfs.v9i3.16165]

complementary food supplements and dietary counselling on anaemia and stunting in children aged 6–23 months in poor areas of Qinghai Province, China: a controlled interventional study. *BMJ open.* **6 (10)**: e011234.

Zimmermann MB 2012. The effects of iodine deficiency in pregnancy and infancy. *Journal of paediatric perinatal epidemiology.* **26**: 108-117.

[DOI: 10.18502/jnfs.v9i3.16165]