

Assessment of Food Insecurity and Nutritional Outcomes in Bachok, Kelantan

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Abstract

Aim: This study is to examine the association between food insecurity and nutritional outcomes among children and adults and its impact on the quality of life of the mother in rural sample in Bachok-Kelantan.

Method: A cross-sectional survey of low income households was conducted and 223 households of mothers aged 18-55 years old, non-lactating, non-pregnant mother and having at least one child in 2-12 years range were purposively selected. A questionnaire was administered including the Radimer/Cornell scale; items on socio-demographic characteristics, anthropometric measurements and quality of life tool (SF36).

Results: The study reported that 16.1% of the households were food secure, while 83.9% experienced some kind of food insecurity, (29.6% households were food insecure, 19.3% individuals were food insecure and 35.0% fell into the child hunger category). The prevalence of underweight, stunting and wasting among the food insecure children were 61.0%, 61.4% and 30.6% respectively, and the prevalence of weight-for-height (overweight) was 1.3%. Based on multinomial logistic regression, larger household size (OR=1.776; 95%CI, 1.35, 2.32; $p<0.001$), number of children in the household (OR=1.20; 95%CI, 1.025, 1.42; $p=0.024$), total monthly income (OR=0.977; 95% CI, 0.995, 0.998; $p<0.001$), income per capita (OR=0.98; 95% CI, 0.97, 0.98; $p<0.001$) and food expenditure (OR=0.977; 95% CI, 0.99, 1.00; $p=0.049$) were found to be significant risk factors for household food insecurity. This study showed there was an association between food insecurity and Diet Dietary score and dietary pattern. Furthermore, food insecure households had lower intake of animal protein, fruits and vegetables compared to their counterparts in the food secure group. The findings of the study reveal that the children in the food insecure were 2.15 times more likely to be underweight and 3 times more likely to be stunted than the children in the food secure households, while no association with wasting was reported. Although, the study reported higher prevalence of overweight and obese mothers (52%) and (47.1%) at-risk WC (≥ 80 cm), no significant association has been found between food insecurity, BMI and waist circumferences. The score for all the eight domains of quality of life were negatively associated with food insecurity.

Conclusion: Our study showed that food insecurity in low income households from Bachok is highly prevalent and associated with poor living conditions and it highlighted the pervasive vulnerability of individuals living in food insecure households. In addition to nutritional problems, food insecure households in Bachok- Kelantan struggle with a broad spectrum of health- related problems.

Introduction

Food security is a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life [1].

The definition of food security not withstand reference to food supply at global, regional, national, community, household or individual levels, has been extended to include accessibility, adequacy, stability and sustainability of food supply [2]. At the household level, food insecurity has always been linked with low socio-economic status, inadequate dietary intake, anxiety and uncertainty about the supply of food, and experiences of food insecurity include running out of food, running out of money to buy food, skipping meals, experiencing hunger and being unable to buy food, or buying cheaper food items because of financial constraints [3-6], leading to poor health status, inadequate food intake, lower cognitive and academic attainments, and psychosocial problems among children [7-10]. Campbell [11] asserted that possible consequences of food insecurity may include heightened vulnerability to poor health outcomes in long term, suboptimal quality of life and health (physical, social, and mental well-being).

On an individual level, potential biological and stress mechanisms have been proposed to explain a relation among food insecurity, poor

nutrition, and poor physical health and poor mental health. On a household level, existence of food insecurity suggests a high degree of vulnerability to a broad spectrum of consequences including poor health status [12].

In Malaysia, many 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 [13-17], one of these studies on food security levels among low income households in Kuala Lumpur reported that 65.7% of these households experienced some kind of food insecurity, 27.7% households were food insecure 10,9% individual insecure and

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27.0% felt into child hunger [17], a recent Malaysian study showed that 58% of the household in rural community samples experienced some kind of food insecurity [18].

Many of these undernourished children lived in rural communities with a high poverty index. The most affected states are those located on the east coast and northeast areas of peninsular Malaysia, particularly in Kelantan [19], which in 2002 had the second highest poverty index with 12% of households below poverty line, compared with the national level of 5% [20]. The Bachok District in the state of Kelantan - Malaysia was chosen for this study because earlier researches have indicated that Kelantan has the highest prevalence of moderate malnutrition (24%) and severe malnutrition (5.9%) [19]. Between 1999 and 2000, Kelantan was placed as one of the top five states that received the most assistance in the Food Basket Program, between 800 and 1600 cases per year [21].

The food insecurity levels in rural areas in Malaysia generally and in Kelantan particularly is attracting the nutritionists and health professionals and in order to manage food insecurity and food inequity, several strategies were developed. These included: small livestock raising, food assistance and food intervention, and community awareness programs.

The present study addresses the following four principal questions:

1. What are the determinants of household food insecurity in rural and poor community?
2. What are its nutritional consequences?
3. Is food security status associated with the quality of life?
4. How we can improve the nutritional status of malnourished children?

Information on food security determinants provide a better understanding of which types of households are likely to be affected by the problem and what are possible interventions to reduce food insecurity and its consequences.

The first three research issues encompassed by the above questions set food insecurity within a causal chain that begins with socioeconomic and demographic considerations and ends with nutritional outcomes while the fourth research question attempt to present successful solutions to malnutrition and help poor families to overcome this nutritional condition and its serious consequences, and on the other hand it will help the decision makers in choosing the best way to reduce the malnutrition in poor communities through programs and projects relies mainly on sustainable development.

Literature Review

The concept of food security has emerged and extended over time to incorporate a wide range of food-related issues and to more completely reflect the complexity of the role of food in human society. Early definitions focused almost exclusively on the ability of a region or nation to assure an adequate food supply for its current and projected population. The emphasis was on secure access to food for a population, with a singular focus on the role of food as a vehicle for nutrition. However, food holds much more significance to humans than just its nutritional value. It can also have important symbolic, cultural, social and political roles. Food security, as a conceptual goal, has extended to include more and more of these roles. The development of thinking reflects an approach that society's goals should reach beyond the ability of a country to produce and import enough food. Issues related to its production, distribution, availability and acceptability have become equally important.

Historically food security linked to the overall regional, national, or even global food supply and shortfalls in supply compared to requirements. But, with increased observations of insufficient food intake by certain groups (despite overall adequacy of supply), the term has been used more recently mostly at a local, household, or individual level [22]. Further, the term has been broadened beyond concept of food supply to include elements of access (determined by food entitlements, [2] vulnerability [23], and sustainability [24,25].

To set up a conceptual frame work for food security, definite concepts must be taken into account such as; availability, access, utilization and stability or sustainability (Figure 1). The food security conceptual framework suggests a hierarchy of causal factors which ultimately influence the various dimensions of food insecurity: adequate food availability at the aggregate level is a necessary, although not sufficient, condition to attain adequate food access at the household level, which in turn, is necessary but not sufficient for adequate food utilization at the individual level [26].

Determinants of the food security status and the outcomes

Many variables considered as risk factors are involved in the occurrence of each dimension of food security. However, this study focused on food security at the household level and discussed what are the variables related to food access dimension? and what is the impact of food insecurity on the nutritional status of the child as well as quality of life of the mother ?

A conceptual framework has been drawn (Figure 2) taking into account the study setting and considered the following three sets of variables as determinants of the food security status of household:

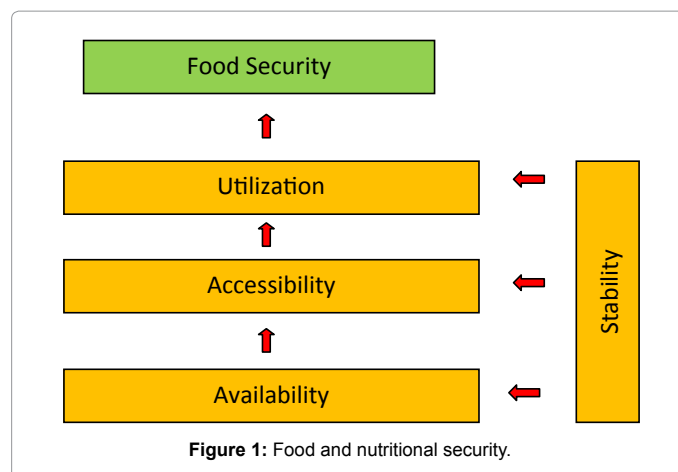
Characteristics of the household head: gender, educational level and occupation and marital status.

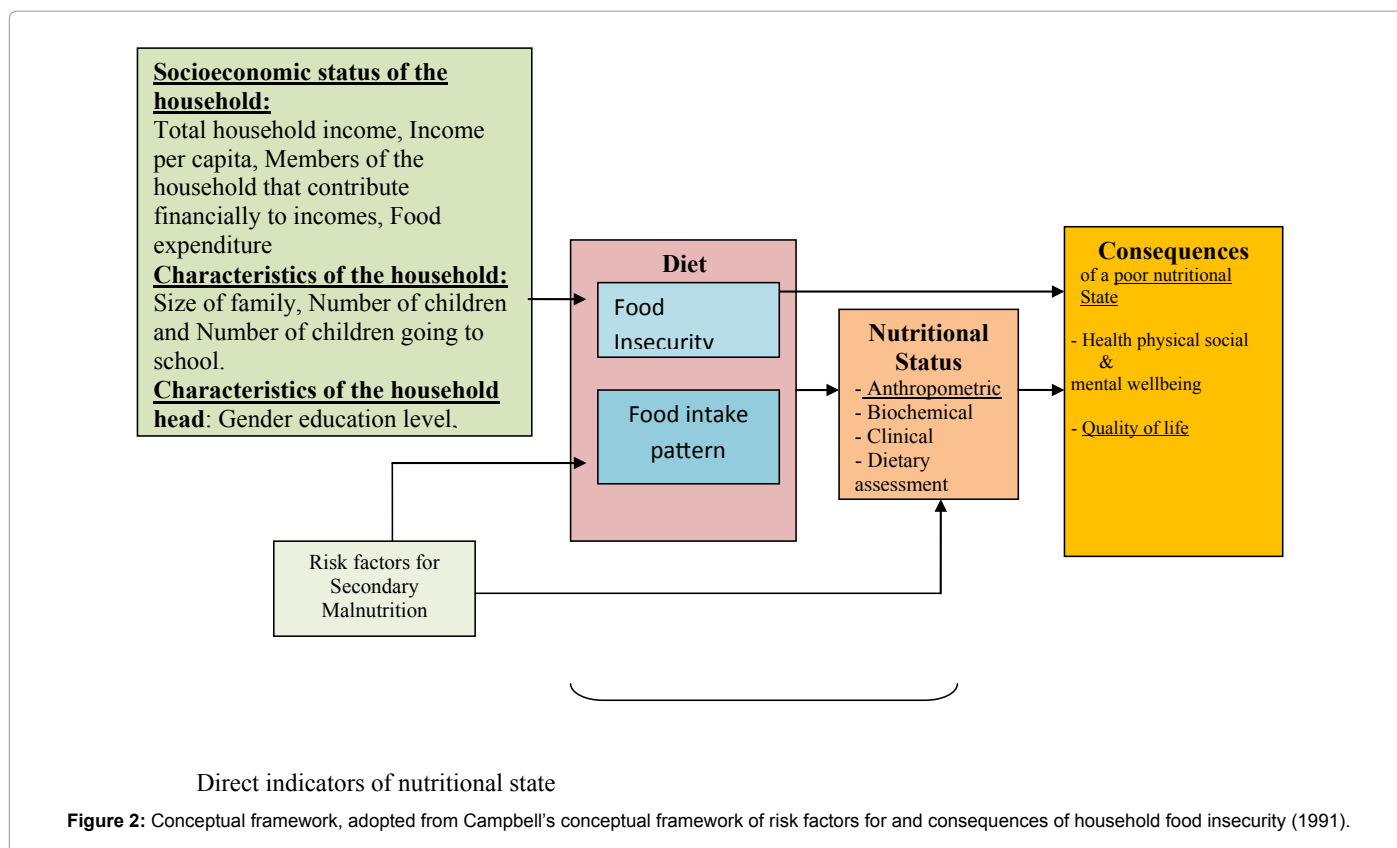
Characteristics of the household: size, composition, number of children and number of children going to school

