

Association between household food insecurity and nutritional outcomes among children in Northeastern of Peninsular Malaysia

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BACKGROUND/OBJECTIVES: The purpose of the study was to investigate the relationship between household food insecurity and nutritional status of children in low-income households. A cross sectional study involved a survey of households (n = 223) receiving the financial assistance.

SUBJECTS/METHODS: Eligible mothers that fulfilled the inclusion criteria such as non-pregnant, non-lactating mothers, aged 18 to 55 years with their youngest children aged 2 to 12 years, were purposively selected. The Radimer/Cornell hunger and food-insecurity instrument was administered and children's height and weight were measured.

RESULTS: About 16.1% of the households were food secure, while 83.9% experienced some kind of food insecurity. Out of food insecure category, 29.6% households were food insecure, 19.3% women were individual food insecure and 35.0% fell into the child hunger category. Education of the mother ($P = 0.047$), household size ($P = 0.024$), number of children ($P = 0.024$), number of children going to school ($P = 0.048$), total monthly income ($P < 0.001$), income per capital ($P < 0.001$), number of household members contributing to the income ($P = 0.018$) and food expenditure ($P = 0.006$) were significant risk factors for household food insecurity. The prevalence of underweight, stunting and wasting in children were 61.0%, 61.4% and 30.6% respectively. Based on multinomial logistic regression, children in food-insecure households were 2.15 times more likely to be underweight and three times to be stunted than children in the food-secure households.

CONCLUSIONS: The findings suggest that household food insecurity is associated with the nutritional status of the children in the rural area of Northeastern Peninsular Malaysia.

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INTRODUCTION

Food security has been described as an important aspect in considering the wealth and economic sustainability of a nation. Important aspects to be considered in food security issues include the availability of food, quality of diet, stability of supplies over time and access to food produced [1]. Food insecurity remains a global threat and a human tragedy. The Food and Agriculture Organization of the United Nations (FAO) reported that "For the first time since 1970, more than one billion people, about 100 million more than those registered last year and around one-sixth of all of humanity, are hungry and undernourished worldwide." The report likewise said the number of undernourished people in the world increased from 854 million in 2006 to 1.02 billion in 2009, and half of all malnourished children in the world and a large proportion of malnourished adult women are housed in three south central Asian countries, namely, Bangladesh, India, and Pakistan [2].

At the household level, food insecurity was related to low

socio-economic status, inadequate dietary intake, and poor nutritional status. Low socio-economic status of a household is characterized as having low monthly income, low income per capita, low educational level, large household size, unemployment among adult members, and single female head, and one that is renting [3-6].

Concerns on food insecurity at the household level involve the well-known association between household food insecurity and poor health status, inadequate food intake, lower cognitive and academic attainment, and psychosocial problems among children [7-11]. Moreover, household food insecurity has been identified as a possible underlying determinant of malnutrition [12]. Poor dietary quality or diversity is a significant contributing factor to malnutrition, specifically, micronutrient deficiencies [13]. Therefore, food insecurity may be a core variable for understanding the nutritional status of low-income populations [14]. Among children, household food insecurity was associated with being underweight, and with wasting and stunting in South Africa [15], Colombia [16], and Pakistan [17]. On the other hand,

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household food insecurity was associated with obesity among urban children in Korea [10]. In Malaysia, food insecurity was not associated with nutritional status [18].

The association between household food insecurity and growth of children has not been studied well in developed countries, much less in developing countries. In Malaysia, few studies have been carried out to assess the socioeconomic profile, nutritional status, and dietary intake of individuals and households as direct indicators of individual or household food insecurity [18,19]. The most recent study on food insecurity rates among rural households in Malaysia showed that 85.2% of these households are food insecure [20]. As the root problem of inadequate access to food, poverty becomes a common problem among the low-income households. These households are focused because of their lower socioeconomic status and vulnerability to food shortages of these households that may affect their allocation of resources, particularly food, to household members [21].