Socioeconomic status of the household: main source of household incomes, number of persons in the household contributing financially to incomes, income per capita and the food expenditure of the households.

The outcome variables: nutritional status and quality of life

Potential consequences of food insecurity include hunger, malnutrition and (either directly or in indirectly) negative effects on health and quality of life.





In the nutritional status the effect of food security becomes apparent. Among the most relevant factors are the micronutrient deficiencies (i.e. lack of essential nutrients such as vitamins or minerals) and under nutrition (lack of calories and proteins necessary for normal growth, body maintenance and the energy necessary for activities) These kinds of malnutrition have not only adverse effects on the child, on his family, but also on society. It causes disease and death in its most dramatic form, impacts negatively on the intellect, cognitive and education of the child, (with long time effects on the society) and it undermines the capacity to work, reducing productivity through work time lost to sickness, lower productivity when working, and decreasing the total number of working years during a lifetime [22]. Campbell asserted that “possible consequences of food insecurity may include suboptimal quality of life and health (physical, social, and mental well-being)”

The immediate determinants

The immediate determinants of the nutritional status manifest themselves at the level of the individual human being. They are dietary intake and health status. These factors themselves are interdependent.

Dietary intake: Dietary intake must be adequate in term of quantity and quality, and nutrients must be consumed in suitable combinations for the human body to be able to absorb them (energy, protein, fat, and micronutrients). On household level the decision what food is being put on the table (demand) and who is to eat it (intra-household distribution) determines the composition of the meals for the individual. Habits (e.g. food taboos) and knowledge (e.g. preparation, processing, child feeding practices) influence the composition but also the biological utilization of the food.

Health status: There are strong synergistic relationships between

the health status and the nutritional status. A sick person is likely to lose his appetite, eat a poor diet, digests his food poorly and must use some of his nutrients to fight infection. A poorly nourished person has a weakened immune system and is more prone to infections, increase the potential for and severity of malnutrition [22].

(Health status was not investigated in this study).

The underlying determinants

The nutritional status and quality of life are in turn, influenced by four underlying determinants manifesting themselves at the household level. These are food availability and access, adequate care for mothers and children (specifically relevant in the case of child nutritional status), a proper health environment as well as access to health services.

A further key factor affecting all underlying determinants is poverty, a person is considered to be in (absolute) poverty when the person is unable to satisfy his or her basic needs - for example, food, health, water, shelter, primary education and community participation - adequately. The effects of poverty on child malnutrition are persistent. Poor households and individuals are unable to achieve food security, have inadequate resources for care and are not able to utilize (or contribute to the creation of) resources for health on a sustainable basis.

Finally, the general socio-economic and political conditions of a country influence the determinants of nutrition (and poverty). These include the potential resources available to a country or community, which are limited by the natural environment, access to technology, and the quality of human resources. Political, economic, cultural, and social factors affect the utilization of these potential resources and how they are translated into resources for food security, care and health environment and services [27].

Method

Study location

Bachok is a district in Kelantan, Malaysia. It is located twenty five Kilometers east of Kota Bharu. Its borders, Pasir Puteh to the south and Kota Bharu to the west. Bachok district's mukims (smaller subdivisions) are Tawang, Perupok, Repek, Telong, Gunung, Mahligai, Tanjong Pauh, Melawi and Bekelam.

The population of Bachok is about 116,128. Malays are the predominant ethnic group in Bachok, like the rest of Kelantan. Chinese and Siamese are the minority groups in Bachok (Figure 3).

Selection of subjects

A cross-sectional survey of households receiving monthly allowance from welfare was conducted and 223 households of mothers aged 18-55 years old, non-lactating, non-pregnant mother and having at least one child in 2-12 years range were purposively selected, children were eligible for this study if they not developed mentally delayed or handicapped (per parental report). If the family has more than one child, the youngest child within our age range parameters was selected.

Data collection

Prior to data collection, permission to carry out the study was obtained from Social Welfare Department of Malaysia and the research protocol was approved by the Medical Research Ethical Committee University Sains Malaysia.

Data collection had been carried out through several instruments namely:

Questionnaire - by deep interview

Two trained research assistances (interviewers) had made a house visit to collect all the pertinent research information through in depth interviews and face-to-face individual interviews with the mother and the child (depends on the age of the child), a pre-tested questionnaire was used for the interview and household food security information. Demographic and socioeconomic data collected were on household income, income per capita, income of father and mother, household size and educational levels of mother. The mother were interviewed for information such as income, household size, number of children, children's particular (age, gender, and education level), parental age, education and occupation.



Figure 3: Kelantan State (Bachok District map).

Provision of children's birth certificates by mother facilitates the recording of children's age which is calculated in months as the difference between that date of measurement and the date of birth. The weight of child during birth will be obtained from the clinic card. In some cases fathers were interviewed by the interviewers when the needed information could not be obtained from the mothers.

For household food security, the Radimer/Cornell hunger and food insecurity instrument was utilized. The instrument was developed by Radimer et al. [28] from the perspective of women who had experienced hunger through in-depth interviews with these women. The ten items reflect four levels of food insecurity with increasing severity - food secure, household food insecure, individual or adult food insecure and child hunger. Each level of food insecurity (household, individual and child) has both quantitative and qualitative aspects of food intake.

Anthropometry measurements (child)

Interviewers who were trained to use standardized procedures measured weight and height of the child (2-12 years old) using SECA digital weighing scale (to the nearest 0.1 kg) and SECA body meter with precision of 0.1 cm respectively and the average of two measurements was used in the analyses. The age of the child was calculated in months from their birth date to the day of data collection. The age, weight and height of the children were translated into three indices height - age, (HAZ), weight-age (WAZ) and weight-height (WHZ). The three anthropometric indices were then expressed in term of Z score using the (Epi info 3.5.1) version (CDC 1983).

Weight for height is used to denote underweight. It is an overall indicator for malnutrition and is also one of the four direct health indicators that have been proposed by the World Health. Height for age is used as an indicator of stunting and index of chronic malnutrition; while weight for height is used as an indicator of wasting, an acute condition of current malnutrition. In this study the underweight children group would include all children whose WAZ < -1SD. Measurements on Mid-upper arm circumference for the child were carried out using a un-stretchable (inelastic) measuring tape and skin fold thickness will be also measured for the child by using Harpenden Skin fold Clipper.

Anthropometry measurement (mother)

Subjects' (mother) height was measured according to standard procedures of the World Health Organization (WHO, 1995) using a portable SECA body meter with a horizontal head board attachment. Participants removed their shoes, stood as tall and straight as possible with their head level and their shoulders and upper arms relaxed. The vertical distance between the standing surface and the top of their head was measured at the maximum point of inhalation. The measurement was repeated two times to a precision of 0.1 cm and a mean value calculated.

Weight were obtained using a SECA digital weighing scale (to the nearest 0.1 kg) Participants removed shoes, socks and all bulky clothing items and the average of two measurements' was used in the analyses and body mass index (BMI) was computed with the imputed height and calculation weight (kg)/height (m)².

Waist circumference was measured using a flexible tape measure. Clothes pins were used to secure clothing for access to the abdominal area. Participants stood straight and relaxed with their arms by their sides and feet together. The superior border of the iliac crest and the inferior border of the last rib were marked on both lateral sides of the abdomen. The tape measure was looped around the waist at the

midpoint between the two marks. Two consecutive measurements were taken at the anterolateral side of the participant at the end of a normal exhalation and recorded with a precision of 0.1 cm and a mean value calculated. Research assistances who took the measurements had been trained according to the protocols of World Health Organization [29].

Dietary assessments

Diet Diversity (for the mother): Food Frequency Questionnaire (FFQ) which is used to record all the usual dietary intake of the mother. The FFQ consisted of 30 food items that were common among the Malay. The 30 food items represent 8 major groups of cereals and cereal products, meat and meat products, fish, fruits, vegetables, legumes, milk and dairy products, and beverages. A score of 1 is given if the food group is consumed daily or at least twice a week and 0 for other responses. The possible score range is 0-30 with a higher score indicating a more diverse diet (Haemamalar et al.)

Food patterns

Given the size of the sample, we chose to characterize food patterns rather than attempt to quantify nutrient intakes. To determine food patterns, we developed a pre tested 90-item FFQ. Frequency of parents was asked how often (times per day, week, or month) each of the 90-items was consumed during the past month. Frequency of food consumption was classified using a 5-point scale ranging from 5=daily, 4=2-3 times a week, 3=once a week, 2=once a month, 1=never. A score was calculated for each of the food items using an equation adapted from Reaburn, Krondl, Lau, Zaitun and Terry [30,31].

$$\text{Score} = \frac{R_1S_1 + R_2S_2 + R_3S_3 + \dots + R_nS_n}{5}$$

Where $S_1 \dots S_n$ are the scale ratings and $R \dots R$ are the percent respondents selecting a rating, and 5 is the maximum scale rating.

The higher the score for a particular food item, the more frequent is the intake of that food item. The range of scores was divided into three food frequency categories: highly consumed foods (score=80.0 - 100.0), moderately consumed foods (score=60.0 - 79.9), less consumed foods (score=59.9) (Khor and Sharif, 2003).

Food security measurement

For the food security measurement, the Radimer/Cornell hunger and food security instrument was used (Table 1); the instrument was developed by Radimer et al. [28] from perspective of women who had experienced hunger through in-depth interviews with these women.

The instrument was used whereby the ten items reflect four levels of food insecurity with increasing severity - food secure, household food insecure, individual or adult food insecure and child hunger. The ten items have been translated into Malay language and the translated version was used in previous studies with reported alpha Cronbach's in the range of 0.8-0.9 [32,33]. The mother's responses were analyzed and yielded two conceptions of hunger -narrow individual and broad household. The narrow description of hunger includes insufficient food intake, nutritional inadequacy, lack of choice and feelings of deprivations and disrupted eating patterns. The broader concept involves household food depletion, quality of diets, uncertainty on the sufficiency of household food supply (food anxiety) and acquisition in socially acceptable ways.

Consequently, the managed process will identify households, women and children experiencing different components of hunger at different times and degrees. Household food insecurity, Anxiety about the household's food supply typically occurs first. This is followed by compromises in the quality and then quantity of parent's food intakes, possibly accompanied by a more general deterioration in the quality of the whole household's diet. The individual food insecurity refers to the adult's (or mother's) inadequate food intake (quality and quantity) while child hunger (the most severe form of food insecurity in the household) occurs only after the adults in the households and the children's diet quality have been affected by household food shortages. The instrument rationalizes that in a food insecure household, children will be the last ones to go hungry. To classify individuals by severity of food insecurity:

Food secure: negative answers to all hunger and food insecurity items

Household insecure: positive answers to one or more items (1-4) but not to adult or child level items

Individual insecure: positive answers to one or more of items (5-8) but not to items (9-10)

Child hunger: positive answer to items (9-10)

Response categories for items 1-10:

Negative answers: "not true"

Positive answers: "sometimes true" or "often true"

Medical outcome study short form-36 (SF-36):

Functional health and well-being of individuals or groups were

Household Level	
1.	I worry that if the food or raw materials for cooking will run out before I could have more money to buy food.
2.	Food or raw materials for cooking that I bought for my family at home is always run out fast and I do not have the money to buy food again
3.	I do not have enough food or raw materials to cook or prepare a family meal (for the time of the morning, noon or night) and I did not have enough money to buy food.
4.	We eat the same thing for several days in a row because we only have a few different kinds of food on hand and don't have money to buy more.
Individual level (Adult)	
5.	I am often hungry but I don't eat because I do not have enough money to buy food
6.	I only eat a little of what should I eat because I don't have enough money to buy food
7.	I was not able to eat properly or eat to satiety because I don't have enough money to buy food
Child Level	
8.	My children do not eat enough or always lack of food because I am not able to buy enough food
9.	I know sometimes my children are hungry, but I can't do anything because I am not able to buy food in excess of what I always buy
10.	I am not able to provide a balanced meal to my children because I do not have enough money to provide food

Table 1: Radimer/Cornell hunger and food insecurity items.

evaluated using the SF-36, a multipurpose survey consisting of 36 items representing an eight-scale profile. It does not rely on the traditional of specific age, disease, or treatment [34]. The eight health concepts measured by the survey are: physical functioning, role limitation because of physical health problems, bodily pain, general health, vitality, social functioning, role limitations because of emotional problems, and mental health. These eight health concepts were selected from many included in the Medical Outcomes Study [35] and represent the most frequently measured concepts in widely used health surveys. They can characterize both favorable and unfavorable self-evaluations of general health status [35]. The SF36 questionnaire was translated to Malay version and the instrument was valid and reliable and could be used in Malaysia [36].

Statistical analysis

SPSS (Statistical Package for Social Sciences) version 17.0 and STATA Version 9.2 (Stata statistical software, release 9.2 for Windows) were the computerized database programs used to analyze the data. The data analysis was divided into two steps: descriptive statistics and inferential statistics.

The descriptive statistics were used to describe the basic features of the data in the study. They provided simple summaries about the sample and the measures. They were computed for all potential risk factors to describe the characteristics of food insecure and food secure households. The data were synthesized in tables. The qualitative data were represented in the form of proportions (%) and the quantitative information in the form of means with standard deviations or medians with their extremes (minimum and maximum).

The inferential statistics were used to examine questions related to socioeconomic and demographic determinants of household food insecurity.

Those inferential statistics included:

- Comparing the food-insecure and food-secure households on each of the independent variables with the chi-squared tests or Fisher Exact test (STATA) for categorical variables and the t-tests for numerical variables.

- For the analysis on socioeconomic risk factor of household food insecurity, univariate and multivariate regression were involved and odds ratio (OR) for each factor was calculated.
- Simple and multiple linear regressions were used to examine the predictors which are related to the eight domains of the quality of life (Figure 4).

Results

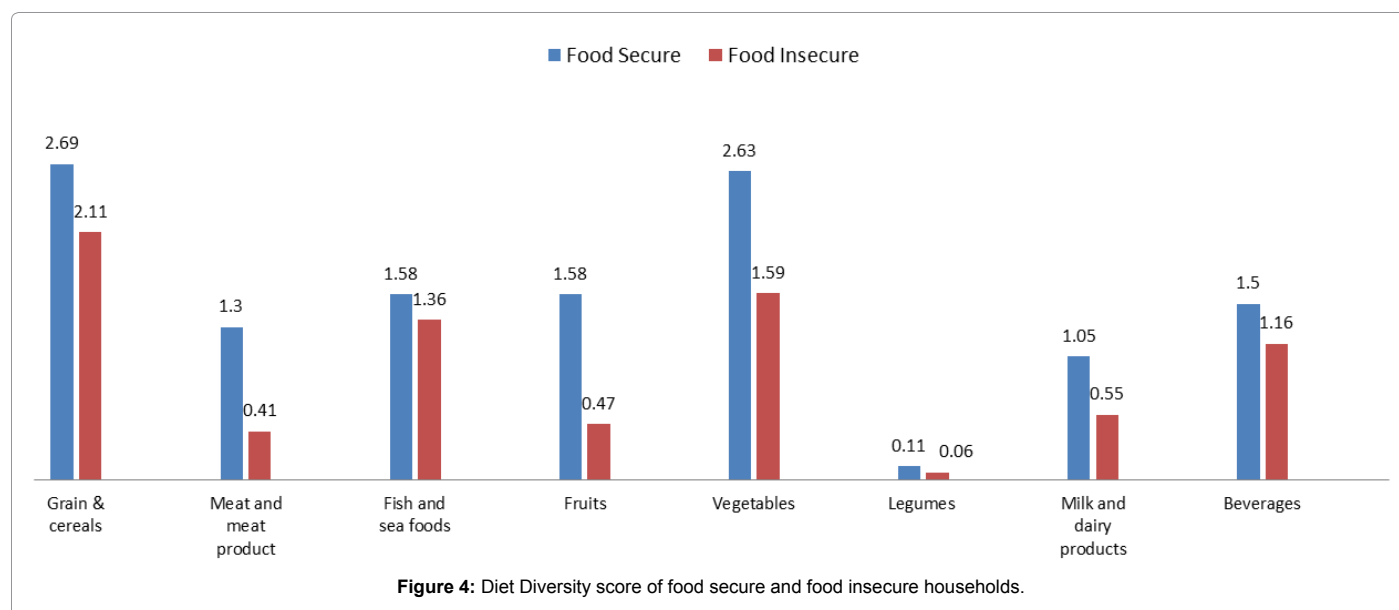
Descriptive of the sample

The respondent's mean age was 42.14 (6.974) years, ranging from 22 to 54 years; 60.5% of them at that age 31-45 years. The mothers with low educational level were 22% half of them had never been to school and had not received formal schooling and the majority of the mothers had enjoyed moderate educational level where 49.3% attained tertiary education and 20.6% of all mothers attained secondary schooling, meanwhile only 8% of the mothers hold diplomas or university degrees.

The average household size was 6.71(2.29) ranging from 2 to 15, the average was higher than the average household size of 4.6 reported for households in rural areas of Malaysia More than half (61.4%) of our respondents having a range of 6-10 household size while families with more than 10 members were 8.1%. The children comprised of 95 (42.6%) males and 126 (57.4%) females. The mean age of the children was 91.43(31.46) months and ranged from 24 to 143 months. The average of number of children per household is 6.71(2.29) while the average of the number of children going to school is 3.05(1.52).

Sixty percent of the total households are single headed families and the mother is either widow or divorced 38.1% and 21.5% respectively, while households with double head were 40.4%. Sixty seven percent of the mothers are working mothers while the rest 32.2% are house wives and had no occupation.

The data on economic characteristics of the households show that the mean monthly household income RM 815.77(365.67), forty four percent of the respondents are living with total income below than RM691 which is the poverty line while 33.6% percent have a total income between RM 691 to 1000, and 22.0 percent are crossing the RM 1000.



The household income per capita average of our sample is 130.66(62.15). Using RM118.04 as the poverty level of income per capita in Malaysia, approximately 51.4% of the households can be considered as living in poverty.

In 64.1% of all households, there was only one person who contributed to household incomes and 29.6% more than one person, in 6.3% of the households, none of the household members contributes to the income and the households depend fully on financial aids. The average food expenditure is 476.46(206.15), and the results shows that 11.2% of the households spend less than RM 250 while fifty percent of the households spend RM 250-499 on food and only 9.0% spend more than RM 750.

Households were assigned to mutually exclusive groups representing increasingly severe problems of food insecurity. A majority of the mothers (83.9%) reported some kind of household food insecurity with 29.6% (n=66) reporting household food insecure, 19.3% (n=43) individual food insecure and 35% (n=78) child hunger. The frequencies of the mother child pair is presented in Table 2 in which 29.6% of all the pairs is Overweight Mother/Underweight Child (OWM/UWC), while the percentage of Normal Weight Mother/Normal Weight Child (NWM/NWC) is 15.2%, out of the 223 child-mother pairs measured, a total of 100 pairs were included in the study, comprising 66 cases (29.6%) (OWM/UWC), and 34 cases (15.2%) (NWM/NWC).