In Malaysia, the undernourished children lived in rural communities with a high poverty index. The most affected states are those located in the east coast and northeast areas of peninsular Malaysia, particularly Kelantan [22], which in 2002 had the second highest poverty index with 12% of households below poverty line, compared with the national level of 5% [23]. The recent findings reported by Cheah were alarming. She indicated that the prevalence of stunting, being underweight, and wasting was 69%, 63.4%, and 40%, respectively, in Tumpat, a rural district of Kelantan [24].

This study tried to answer two research questions: 1) What are the socio-demographic factors influencing food insecurity status? 2) Is there an association between food insecurity and nutritional outcomes for children belonging to low-income households in a rural area in East Coast, Peninsular Malaysia?

SUBJECTS AND METHODS

Location

This study was carried out in the district of Bachok, which is located 25 kilometers east of Kota Bharu, the capital city of Kelantan state. Kelantan reportedly has the highest rate of moderate and severe malnutrition in children [22]. It was also among the top five states in Malaysia benefitting from the food basket assistance program for the poor [25]. Kelantan has 12 villages, and the Malay ethnic group comprises majority of the population. Based on population density, eight of the largest villages were selected for this cross-sectional study. Owing to the strict inclusion criteria of households, mothers, and children, no probability sampling was run, and all the respondents were selected from the records of the welfare department until the calculated sample size was reached ($n = 223$).

Study subjects and data collection

A list of recipients of financial assistance from the Department of Welfare was provided by the key informants (i.e., village head, welfare officer). The key informants contacted respondents receiving financial assistance to arrange for a meeting with the researchers at the homes of the respondents. The respondents were children aged 2-12 years and their caregivers (mothers).

Mothers were recruited because they were primarily responsible for food acquisition and preparation in the households [26].

A home-based survey of households receiving monthly allowance from welfare was conducted, and 223 households with mothers aged 18-55 years old, who were not lactating, not pregnant, and having at least one child aged 2-12 years, were purposively selected. The specified age range includes children from post-weaning to pre-puberty age. Moreover, during this stage, the children are dependent on mothers for food, and their food pattern resembles that of the households. In households with more than one child in this age group, the youngest one was selected for the study because they are the most affected and most vulnerable [27]. Children were eligible for this study if they did not suffer from delays in mental development and were not handicapped.

Prior to data collection, permission to conduct the study was obtained from the Social Welfare Department of Malaysia and from the Medical Ethics Committee, Universiti Sains Malaysia IRB No. USMKK/PPP/JEPeM [235.4.(1.2)]. Mothers who participated in this study signed consent forms.

Data collection was carried out from November 2009 to June 2010 through face-to-face interviews. Two trained research assistants collected demographic and socioeconomic data from the mothers. The data included household income, income per capita, household size, and parental education level. Information on children, such as date of birth, sex, and weight during birth, was obtained from their birth certificates.

Food insecurity was assessed at the household level with the 10-item Radimer/Cornell hunger scale [28,29], which was translated to Malay version and validated [18]. The food insecurity construct consists of four components: quantity of food, quality of food, food acceptability, and certainty of getting food. According to the conceptualization of the Radimer/Cornell Scale, as the problem worsens, household food insecurity representing uncertainty and anxiety about food at the household level is experienced first (mild food insecurity), followed by adult food insecurity (or moderate food insecurity) characterized by decreases in the quality and quantity of food eaten by adults [30]. Child hunger (or severe food insecurity) is the most severe problem arising from household food insufficiency, and is characterized by decreases in the quantity of food eaten by children. Based on the responses of mothers to the items in the Radimer/Cornell Scale, households were classified into four mutually exclusive categories: food secure, household food insecure, adult food insecure, and child hunger, as suggested by Kendall *et al.* (1996). The overall food insecurity is obtained by the combination of household food insecurity, adult food insecurity and child hunger)

Two trained research assistants measured height and weight of children following standard recommended procedures [31]. A SECA digital weighing scale (to the nearest 0.1 kg) and SECA body meter (with precision of 0.1 cm) were used. The ages of the children were calculated in months from their birth certificates. The age, weight, and height of the children were translated into three indices; height-for-age (HAZ), weight-for-age (WAZ), and weight-for-height (WHZ). Z-score was used to distinguish between normal and stunted ($HAZ < -1$), underweight ($WAZ < -1$), and wasted ($WHZ < -1$) children.

Table 1. Socio-demographic characteristics of food secure and food insecure households (n = 223)

Variables	Food secure (n = 36)		Food insecure (n = 187)		t-stat (df) χ^2 (df)	P value
	n (%)	Mean (SD)	n (%)	Mean (SD)		
Age of mother (yrs)		42.14 (6.97)		42.26 (6.33)	-0.10 (221)	0.921 ¹⁾
Educational level of mother						0.047 ²⁾
No schooling	1 (2.8)		23 (12.3)			
Primary	4 (11.1)		21 (11.2)			
Lower secondary	15 (41.7)		95 (50.8)			
Higher secondary	14 (38.9)		32 (17.1)			
Others	2 (5.6)		16 (8.6)			
Household size		5.92 (1.90)		6.87 (2.33)	-2.29 (221)	0.023 ¹⁾
Household size category					4.75 (2)	0.024 ³⁾
≤ 5 members	16 (44.4)		53 (28.3)			
6-8 members	19 (18.9)		98 (52.5)			
≥ 9 members	1 (2.8)		37 (16.6)			
No. of children per household					7.46 (2)	0.024 ³⁾
≤ 3 children	18 (50.0)		51 (27.3)			
4-6 children	12 (33.3)		83 (44.4)			
≥ 6 children	6 (16.7)		53 (28.3)			
No. of children go to school					6.06 (2)	0.048 ³⁾
No children	2 (5.6)		8 (4.3)			
1-3 children	28 (77.8)		108 (57.8)			
≥ 4 children	6 (16.7)		71 (38.0)			
Type of household					0.03 (1)	0.861 ³⁾
Double headed HH ⁴⁾	15 (41.7)		75 (40.1)			
Single Headed HH ⁵⁾	21 (58.3)		112 (59.9)			
Employment status						
Working women	26 (72.2)		125 (66.8)		0.39 (1)	0.527 ³⁾
Housewife	10 (27.8)		62 (33.2)			
Sex of the child						
Male	17 (47.2)		78 (41.7)		0.375 (1)	0.541 ³⁾
Female	19 (52.8)		109 (58.3)			
Age of the children (months)		99.94 (30.23)		89.79 (31.51)	1.78 (221)	0.075 ¹⁾
Household income RM					24.99 (2)	< 0.001 ³⁾
< RM691 ⁶⁾	7 (19.4)		92 (49.2)			
691-1,000	10 (27.8)		65 (34.8)			
> RM 1,000	19 (52.8)		30 (16.0)			
Household income per capita					21.16 (2)	< 0.001 ³⁾
< RM 59 ⁷⁾	0 (0)		10 (5.3)			
RM 59-118.04 ⁸⁾	6 (16.7)		99 (52.9)			
> RM 118.04	30 (83.3)		78 (41.7)			
No. of persons contributed to HH income						
None	0 (0)		14 (7.5)		8.06 (2)	0.018 ³⁾
Only	19 (52.8)		124 (66.3)			
More than one	17 (47.3)		49 (26.2)			
Household food expenditure					10.35	0.006 ³⁾
≤ RM 500	16 (44.4)		119 (63.3)			
RM 500-749.99	12 (33.3)		56 (29.9)			
≥ RM750	8 (22.2)		12 (6.4)			

¹⁾ Independent t test.²⁾ Fisher exact test.³⁾ Pearson chi-square test.⁴⁾ Double headed HH: is the household where the father and mother are living together in the same household.⁵⁾ Single headed HH: is the household which is headed by female (mother) due to the absent of the spouse and the mother either widowed or divorced.⁶⁾ Household poverty line income⁷⁾ Hard core poor⁸⁾ Poor.