Data description and univariate analysis

The data presented in Table 3 showed that the difference in the mean and the proportion between the food secure households and the food insecure by using T test and Chi square test respectively to test our hypotheses:

The educational level of the mother

The association between the food insecurity status and the educational level was tested using Fisher Exact Test. *P* - value of less than 0.05 was taken as significant and the result showed that there is significant statistical difference between the proportions of the educational level of mothers in the food secure and the food insecure and food security where ($p>0.05$), hence there is a significant association between educational level and food security status at this level of analysis table.

Household size: The average household size was 6.71(2.29) ranging from 2 to15, which is higher than the overall mean household size in Malaysia 5.3 [37] and 61.4% of our respondents having a range of 6-10 household size while families with more than 10 members were 8.1%. The difference of mean household size between food secure 5.92(1.90) and food insecure households 6.87 (2.33) was statistically significant ($p=0.023$, 95% CI -1.76, -0.13).

Variables	B	Odd Ratio (95.0% C.I.)	P value	Adjusted OR (95.0% C.I.)	p Value ^a
Age of mother(years)	-0.06	1.00(0.94, 1.06)	0.92	0.945(0.88, 1.01)	0.276
Education of mother			0.057		0.15
Never been to school	1.056	2.87(0.24, 34.46)	0.405		
Primary	-0.42	0.65 (0.10, 4.04)	0.65		
Tertiary	-0.23	0.79(0.165, 3.79)	0.77		
Secondary	-1.25	0.28(0.05, 1.41)	0.125		
Others (Ref.)		1			
Household size	0.215	1.23(1.02, 1.49)	0.024	1.77(1.35, 2.32)	<0.001
No. of children per household	0.188	1.20 (1.02, 1.42)	0.024	1.20(1.02, 1.42)	0.024
No. of children going to school	0.258	1.29(1.00, 1.66)	0.044		0.341
Marital status of mother			0.861		0.787
Single Headed HH ^a	0.065	1.06(0.5, 1 2.20)			
Double headed HH ^b (Ref.)		1			
Employment status					
Working women (Ref.)		1			
Housewife	0.254	1.29 (0.58, 2.84)	0.528		0.626
Sex of the child	0.583				
Male		0.80 (0.391, 1.637)	0.541		
Female					
Household income RM	-0	0.998 (0.996, 1.00)	<0.001	0.997(0.995, 0.998)	<0.001
<RM691		15.736 (3.388, 73.088)	<0.001	22.96(6.976, 75.60)	<0.001
RM691-1000		8.031 (2.558, 25.212)	<0.001	7.74(2.710, 22.12)	<0.001
>RM1000(Ref.)		1			
House hold income per capita ^b RM	-0.02	0.986 (0.973, 1.00)	<0.001		
<RM118.04		6.987 (2.775, 17.594)	<0.001		
≥RM118.04(Ref.)		1			
No. of participants in household income	-0.57	0.56 (0.345, 0.922)	0.022		0.724
One person		2.264(1.088, 4.713)	0.029		
More than one person(Ref.)		1			
Total food expenditure	-0	0.998 (0.99, 1.00)	0.024	0.997(0.99, 1.00)	0.049

^aSignificant level at 0.05.

^bThe income per capita was not included in the model.

Table 2: Determinants associated with household food Insecurity.

Variables	Food secure (n=36)		Food insecure (n=187)		t-stat(df)/x2 (df)	Mean Difference (95% C.I.)	p Value
	n (%)	Mean(SD)	n (%)	Mean(SD)			
Age of mother(years)		42.14(6.97)		42.26 (6.33)	-0.10(221)	-0.19 (-2.42, 2.19)	0.921 [†]
Educational level of mother							0.047 [‡]
Never been to school	1(0.4)		23(10.3)				
Primary	4(1.8)		21(9.4)				
Tertiary	15(6.7)		95(42.6)				
Secondary	14(6.3)		32(14.3)				
Others	2(0.9)		16(7.2)				
Household size		5.92(1.90)		6.87(2.33)	-2.29(221)	-0.95 (-1.76, -0.13)	0.023 [†]
No. of children per household		4.28(2.27)		5.31(2.49)	-2.3(221)	-1.03 (-1.91, -0.14)	0.022 [†]
No. of children go to school		2.58(1.29)		3.14(1.54)	-2.0(221)	-0.56 (-1.10, -0.020)	0.042 [†]
Marital status of mother					0.03(1)		0.861 [†]
Double headed HH ^a	15(6.7)		75(33.6)				
Single Headed HH ^b	21(9.4)		112(50.2)				
Employment status					0.39(1)		0.527 [†]
Working women	26(11.7)		125(56.1)				
Housewife	10(4.5)		62(27.8)				
Sex of the child							0.541 [†]
Male	17(7.6)		78(35.0)		0.375(1)		
Female	19(8.5)		109(48.9)				
Age of the children		99.94(30.23)		89.79(31.51)	1.78(221)	10.15 (-1.07, 21.38)	0.075 [†]

[†]Independent t test.

[‡]Pearson Chi-Square Test.

[†]Fisher exact test.

^aDouble headed HH: is the household where the father and mother are living together in the same household.

^bSingle 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.

Table 3: Socio-demographic characteristics of food secure and food insecure households (n=223).

Number of children per household: The data presented in Table 3 show that the average of number of children per household is 4.28 (2.27), while for the food insecure it was 5.31 (2.49) and there was statistical significant difference between the mean of the number of children in the food secure and the food insecure households ($p=0.022$, 95% CI -1.91, -0.14).

Number of children going to school: The average of the number of children going to school in both groups of households was 3.05(1.52), meanwhile our result shows that there was a difference between the two means and it was in the favor of the food insecure which was 3.14(1.54), the difference between the two group was statistically significant ($p=0.042$, 95% CI -1.1, -0.02).

Marital status of mother: The widowed and divorced mothers were gathered in one categories named Single headed families while the married mothers is in another category named Double headed families. Almost sixty percent of the families in our sample are single headed family, the mother either widow 38.1% or divorced 21.5%. By running Chi square test between the two group of households, it is apparent that there was no significant difference between the two groups ($x^2=0.031$, $p=0.861$), hence, there is no significant association between the mother marital status and the food security status.

The employment status of the mother: All the mothers in our sample were categorized to two group; the first is the working mother in which the mother is participating in the total income of the family by working outside or inside the house and she can be skilled worker, having her own account or having a part time job, the second category is house wives mothers, in which the mother doesn't participate into the household income and all her time is devoted to the family, while conducting Chi square test to see the difference between the two groups

of households, there was a difference between the two groups but this difference was not statistically significant ($x^2=0.39$, $p=0.527$)

Household monthly income: The results reported that the mean household monthly income of food secure 1101.97(437.19) is greater than the income of the food insecure 760.67(323.60). The difference between the means is statistically significant ($p<0.001$, 95 CI % 186.7, 495.8), when independent T test is performed and this indicates that there is an association between food insecurity and monthly income of households (Table 4).

Income per capita: The average of the income per capita was 130.66(62.15), meanwhile the mean income per capita of the food secure households is higher than that of the household insecure and the difference between the two means was statistically significant ($p<0.001$, 95%CI, 57.5, 111.6), when T test was implemented. This finding came to confirm the association between income per capita and food insecurity.

Number of family member participating in the household income: As we can see from Table 5 the mean of the of the number of family who participate in the household income in the food secure group 1.53 (0.61) is more than that of the food insecure 1.24 (0.68) and the difference between the two means is statistically significant ($p=0.019$, 95% CI 0.046, 0.52).

Food expenditure: The total food expenditure results presented in Table 5 show that the difference between the means of food expenditure of both groups is statistically significant ($p=0.019$, % CI 14.57, 160.96), when Independent T test is performed to investigate the associations between amounts of money expended on different food groups and food security status, our results show that there is an association between food expenditure and food security status at least

Variables	Food secure (n=36)		Food insecure(n=187)		t-stat(df)	Mean Difference (95% C.I.)	p-Value ^a
	n(%)	Mean(SD)	n(%)	Mean(SD)	/x ² (df)		
Household income RM		1101.97(437.19)		760.67(323.6)	4.45(42.6)	341.30 (186.76, 495.83)	<0.001 [†]
<RM691	7(3.0)		92(41.3)				<0.001 [¶]
691-1000	10(4.5)		65(29.1)				
>RM 1000	19(8.5)		30(13.5)				
House hold income per capita RM		201.57(77.44)		117.00(48.18)	6.3(40.3)	84.56 (57.53, 111.59)	<0.001 [†]
<RM 59	0(0.0)		10(4.4)				<0.001 [¶]
RM 59-118.04	6(2.7)		99(44.4)				
>RM 118.04	30(13.5)		78(35.0)				
No. of participants in HH income		1.53(0.61)		1.24(0.68)	2.3(221)	0.28 (0.046, 0.52)	0.019 [†]
None contributing to HH income	0(0.0)		14(6.3)				0.018 [¶]
Only one contributing to HH income	19(8.5)		124(55.6)				
More than one contributing to HH income	17(7.6)		49(22.0)				
Total food expenditure RM		550.06(257.69)		462.28(192.29)	2.36 (221)	87.76 (14.57, 160.96)	0.019 [†]

^aSignificant level at 0.05.

[†]Independent t test.

[¶]Pearson Chi-Square Test.

Table 4: Economical characteristics of food secure and food insecure households (n=223).

Food Groups	B	Odd Ratio (95.0% C.I.)	P value	Adjusted OR (95.0% C.I.)	p-Value ^a
Grain & cereals	-0.53	0.58 (0.41, 0.82)	0.002		
Meat and meat product	-1.53	0.21(0.12, 0.36)	<0.001	0.36 (0.16, 0.79)	0.011
Fish and sea foods	-0.61	0.54 (0.29, 0.98)	0.046		
Fruits	-0.98	0.37 (0.25, 0.54)	<0.001	0.52 (0.28, 0.94)	0.032
Vegetables	-0.39	0.67 (0.53, 0.84)	0.001		
Legumes & Nuts	-0.6	0.54 (0.16, 1.80)	0.324		
Milk and dairy products	-1.29	0.27 (0.14, 0.51)	<0.001	0.41 (0.19,0.91)	0.028
Beverages	-1.18	0.30 (0.15, 0.61)	0.001		
Diet diversity final score	-0.44	0.64 (0.56, 0.74)	<0.001	0.80 (0.65, 0.98)	0.038

^aAdjusted for household size, educational level, and total monthly income.