Data was entered and analyzed using PASW Windows version 18.0. The first step in the statistical analysis was to compare demographic and socioeconomic variables, and anthropometric measurements against food insecurity status. Responses of women who reported household and individual food insecurity as well as child hunger were categorized in the food-insecure households. Chi-square and T-tests analyses were performed to compare categorical and continuous variables, respectively. Multivariate logistic regression was then run to identify the association between food insecurity status and the outcome variables (nutritional status), adjusting for the factors that were significant according to food-insecurity levels. However, important factors also were included in the multivariate regression model, despite their insignificant associations with food insecurity status. Significance level was set at $P < 0.05$.

RESULTS

Household food insecurity status

Households were first classified into one of four food insecurity categories using the Radimer/Cornell measures. Thirty six (16.1%) households were classified as food secure. Sixty six (29.6%) households were experiencing the least severe level of food insecurity and were classified as "household insecure." These households ran out of food, were uncertain about their ability to obtain sufficient food, and were beginning to compromise the quality of the family diet. Another 43 (19.3%) households had adults who were experiencing food insecurity while 78 (35%) households had hungry children. This means

that children were judged by parents to not be getting a sufficient amount or the right kinds of food, and were asking for more food to eat. This is the most severe level of food insecurity.

Socio-demographic characteristics

The data on socio-economic characteristics of the households are presented in Table 1. The table indicates that there was no significant difference existed between the mean age of mothers in food-secure households and that of mothers in food-insecure households ($P = 0.921$). The proportion of those who had not received any type of education was higher food-insecure households, while the higher secondary education was higher among food-secure households. A statistically significant difference was found when the proportions of the educational level of mothers in food-secure households and food-insecure ones were compared. Results of the Fisher Exact Test showed a significant association ($P = 0.047$) between educational level of mothers and household food insecurity. The mean difference of household size between food-secure households 5.92 (1.90) and food-insecure households 6.87 (2.33) was statistically significant ($P = 0.023$). The proportion of households with more than nine members was higher in the food-insecure households (16.6%) than those in the food-secure households. The average household size was 6.71 (2.29), which was higher than the average household size of 4.6 reported for households in rural areas of Malaysia [32]. The result suggested that there is association between household food insecurity and household size ($P = 0.024$), number of children ($P = 0.024$) and number of

Table 2. Anthropometric characteristics of children (n = 223)

Variables	Total		Food secure (n = 36)		Food insecure (n = 187)		t-Stat (df)/ χ^2 (df)	Mean difference (95% C.I.)	P value
	n (%)	Mean (SD)	n (%)	Mean (SD)	n (%)	Mean (SD)			
Weight (kg)		22.01 (8.79)		24.90 (10.75)		21.46 (8.29)	2.16 (221)	3.44 (0.31, 6.57)	0.031 ¹⁾
Height (cm)		116.52 (19.10)		119.22 (23.56)		116.00 (18.15)	0.92 (221)	3.21 (-3.64, 10.06)	0.357 ¹⁾
Weight / Age Z		-1.07 (1.06)		-0.72 (1.24)		-1.15 (1.02)	2.17 (221)	0.41 (0.03, 0.79)	0.031 ¹⁾
Sig. Underweight ³⁾	42 (18.8)		6 (16.7)		36 (19.3)				0.114 ²⁾
Mild underweight ⁴⁾	94 (42.2)		10 (27.8)		84 (44.9)				
Normal ⁵⁾	83 (39.0)		19 (52.8)		64 (34.2)				
Overweight	4 (1.8)		1 (2.8)		3 (1.6)				
Height / Age Z		-1.26 (1.04)		-0.93 (1.07)		-1.35 (1.03)	2.04 (221)	0.38 (0.01, 0.76)	0.042 ¹⁾
Sig. Stunting ³⁾	56 (25.1)		7 (19.4)		49 (26.2)				0.048 ²⁾
Mild stunting ⁴⁾	81 (36.3)		8 (22.2)		73 (39.0)				
Normal ⁵⁾	86 (38.5)		21 (58.3)		65 (34.7)				
Weight / Height Z		-0.46 (1.02)		-0.08 (1.34)		-0.52 (0.94)	2.08 (221)	0.43 (0.02- 0.85)	0.039 ¹⁾
Sig. Wasting ³⁾	12 (6.1)		3 (10.3)		9 (5.4)				0.074 ²⁾
Mild wasting ⁴⁾	48 (24.5)		4 (13.8)		44 (26.3)				
Normal ⁵⁾	136 (69.3)		22 (75.9)		114 (68.3)				
MUAC		17.8 (2.92)		19.09 (3.94)		17.57 (2.6)	2.21 (41.16)	1.51 (0.48, 2.54)	0.032 ¹⁾
Weight during birth		3.11 (0.46)		3.117 (0.49)		3.11 (0.46)	0.04 (221)	0.003 (-0.16, 0.17)	0.968 ¹⁾
< 2.5 kg	36 (16.1)		1 (2.7)		16 (8.6)		1.43 (1)		0.320 ⁶⁾
≥ 2.5 kg	187 (83.8)		35 (97.2)		171 (91.4)				