Table 5: The association between food security and Diet Diversity.

for three food groups namely; Fruits and vegetables, Animal based food and Milk and dairy products.

Three socio-demographic determinants namely household size, number of the children in the household and number of children going to school were positively associated with food insecurity, while the educational level, the marital status and the job status of the mothers were not significantly associated with food insecurity when the univariate analysis is performed.

Meanwhile all the economical determinants namely household monthly income, income per capita, number of family member contributing financially to the household income and food expenditure were negatively associated with food insecurity.

Multivariate analysis

At the multivariate level (Table 2), after controlling for significant factors in the model (income per capita was not included in any of the model as the variable was operationalized as both household income and household size) the determinants which remained significantly associated with the outcome were:

Household size: The results show that larger household size are more likely to be food insecure (OR_{adj}, 1.77; 95% CI, 1.358, 2.323) than small size household

- Number of children per household.

- The larger the number of children per household the more likely to be food insecure and the multivariate regression for numerical data result says (OR_{adj}, 1.20; 95% CI, 1.025, 1.42).
- Total monthly income of household. The results exhibit that households with low income were significantly associated with food insecurity (OR_{adj}, 0.977; 95% CI, 0.995, 0.998).
- Food expenditure. Food expenditure was also significantly associated with food insecurity (Table 3).

Diet diversity score

Table 6 demonstrates the dietary diversity score of the targeted households, the total household dietary diversity scores ranged from 2-20, the mean score was 12.69(3.26). The result of the t test full the total dietary score showed that the mean of the eight food groups shows that the food secure household have a higher mean score than the food insecure and the difference between the means was significant (p<0.001) and the (t=8.877). The only food group which was not significant is Legumes and Nuts, while the remaining seven groups were significant. When multiple linear regression performed (Table 5), out of the seven food groups, only three food groups were associated to food security status namely, meat and meat products (p=0.011), fruits (p=0.032) and milk and dairy products (p=0.028) (Figure 5).

^a Adjusted for household size, educational level, and total monthly income.

Food Groups	Range	Food Secure	Food Insecure	t-stat (df)	Mean Difference (95% C.I.)	p Value
		Mean(SD)	Mean(SD)			
Grain & cereals	5-Jan	2.69(0.85)	2.11(1.04)	3.18(221)	0.58 (0.22, 0.95)	0.002
Meat and meat product	0-3	1.30(0.66)	0.41(0.65)	7.49(221)	0.89 (0.65, 1.12)	<0.001
Fish and sea foods	0-3	1.58(0.60)	1.36(0.57)	2.01(221)	0.21(0.01, 0.42)	0.043
Fruits	0-5	1.58(1.33)	0.47(0.77)	6.86(39.5)	1.10 (0.78, 1.42)	<0.001
Vegetables	0-10	2.63(1.43)	1.59(1.53)	3.76(221)	1.04 (0.49,1.59)	<0.001
Legumes and Nuts	0-1	0.11(0.31)	0.06(0.24)	0.99(221)	0.04 (-0.04, 0.13)	0.407
Milk and dairy products	0-3	1.05(0.67)	0.55(0.57)	4.61(44.45)	0.49 (0.28, 0.71)	<0.001
Beverages	0-2	1.50(0.56)	1.16(0.51)	3.49(47.1)	0.33 (0.14, 0.52)	0.001
Diet diversity final score	20-Feb	12.69(3.26)	7.63(3.11)	8.87(221)	5.06(3.94, 6.19)	<(0.001

Table 6: Diet Diversity score of food secure and food insecure households.

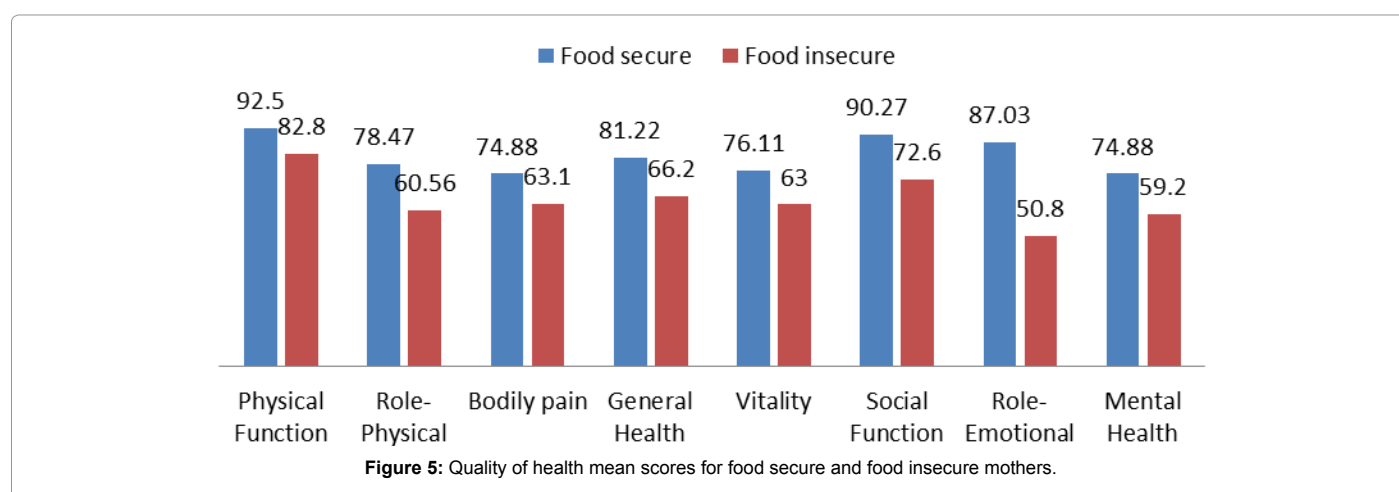


Figure 5: Quality of health mean scores for food secure and food insecure mothers.

Dietary pattern

The food use frequency score of 90 food items is shown in Table 7. The higher scores indicate more frequent intake of these food items. The range of scores was divided into three food frequency categories: highly consumed foods (score=80.0 - 100.0), moderately consumed foods (score=60.0 - 79.9), less consumed foods (score=59.9 and below).

Rice, sugar and candies were in the highly consumed food category for the children of both the food secure and food insecure households, indicating these are the major sources of calories in the diet of these groups. Rice, being the staple diet in Malaysia, had the highest score of (100.0 for the food secure and 99.39 for food insecure) was consumed daily by 100% of these subjects but children in the food security group are consuming chicken and eggs more frequent than those in the food insecure as a source of protein with score (84.98) and (82.76) respectively. The score of fish which was consumed two to three times a week or on daily basis consumption is almost equal between the two groups (food secure 91.16, food insecure 91.24)

Bread, snacks, noodles and biscuits are consumed moderately by the children of the two groups but the score for these food items is higher in the food security group. Anchovy and Vitamin A rich vegetables are consumed moderately by the children in the food secure group whereas these food items are less consumed by the children of the food insecure households. Sweet condense milk come on the top of the moderately consumed foods by the food secure children with score (79.42), while the score for the food insecure group. Although the frequencies of fruit consumption is low by the children in both types of households but it is obvious that the score for fruits (Banana, citrus, mango, apple, guava, papaya, pineapple, grapes and durian) is

still higher in the food secure households than in the food insecure. The score of fresh milk for the food secure households was 40.0 while in the food insecure it was just 29.58.

Nutritional status of children

In the study, the children in the sample were comprised of males (42.6%) and females (57.4%) and the children were at average age 91.43(31.46) months. The mean body weight of the children in the food secure households was 24.90kg (10.75) significantly higher than that of the food insecure, 21.46 kg (8.29) and the (p value=0.031) and 95% C.I. doesn't include the zero, while no significant difference was reported for height of children between the two groups and the mean height of all the children was 116.52(19.11), 95% C.I. include the zero. The mean HAZ, WAZ, and WHZ were all negative, suggesting a generally poor nutritional status of the children in the study (Table 8).

Among the children, more than half were underweight (61%) and stunted (61.4%), while the wasted were (30.6%) and the overweight children were (1.8%). The present study reported a significant difference in weight for age, height for age and weight for height z scores of the children between food secure and food insecure ($p=0.031$), ($p=0.042$) and ($p=0.039$) respectively and 95% C.I. doesn't include the zero.

The prevalence of nutritional outcomes such as underweight, stunting and wasting in the food insecure households is (53.8%), and (54.7%) and (27.0%) respectively, which is much higher than those for the food secure households, where the prevalence of the underweight was (7.2%), stunted children were (6.7%) and the wasted children were (3.5%). When Pearson Chi-Square test performed to compare between the proportions of the overall underweight children (Significant

Food secure households (N=36)		Food insecure households (N=187)	
Food	Score	Food	Score
Highly consumed foods (score: 80-100)			
Rice	100	Rice	99.38
Drinking water	100	Drinking water	98.72
Peanut butter	98.88	Sugar	96.46
Sugar	98.88	Fish	91.24
Fish	91.16	Candies	87.64
Tea	88.32		
Soya sauce	86.1		
Chicken	84.98		
Candies	82.8		
Eggs	82.76		
b - moderately consumed foods score: (60- 79.9)			
Sweet condense milk	79.42	Soya sauce	77.12
Tembikai	74.82	Tea	75.72
Fish crackers	74.46	Eggs	73.36
Traditional Malay cake	73.97	Chicken	70.26
Chocolate drink	73.82	Bread	67.46
Bread	73.3	Snack	67.3
Snack	71.74	Chocolate drink	67.14
Syrup	70.08	Biscuit	66.51
Noodles	69.42	Fish crackers	65.8
Biscuit	66.64	Traditional Malay cake	65.66
Anchovy	64.42	Sweet condense milk	64.72
Fermented fish sauce	64.42	Syrup	64.14
Carrot/tomato/chili	64.12	Noodles	61.74
Burger	62.76		
c - less consumed food scores : (20.0-59.9)			
Watermelon	59.86	Fermented fish sauce	56.82
Banana	58.89	Water melon	51.56
Citrus	58.36	Chili sauce	50.06
Food	Score	Food	Score
Green leafy vegetables	58.3	Burger	49.94
Cabbage/cauliflower/broccoli	55.08	Pumpkin/cucumber	47.3
Yogurt	54.64	Ice cream	47.22
Chili sauce	54.46	gGreen leafy vegetables	46.2
Pumpkin/cucumber	53.4	Anchovy	46
Cereals	53.32	Banana	45.44
Fish ball	53.24	Cabbage/cauliflower/ broccoli	45.2
Mango	52.28	Papaya	43.62
Ice cream	52.22	Citrus	42.56
Apple	50.56	Organ of chicken/cow	42.44
Coconut jam	50.46	Apple	41.62
Wheat flour pancake (roti chani)	48.9	Fish ball	38.82
Guava	48.9	Dry/salted fish	38.54
Glutinous rice (pulut)	48.3	Guava	38.06
Jelly	46.1	Carbonated drinks	38.04
Sweet potato	45	Cereals	37.06
Fresh milk	44	Ubi7	36.32
Meat (cow/buffalo/goat)	43.8	Meat (cow/buffalo/ goat)9	35.88
Papaya	43.06	Soya milk	35.28
Oyster sauce	42.2	Glutinous rice (pulut)	33.88
Roots and tubules	41.74	Mango	33.62

Carbonated drinks	40.52	Prawn	33.24
Legumes	39.5	Coffee	33.16
Prawn	39.48	Jelly	32.98
Isotonic drink	38.64	Wheat flour pancake (roti chani)	32.46
Cheese	38.48	Carrot/tomato/chili	32.42
Coffee	38.34	Milk powder	32.4
Food	Score	Food	Score
Dry fruits	38.32	Crab	32.26
Wet squid	38.28	Legumes	31.76
Pear	37.8	Coconut jam	31.68
Dry/salted fish	37.34	Evaporated milk	31.56
Milk powder	36.66	Soya bean curd	31.18
Soya milk	36.1	Wet squid	30.88
Canned fish	35.62	Oyster sauce	30.68
Cake	35.54	Isotonic drink	30.42
Bean sprouts	33.34	Fresh milk	29.58
Salted eggs	32.76	Dry fruits	29.52
Evaporated milk	32.3	Local salads	29.34
Jam	32.24	Roots and tubules	29.24
Organ of chicken/cow	32.18	Pear	28.82
Pineapple	30.02	Bean sprouts	28.54
Butter	30.02	Canned fish	28.34
Canned fruit	29.46	Cake	27.98
Soya bean curd	28.88	Butter	26.82
Grape	28.88	Jam	26.38
Malted drink	28.4	Tembikai	26.3
Local salads	27.84	Telurmasin	25.73
Crab	27.22	Rambutan	24.3
Rambutan	27.18	Canned fruit	24.3
Fruit juice	26.7	Yogurt	23.96
Jack fruit	24.8	Pineapple	23.2
Mushroom	24.6	Durian	23.2
Shell fish	24.44	Grape	23.2
Longan	23.34	Fruit juice	23.14
Honey	22.8	Star fruit	23.12
Herbal drink	22.24	Shell fish	23
Food	Score	Food	Score
Durian	22.22	Mushroom	22.88
Star fruit	21.66	Jack fruit	22.62
Cream cheese	21.12	Malted drink	21.6
Petis	20.56	Peanut butter	21.32
Pork	20	Dry squid	21.26
Dry squid	20	Longan	20.74
Fermented soya bean cake	20	Cheese	20.52
		Fermented soya bean cake	20.42
		Honey	20.38
		Cream cheese	20.3
		Herbal drink	20
		Petis (traditional Malay food)	20
		Pork	20

Table 7: Dietary Pattern of food secure and food insecure children.

underweight and mild underweight) against the normal children the difference in the proportion was statically significant ($p=0.026$), this significant difference was also reported in the proportions for overall stunting children(Significant stunting and mild stunt) between the

Variables	Total	Food secure (n=36)		Food insecure (n=187)		t- Stat(df)	Mean Difference (95% C.I.)	p value
		n (%)	Mean(SD)	n (%)	Mean(SD)			
Male	95(42.6)	17(7.6)		78(35.0)				0.583 ^I
Female	128(57.4)	19(8.5)		109(48.9)				
Age of the children	91.43(31.46)		99.94(30.23)		89.79(31.51)	1.78(221)	10.15 (-1.07, 21.38)	0.075
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 ^I
Height(cm)	116.52(19.1)		119.22(23.56)		116.00(18.15)	0.92(221)	3.21(-3.64, 10.06)	0.357 ^I
Weight/Age Z	-1.07(1.069)		-0.72(1.24)		-1.15(1.02)	2.17(221)	0.41 (0.03, 0.79)	0.031 ^I
Sig. Underweight	42(18.8)	6 (2.7)		36(16.1)				0.114 ^F
Mild Underweight	94(42.2)	10(4.5)		84(37.7)				
Normal	83(39.0)	19(8.5)		64(28.7)				
Overweight	4(1.8)	1(0.4)		3(1.3)				
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 ^I
Sig. Stunting	56(25.1)	7(3.1)		49(22.0)				0.048 ^F
Mild stunting	81(36.3)	8(3.6)		73(32.7)				
Normal	86(38.5)	21(9.4)		64(29.1)				
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 ^I
Sig. Wasting	12(6.1)	3(1.5)		9(4.6)				0.074 ^F
Mild Wasting	48(24.5)	4(2.0)		44(22.4)				
Normal	136(69.3)	22(11.2)		114(58.1)				
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 ^I
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 ^I
< 2.5 kg	36(16.1)	1(0.4)		35(15.7)				0.32
≥ 2.5 kg	187(83.8)	15(6.7)		172(77.1)				

^IIndependent t , ^FPearson Chi-Square Test., ^FFisher exact test.

Table 8: Anthropometric characteristics of children.

Nutritional Status	N	B	Adj. Odd Ratio	95.0% C.I.	p value
Underweight					
Food secure	36		1		
Food insecure	187	0.77	2.156	(1.03, 4.47)	0.039
Stunting					
Food secure	36		1		
Food insecure	187	1.05	2.847	(1.35, 5.99)	0.006
Wasting					
Food secure	29	0.31	1		
Food insecure	167		1.36	(0.540, 3.426)	0.515
Mother-child pair					
OWM/UWC ^a	66	1.7	5.44	(1.309, 22.05)	0.021
NWM/NWC ^b	34		1		

^aOverweight mother/Underweight Child.

^bNormal weight mother/Normal Weight Child.

Table 9: The association between food security status and nutritional status of the children.

two group of households ($p=0.009$), but the result did not show any significant difference in the proportions for overall wasting ($p=0.370$),

The mean mid upper arm circumferences (MUAC) was 17.82(2.92) and the mean of MUAC for the food secure children was higher than that in the food insecure and the difference was significant ($p=0.032$). The 95% C.I., 0.486, 2.548 doesn't include the zero. The average weight of child during birth was 3.11(0.46) and not significant statistical difference was reported between the two groups of household.

In the multivariate analysis when the sex and age were adjusted, there was association between food security status and underweight. The findings of the study reveal that the children in the food insecure were 2.15 times more likely to be underweight than food secure children and 95% C.I. 1.039, 4.474. While investigating the association

between food security and stunting, finding of the present study imply that a significant association between food security status and stunting ($p=0.006$) and the children in the food insecure were three times more likely to be stunted (Table 9) but the association between the food security status and wasting was not existing.

The nutritional status of mother

In the study, the average weight and height of the mother was 59.29(13.71), 151.46(8.0) respectively, while the mean of the BMI and waist circumference was 25.42(4.96) and 80.12(12.09) (Table 10). Surprisingly 52% of the mothers were overweight and obese, while only 6.3% were underweight. The result also showed that 47.1% of the mother had at-risk waist circumference ≥ 80 cm. The findings from independent t test and chi square test emphasized that there is

Variables	Total	Food secure(n=36)		Food insecure(n=187)		Mean Difference (95% C.I.)	p value
		n (%)	Mean (SD)	n (%)	Mean (SD)		
Weight	59.29(13.71)		58.0(13.9)		59.53(13.6)	-1.48 (-6.408,3.446)	0.554
Height	151.91(5.4)		151.1(4.3)		152.06(5.6)	-0.92 (-3.268,2.495)	0.358
BMI	25.42(4.96)		25.33(5.4)		25.44(4.88)	-0.11 (-1.903,1.667)	0.896
<18.5	14(6.3)	2(0.9)		12(5.4)			0.55
18.5-24.99	93 (41.7)	18(8.1)		75(33.6)			
25-29.99	78 (35.0)	9(4.0)		69(30.9)			
equal or more than 30	38 (17.0)	7(3.1)		31(13.9)			
Waist circumference	80.12(12.09)		78.6(12.5)		80.40(12.0)	-1.71 (-6.05, 2.631)	0.438
Waist circumference classifications							
< 80 cm	118(52.9)	24(10.8)		94(42.)			0.1
≥ 80 cm	105(47.1)	12(5.4)		93(41.7)			

^a Overweight mother/Underweight Child.

^b Normal weight mother/Normal Weight Child.

Table 10: Food security status and nutritional status of mother.

Measure	Food secure	Food insecure	t- Stat(df)	Mean Difference (95.0% C.I.)	p value
	Mean(SD)	Mean(SD)			
Physical Function	92.50(7.88)	82.8(14.32)	3.942(221)	9.69 (4.84, 14.53)	<0.001
Role- Physical	78.47(31.7)	60.56(34.66)	2.876(221)	17.91(5.63, 30.18)	0.004
Bodily pain	74.88(22.59)	63.1(9.55)	3.226(221)	11.78 (4.58, 18.98)	0.001
General Health	81.22(15.95)	66.2(16.02)	5.153(221)	15.01 (9.27, 20.76)	<0.001
Vitality	76.11(11.95)	63.0(13.96)	5.242(221)	13.03 (8.13, 17.93)	<0.001
Social Function	90.27(1.22)	72.66(13.04)	7.580(221)	17.61 (13.03, 22.19)	<0.001
Role- Emotional	87.03(19.96)	50.8(34.62)	6.081(221)	36.23 (24.49, 47.97)	<0.001
Mental Health	74.88(13.67)	59.2(14.52)	5.984(221)	15.68 (10.51, 20.84)	<0.001

Table 11: Quality of life between food secure and food insecure.

no significant difference in the mean for weight, height, BMI, waist circumference and proportions of waist circumferences categories of the mothers between food secure and food insecure households. The findings of the study agree with the null hypothesis in which there is no association between food security status and the nutritional status of the mother.