¹⁾ Independent t test.

²⁾ Fisher exact test.

³⁾ Significantly underweight/stunting/wasting (moderate + severe): < -2 SD of the National Center for Health Statistics (NCHS) median for WAZ -3

⁴⁾ Mildly underweight/stunting/wasting: ≤ -2 SD $\leq x < -1$ SD of the NCHS median for WAZ -4

⁵⁾ Normal: -1 SD $\leq x \leq 2$ SD -5

⁶⁾ Pearson Chi-Square Test,-6

Table 3. The association between household food insecurity status and nutritional status of the children.

Nutritional status and type of household	Simple logistic regression		b	Multiple logistic regression	
	Odd ratio (95.0% C.I.)	P value		Adj. odd ratio ¹⁾ (95.0% C.I.)	P value
Underweight					
Food secure	1.00		-	1.00	
Food insecure	2.24(1.087, 4.60)	0.029	0.89	2.44 (1.17, 5.09)	0.017
Stunting					
Food secure	1.00		-	1.00	
Food insecure	2.56(1.24, 5.31)	0.011	1.04	3.04 (1.42, 6.49)	0.004
Wasting					
Food secure	1.00		-	1.00	
Food insecure	1.50(0.60, 3.73)	0.381	0.30	1.36 (0.54, 3.42)	0.515

¹⁾ Adjusted for educational level of the mother, household size, number of children, number of children going to school, total income, and sex of the child. C.I.: Confidence Interval.

children going to school ($P = 0.048$). The children were composed of 95 (42.6%) males and 128 (57.4%) females. The mean age of the children was 91.43(31.46) months and average number of children per household was 5.14 (2.48). The type of household (Single headed household /Double headed household) was almost distributed equally in the food-secure (85.3%/41.7%) and food-insecure households (59.9%/40.1%). The type of household was not associated with the household food insecurity status. Based on Pearson's chi-square test, when comparing the employment status between the two categories of households, the difference between proportions was not statistically significant, suggesting that no significant association was reported between the status of household food insecurity and the employment status of the mother ($\chi^2 = 0.39$, $P = 0.527$).

Data on economic characteristics of the households showed that the proportion of households under the poverty line (49.2%) is higher in food-insecure households than their counterparts in the food-secure households (19.4%). Referring to RM 118.04 [US \$37.47] as the poverty level of income per capita in Malaysia, approximately 58.2% of the households in food-insecure group are considered to be living in poverty. Almost Half of the food insecure household (47.3%) have more than one person who contribute to the family income and association was observed between the number of family members contributing to household income and food security status ($P = 0.018$). As long as food expenditure is concerned, 22.2% of the food-secure households spend equal or more than RM 750, while in the food-insecure households the proportion is only 6.5% of these households Economic characteristics (total income, income per capita, number of family members contributing to the income and food expenditure) of food-secure households were significantly different from those of food-insecure households.