Mother child pairs

Out of the 223 child-mother pairs measured, a total of 100 (OWM/UWC) and (NWM/NWC) pairs were included in the study, comprising 66 cases (29.6%) (OWM/UWC) and 34 cases (15.2%) (NWM/NWC) (Table 9) The remaining 123 child-mother pairs did not fit into either of these combination types. The OWM/UWC were 66% while the NWM/NWC were 34% and by running the cross tabulation (Pearson Chi Square Test), the results showed a significant difference in the proportions of overweight mothers/Underweight child and it was in the favor of food insecure households. The result of the multivariate analysis pointed out that the pairs in the food insecure households were 5.44 times more likely to be (OWM/UWC) than the pairs in the food secure households (Table 9).

Quality of life

The findings of the present study showed a statistical significant difference in the eight domains of the quality of life between food secure and food insecure and the 95.0% C.I. of all the eight domains doesn't include the zero when independent T test was applied. The result rejected the null hypothesis for the eight domains (Table 11). The results of the Multiple Linear Regression analysis showed (Table 12) that there were significant association between each of the eight SF-36 scales and the predictor variable (food security status), but the association was weak. The findings rejected the null hypothesis.

Discussion

The level of food insecurity

This study examined the associations between food insecurity, socioeconomic-demographic characteristics, children's dietary intake, children nutritional status as well as the nutritional status of the mothers and their quality of life in Bachok District and constructed measure of household food security for that by using Radimer/Cornell Hunger and Food Security instrument which was translated and validated in previous Malaysian studies.

In this sample of rural households (n=223), 16.9% reported to be food secure, 29.6% household food insecure, 19.3% individual food insecure and 35% child hunger. Previous studies with low-income households indicated that the prevalence of overall food insecurity was lower (58%, 66.6% and 65.7%) than our findings (83.1%) in Bachok, Kelantan [18,32], and this can be attributed to first, the nature of our data which are from a convenience sample of households receiving monthly assistance from the Welfare Department and already classified as poor families, hence the variations are not surprising. Second, the low economic structure of this geographical area since the state of Kelantan is recognized as one of the four poorer states in the country (Malaysia statistic Dept.) and Bachok District is occupying the top of the list of welfare recipients. Moreover the state of Kelantan is the state of the highest number of household size (Malaysia statistic Dept.) which is another important factor might contribute to the increase the risk of food insecurity in Bachok District.

The distribution of individual food insecurity and child hunger in our study differs from that of ref. [38] in which the prevalence of child hunger is higher than the prevalence of individual food insecure while

Domains	Food Security						Other Variables Entered the Model			
	R ²	Intercept	Slope	Step	95% C.I.	p	Name (Step)	p	Name (Step)	p
Physical Function	0.06	102.18	-9.64	1	(-14.53, -4.84)	<0.001	BMI (2)	0.04		
Role-Physical	0.04	78.47	-18.5	1	(-30.18, -4.63)	0.003	Job Status (2)	0.03		
Bodily pain	0.04	74.88	-11.8	1	(-18.98, -4.58)	0.001				
General Health	0.1	87.35	-15.1	1	(-20.76, -9.27)	0.027	Marital status (2)	0.02	Age (3)	0.04
Vitality	0.11	76.11	-13	1	(-17.93, -8.13)	<0.001				
Social Function	0.2	90.27	-17.6	1	(-22.19, -13.03)	<0.001				
Role-Emotional	0.14	87.03	-36.2	1	(-47.97, -24.49)	<0.001				
Mental Health	0.14	74.889	-15.7	1	(-20.84, -10.51)	<0.001				

Table 12: Stepwise multiple linear regression models of the adjusted influence of BMI and socio-economic and demographic status on SF-36 scores.

in the US sample, the reverse was reported. (Kendall et al. [5] found the prevalence of household food insecure, individual food insecure and child hunger to be 25%, 17% and 11%. There are two possible explanations as to why the percentage of households with individual food insecure is lower than the percentage of households with child hunger in our samples. First, the prevalence of individual (mother) food insecure may be under-reported because mothers may not report the truth as they may be embarrassed to answer these questions which are directly related to them. However, being poor and very concerned about their children, the mothers may have the perception that they do not provide enough food for them due to lack of food in their households. Thus, it would be easier for mothers to respond to questions pertinent to household food insecure and child hunger. Second, in the process of making sure that their children have enough food to eat, mothers focus on feeding their children first, and in doing so may sacrifice and compromise their own nutrient needs to protect their children from the effects of food insufficiency in their homes as much as possible when household food shortages became acute were the children's intakes affected [18,39,40].

Association between determinants and household food insecurity

Although it is difficult to compare across studies, because of different measures used, the results of this study have shown some expected correlations of household socioeconomic and demographic characteristics with household food insecurity.

Many previous studies across the world have emphasized the association between low educational level and the household food insecurity [5,41-43]. However our findings surprisingly didn't support this association and was consistent with the results of [44,45]. In the later study, Tingay and his colleagues who reported that subjects with technical qualifications (such as nursing and teaching) were more likely to be food insecure than those with no qualifications [45]. The non-significant association between the education level and household food insecurity might be attributed to the fact that majority of our respondents were moderately educated and the educational level was almost distributed equally between the two groups except for the never been to school and as we can see from the odd ratio (2.8) for the mother who have never been to school but the association is still not significant and this might be due to the sample size. Any increase in the education level among the mothers will not increase the chances of being food secure because of the fact that educational level have nothing to do when the family is under economical constrains. Our findings were in line with Zalilah and her colleagues where they reported that there is no significant difference in the educational level of the mothers between food secure and food insecure [32].

This study found a significant association between household size

and household food insecurity. This result was consistent with [41,43] in United States, [46] in Philippines, [47,48] in Iran and [49] in UK who found that as the household size increased, the probability of being food-insecure also increased, the findings are not surprising because the mean household size in our study(6.7) is higher than the average household size of 4.6 reported for households in rural areas of Malaysia (Malaysia Population and Family Survey 1994 and 2004) in one of the four poorest states in Malaysia. In contrast to that, [44,50,51], who reported that larger households did not tend to be food-insecure compared to households with small size and this might be explained by the presence of more adults in the households who contribute financially to the outcome rather than children who don't contribute to the household income.

In our regression model, the number of children was a risk factor for food insecurity in that more children mean higher child expenditures which include general and education expenses and the result showed significant positive association between the number of children in the household and the food insecurity status and these findings were consistent with previous studied which emphasized the same association [48,52]. In contrast, some of the studies around the world did not support this association and their findings showed little evidence of a trend towards increasing food insecurity with increasing number of children in the family [53].

In the univariate analysis the results showed association between number of children going to school and food insecurity but after the adjusting for confounders and in the multiple regression model the food insecurity was not associated with number of children going to school. Our finding opposed Zillah's result in which she had pointed out the association between food insecurity and number of children going to school in Malaysia poor rural communities. The absence association might be attributed to cause-effect of modeling.

The present study reported no statistical differences between the proportion of single-headed in households food-secure and those in households food-insecure and also no association between the marital status of mother and food insecurity, however this association was not existing because the majority of single headed households are headed by females and in households headed by double parents, it is usually the spouse who is looking for money to solve family problems as it is the case in single-parents headed households. In a study of the relationship between women's autonomy and child health in Yemen [54], it was found that women with healthy children had the opportunity to control and manage a portion of their spouses' incomes (they buy foods, supervise their husbands' spending, buy medicines etc.) compared to mothers with less healthy children and in the study done in both Kenya and Malawi, the female-headed households had the lowest income; despite this low income, preschoolers' nutritional status was significantly better than in the higher income male-headed

[6]. The result was opposing Radimer's finding which emphasized that higher prevalence of food insecurity was associated with single or separated, divorced or widowed status versus married [55], while it was consistent with Hanson's finding where he showed that widowed women experienced relatively high levels of food security [56].

The present study did not report any statistical significant difference between proportion of working mother in the food secure (11.2%) and those in the food insecure households (56.1%) and no association was found between the food insecurity and job status of the mother. These findings has contradicted the results of Frongillo and Zalilah where they reported that households of working mothers usually have greater food expenditures and also higher levels of food security as they contribute to the total household income [57], while our findings were in line with Ghanaian study in which the food security status was negatively affected when mothers work outside the house [58] and the results were also somewhat consistent with Canadian study which indicated that maternal employment is associated with higher rates of restaurant-food consumption and higher costs per calorie of home-prepared food [11]. The authors also pointed that wife's full-time has a negative effect on apparent nutrient intake among household members, not offset by the higher income per capita.

For household income, the present study exhibit a significant in difference in monthly income of household between food secure and food insecure groups moreover, the study showed a negative association between total household income and food insecurity. So in agreement with the hypothesis, its coefficient came out to be negative and statistically significant. Households that have access to better income opportunities are less likely to become food insecure than those households who had no or little access, therefore an increase in the household monthly income by RM 10 will decrease the odd of being food insecure by 3%. Likely, the more money the household has the more access to better food in term of quality or quantity and the relationship between income and food security is a sequential relationship passing through food expenditure, diet diversity leading to food security [47].

The findings were consistent with previous studies in which they reported that household income has frequently been found to influence household food security in that households with lower incomes are at risk for food insecurity [5,6,23].

The proportion of households with more than one member contributing was higher among households food-secure than those food-insecure and the mean of number of family members contributing to the household income was also greater in the food secure households.

Although, at the univariate analysis level, the result reported that there is an association between the number of household members contributing to the household income and food security status and any increment in number of person in the household contributed financially to income, protected the household against food insecurity, this association did not remain significant at multivariate analysis level. We found in this study that if only one person in the household contributed financially to the total income, that household felt in food insecurity. When the contribution came from two persons, the risk to fall in situation of food insecurity was always present. The contribution of other members of the household was necessary to protect family against food insecurity. One also has to remember that our respondents were among populations with low socioeconomic status. So the more people contribute financially in the family, better is the food security status of the household. Maybe this would not be the case if we had different socio-economic status (middle and high classes).