Nutritional status of the children

Anthropometric data are presented in Table 2 wherein the mean body weight of children in the food-secure households was significantly higher than their food-insecure counterparts (P value = 0.031); no significant difference was reported in terms of the height of children between the two groups. The mean HAZ, WAZ, and WHZ were all negative, suggesting a generally poor nutritional status of the children in the study.

The prevalence of nutritional outcomes, such as being underweight, stunting, and wasting, in the food insecure households were 64.2% (19.3% significant + 44.9% mild), 65.2% (26.2% significant + 39.0% mild), and 31.7% (5.4% significant + 26.3% mild) respectively, which is much higher than those in the food secure households, where the prevalence of being underweight was 44.5%, stunting 41.6%, and wasting 24.1% in children. The present study reported a significant difference in the z scores of weight for age, height for age, and weight for height at ($P = 0.031$), ($P = 0.042$) and ($P = 0.039$), respectively, between food-secure and food-insecure children.

In multivariate analysis, when the educational level of the mother, household size, number of children, number of children going to school, total income, and sex of the child were adjusted, an association was found between food insecurity and being underweight and stunting (Table 3). The findings revealed that the children in food-insecure households were 2.44 times more likely to be underweight than food-secure children (95%; C.I. 1.17, 5.09). A significant association was found between food-insecurity status and stunting ($P = 0.004$). Children who were food insecure were 3.04 times more likely to be stunted. However, no association between food insecurity status and wasting was reported.

DISCUSSION

The results of this study show associations of household socioeconomic and demographic characteristics with household food insecurity. Evidence from previous studies showed an association between low education levels or decrease of schooling years with household food insecurity [19,33-35]. The findings of this study are inconsistent with those of Isanaka and Tingay and his colleagues who revealed that skilled subjects, such as nurses or teachers, were more likely to be food insecure than those without such qualifications [36,37]. The present study found a significant association between household size and household food insecurity. This result is consistent with studies in the United States [33], Malaysia [8] and Iran [38]. Because of limited resources, increasing family size tends to exert more pressure on consumption. Thus a negative correlation between household size and food security is expected as food requirements increase in relation to the number of persons in a

household

However, marital status of the mother was not associated with household food insecurity. The result opposed Radimer's finding, which emphasized that higher prevalence of food insecurity was associated with the mother's status, whether single or separated, divorced, widowed, or married [39], while being consistent with Hanson's finding wherein widowed women experienced relatively high levels of food security [40]. The absence of the association can be attributed to the fact that majority of single-headed households are headed by females. Similar to the case of single-headed households, the female spouse in double-headed households is usually the one who looks for money and manage the income to solve family problems. In Kelantan, mothers are generally the dominant family member. They are also the breadwinners for most of the families, as they are engaged in small businesses to generate income and dominate business activities [41].

This study finds no association between food insecurity level and job status of the mother, contrary to previously existing evidence [12,19] showing that households with working mothers usually have greater food expenditures and higher levels of food security as these mothers contribute to total household income. The present study showed a significant differences in monthly incomes, income per capita and food expenditure between food-secure and food-insecure households which agrees with the hypothesized association of total household income with household food insecurity status. The relationship between income and household food security is a sequential relationship between food expenditure and dietary diversity that leads to food security [36]. The findings are consistent with previous studies that reported that household income influences household food security status. In brief, those households with lower incomes are at risk for food insecurity [4,6,19,30,37].

Findings of this study show the higher prevalence in all the three nutritional indicators, as compared with a previous study by Tumpat and Bachok that said the prevalence of being underweight, stunting, and wasting was 25.2%, 21.1%, and 6.2%, respectively [42]. A major difference between the two studies in the same region could be attributed to the nature of the data source. Data collected for this study were collected from households classified as poor families and receiving monthly assistance from the Social Welfare Department. A recent study in Tumpat, a rural district of Kelantan, showed that the prevalence of stunting was 69.0%, being underweight was 63.4%, and wasting was 40.0%, slightly higher than the findings of this study [24]. This may be due to the difference in the age group of the study samples. Of the three main nutritional problems, stunting or delayed skeletal growth of children was the most prevalent, reflecting poor overall economic status. As stunting reflects past nutritional status, this finding indicates that children experienced poor diets and repeated infections during their early childhood. Furthermore, they continue living in similar conditions as a consequence of poverty. Higher prevalence of stunting among children was reported in Kelantan [43].

The association between household food insecurity and nutritional status of children has not been studied well in developed countries, much less in developing countries. The

direction of the association differed from one population to another.

Interestingly, the result of this study reported that child stunting and underweight status were significantly associated with household food insecurity, but wasting was not. These findings were consistent with that of Hackett *et al.* (2009) who asserted the same associations in Antioquia, Colombia [16]. In the sample of this study, the highest proportions of stunted, underweight, and wasted children were found in food insecure households. Likewise, in Pakistan, the association between household food insecurity and child stunting was statistically significant [17]. Similarly, in Bogota, Colombia, food-insecure children were almost three times as likely to be underweight as food-secure children, while stunting was not significantly associated with food insecurity when controlling for covariates. The findings of the said study opposed findings of Oh, who reported a significant association between food insecurity and being overweight among children [10]. A study in Kuala Lumpur, the capital city of Malaysia, reported no significant difference in the nutritional status of children between food-secure and food-insecure households [18]. The association between high prevalence of food insecurity and the low nutritional status of the sample for this study suggests that initially, the consumption of expensive food items declines, and is followed by a reduction in portion size, and eventually, frequency of meals. Within families, adults, particularly women, may compromise their own nutrient needs to protect their children from being affected by food insufficiency whenever possible. With insufficient coping strategies, households may also try to reduce expenditure on basic foods, such as sugar, oil, salt, and other staple food. Hence, intake of specific nutrients, particularly micronutrients, is reduced before energy intake is reduced. Malnutrition has consequences in each successive stage and/or the next generation, particularly among low-income households in developing countries. Malnourished mothers are more likely to have babies with low birth: in effect, they pass their malnutrition on to the next generation [44,45].

Given that this was a cross-sectional study, no follow-up and consequently, no opportunity was available for subjects to drop out of the study. The sample size of the study was small and restricted to subjects receiving monthly welfare allowance. As such, the records of the welfare department may under-represent the poor families in Bachok District due to different reasons. Conversely, some of the families included in these records might have generated new incomes that brought them out of poverty circle. Despite these limitations, authors of this study believe it is safe to conclude that food insecurity represents an appreciable problem in rural and low-income households in Malaysia, and the prevalence of food insecurity was consistent with previous rates reported at the same state [20]. Likewise, nutritional indicators were in line with previous findings reported in the neighboring Tumpat district [24]. It is concluded that the prevalence of household food insecurity was high and significantly associated with poor living conditions. A novel outcome of this study includes the quantification of child stunting and underweight by food insecurity status within poor populations when adjusted for associated covariates. Although no significant association was found between household

food insecurity and wasting status, the strong associations between household food insecurity and being underweight and stunting remain major issues of malnutrition among children in Malaysia, particularly in low-income populations.

Author's contributions

Ihab A.N contributed to the data collection, data entry, data analysis and wrote the manuscript. Wan Manan W. M, responsible for the application of grant, budget and ethical approval. Rohana A.J led the overall study, contributed to the design of the study, contacted the authorities involved in the study, supervised the data collection in the fieldwork and wrote the initial draft manuscript. Wan Suriati W.N. totally involved in data collection as trained research assistance and managing technical problems in the fieldwork. Zalilah M.S. and Mohamed Rusli, A advised and participated in the design of the study. All authors participated in the review of the manuscripts, read and approved the final manuscript.

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