Food-secure households have significantly higher total food expenditures (Table 8) as well as expenditures on animal source foods, fruits and vegetables, and milk and dairy products than food-insecure households. The present study explored how total food expenditure and expenditures on specific food groups are associated with food insecurity. The mean differences of expenditure for food groups such as fruits, animal based food, and milk and dairy products which considered as expensive food groups were in the favor of food secure households. Therefore, not only would we expect total food expenditure to decline with increasing food insecurity, but also expenditures on certain expensive food groups, comprised of higher-quality or more expensive items such as animal-source foods, hence food secure households with higher income will able to provide quality diet for their children as they have more purchasing power to choose and prepare healthy foods which were relatively more expensive than low quality or less healthy food [59,60] and this might explain the intricate relationship between food security, food expenditure and diet diversity. These findings are consistent with previous studies in which households classified as food insecure consumed significantly less meat, eggs, and fruit than households classified as food secure [32,41,61].

The consistency of our findings with those from several other populations in the type of association between the food insecurity status and the socio-economic and demographic factors suggests that the instrument we used provides valid indicators of food insecurity in this group.

Diet intake

Diet diversity: The Diet diversity scores differed significantly in all the food groups except the score of legumes and Nuts between food secure and good insecure households, one was expecting that the score of rice will not differ significantly between the households as rice is basic meal in the Malaysia diet, however this can be attributed to under estimation of the diet diversity score of rice and there may also be bias occurring from the self-reported data by mothers e.g. the mothers interviewed may not have reported their diet diversity score precisely as the reporting depends on memorizing, the copying strategies such as skipping meals and reducing the size of the serving might be another explanation. In multivariate models, after adjusting for the presence of other covariates not surprisingly, the food security status was positively associated with the dietary score, of meat and meat products, fruits and milk and dairy products, which considered as expensive food groups and can't be offered by poor families. Our findings suggest that nearly all households, even those in the poorest diet diversity, prioritize the purchase of staple foods. Yet, those with lower dietary diversity scores are likely to be much more deficient in their intake of micronutrient-rich foods, especially those of animal origin. These findings are consistent with a study in which households classified by the indicator as moderately and severely food insecure consumed significantly less meat, eggs, and fruit than households classified as food secure [42,62]. This finding was also in line with Zalilah where she reported that households with higher income have purchasing power enables them to buy and choose healthy foods which were relatively more expensive than low quality or less healthy food [32]. We examined the relation between child food insecurity and dietary intake and found that children from insecure households had lower intake of animal protein foods compared with children from secure households. Reduced meat consumption among food-insecure children had been found in poor, urban children in Seoul, South Korea [9], in urban households of Campinas, Brazil [63], in Mexican-American households with preschool-aged children [64]. In Bolivia, households with greater food

insecurity were similarly found to spend less money on meat [61]. The low consumption of fruits vegetables and dairy product among food insecure households was also reported in Brazil [63].

Interestingly, the positive association reported in our results between the food security status and the diet diversity score of meat and meat products, fruits and, milk and milk products (Table 10) has matched the association between the food expenditure for these groups and food security status.

Dietary pattern:

Although there is a difference in score of animal based food between foods secure and food insecure households but the overall consumption of this food group is either moderate or less consumed and the consumption of meat and meat products, and milk and milk products was categorized as less consumed food items for both groups.

Despite the difference in score of fruits and vegetables between the two groups, the consumption of micronutrients –rich food is very less meanwhile the consumption of energy dense food is considered high and moderate because of low price. The findings of the present study were consistent with Chee's findings where she reported that the overall qualitative assessment of the dietary pattern showed low consumption of poultry, meat and dairy products (Chee *et al.* The dietary pattern was compatible with the results the food diversity and the food expenditure which all of them associated to the socio-demographic and economical factor and indeed to food security status [42,62].

Nutritional status

Child nutritional status: Of the three main nutritional problems (underweight, stunting and wasting), stunting or the slowing of skeletal growth of children is the most prevalent. It reflects the poor overall economic conditions As stunting reflects past nutrition, the finding indicates that these children may have had experiences with poor diets and repeated infections during their early childhood and perhaps were continuously living with similar conditions as a consequence of poverty [65]. The finding of the present study was consistent with Zulkiflis' where he reported higher prevalence of stunting among children in Kelantan [19]. The Annual Report of the Malaysian Ministry of Health reported that the percentage of children with moderate (weight-for-age Z score of less than -2) to severe (weight-for-age Z score of less than -3) malnutrition for the year 2000 was around 14% which is much lower than what we found.

In our study, child food insecurity was significantly associated with child underweight but not of wasting. A sever food insecurity likely leads to shortages of even the least expensive, energy-dense foods that might lead to normal or overweight. Food-insecure children, therefore, may be more likely to have very low total energy intake, which leads to under- rather than overweight, these finding were consistent with other study in which they reported that food insecurity is a good predictor of child underweight in low income community from Bogota, Colombia [44]. By contrast, Oh and Hong have expressed that the child food insecure are fatter than child secure due to the intake of energy- dense food in Korean study on the children from low income communities [9].

The findings of our study recorded higher prevalence in the three nutritional outcomes (Underweight, stunting and wasting) when compared with Chee's result in the study done in Tumpat and Bachok where she reported that the prevalence of underweight was 25.2%, stunting was 21.1% and wasting was 6.2% [64]. The big difference between the two studies might be attributed to the nature of the source

of our data which was the households receiving monthly assistance from the Welfare Department and had been classified as poor families. A recent study done in Tumpat, a rural district of Kelantan, showed that the prevalence of stunting was 69%, underweight was 63.4%, and wasting was 40%, which is a little bit higher than our findings [66]. The difference in the age group of the study samples in the present and previous studies may have contributed to the difference in reported prevalence of underweight, stunting and wasting. For example, in some of the reported studies, the prevalence of under nutrition may increase or decrease with age and thus when all the age groups are combined, the prevalence may change. The height stature of the mother might contributed to the higher prevalence of underweight and stunting as 75% of the mother with height less than 155 cm and the association between height stature of mother and wasting and stunting had been reported in different studies

MUAC is a good indicator of muscle mass and can be used as a proxy of wasting. It is also a very good predictor of the risk of death, MUAC is particularly recommended for the detection of severe malnourished 6-59 month-old children at community-level. The study reported a significant difference in MUAC between the food secure children and the food insecure, but it is not advisable to interpret on the results of the MUAC, because MUAC is mainly measured on children aged 6-59 months while the age range in our study is higher than that, moreover, there is no international agreement on the use of MUAC and on cut-offs for detection of moderately malnourished children.

The present study reported that there is association between food security and stunting and this finding is consistent with Baig-Ansari's study where he and his team asserted that there is an association between food insecurity and stunting, [17]. This study showed a high prevalence of both household food insecurity and malnutrition among children 2 to 12 years of age in Bachok District of Kelantan. Our main finding was that household food insecurity was associated with stunting and underweight among children aged 2 to 12 years in Bachok District of Kelantan In contrast, wasting did not show a significant association with food security status. However, the existence of significant association between household food insecurity and malnutrition in our study children was expected, because of the substantial evidence that a household's access to food is among the key determinants of the nutritional status of children. Our results were largely in line with the Hackett's findings where he asserted that there is a significant association between food security status and stunting and underweight and unexpectedly no association with wasting was reported [48], but it opposed Zalilah's findings where she had reported that no significant difference in the nutritional status between food secure and food insecure children and this might be attributed to the nature of our source of data which is the poor families receiving monthly allowance from the Welfare Department.

Nutritional status of the mother: Although means of BMI of mothers in the two group of households are almost equal, food insecurity was common at every level of BMI and greater percentage of women reporting food insecure were overweight and obese (64.5%) even though no significant association was there and our findings are not consistent with the hypothesis that food insecurity and obesity might be associated and the findings were the same with different analytic approaches [53,67,68] where Jones' findings suggested that food insecurity at one time point is not strongly or consistently associated with women's subsequent weight gain. Although food security status and obesity can be identified in individuals at any given time point, individuals experience and develop these conditions over

time and their association cannot necessarily be explained in a study in which each is measured at only one or two points in time. Obesity is a chronic condition, which develops over a period of months to years and food insecurity can be periodic or chronic. There may be a long lag in the impacts of food security on weight gain and obesity [69].

Identifying the dual burden household is important because it represents a clustering of opposite types of malnutrition among individuals sharing the same household environment and while investigating this phenomena the present study implied that OWM/UWC pairs were associated with food insecurity status and they were higher in the food insecure than in the food secure and this can be attributed to three reasons. First, high prevalence of overweight mother in the food insecure and also the high prevalence of underweight children in the food insecure household which both of them form this type of mother child pairs. Second, woman in food insecure households may engage in binge eating when food is available thereby resulting in being overweight or obese but not having enough food at hand during certain time periods. Third, a food insufficient woman may be consuming cheaper, less nutritious (energy-dense) food that leads to being overweight (Basiotis PP, 2002). The findings of our study were consistent with previous studies which reported that the co-existence of underweight child and overweight non-elderly adult was found to be the most prevalent combination of underweight and overweight household type in China (39%), Brazil (59%) and Russia (62%) [70].

In Malaysia, Khor and Zalilah have reported the coexistence of dual form of malnutrition - the underweight child and overweight mother pair- is 26% of 140 rural households while households with normal child-mother pair consisting 19.7% of the study population [71], another Malaysian study came to confirm the result of the previous study, the percentage of dual burden households (overweight mother/underweight child) was 25.8% while 14.8% households had normal weight mother/normal weight child [72]. In our study, the proportion of households with the underweight child-overweight mother pair (29.6%) was higher than the percentages reported in previous studies [71,72]. This result could be attributed to the high percentages of underweight children and overweight mothers in this rural district which considered on one of top ten least developed district throughout Malaysia and higher prevalence of underweight children [64].

Quality of life

The findings of the present study had reported that food insecurity status has a strong association with the quality of life and may lead to adverse effects on the wellbeing of the individuals of low- income communities and the findings were consistent with Campbell's Model where he asserted that possible consequences of food insecurity may include suboptimal quality of life and health (physical, social, and mental well-being). Evidence of an association between poor health and food insecure households has been reported by Hamelin's quantitative research [73]. A better explanation for this association is the one was asserted by Hamelin [74] where he reported that "according to respondents' description, the experience of household food insecurity is characterized by two categories of manifestations: (a) the core characteristics of the phenomenon which are reflected by not having enough food in the present, by worrying about having enough in the future and by expressing a feeling of alienation; and (b) a related set of actions and reactions by the household to these core manifestations".

Our findings agreed with Tarasuk's in which he found that the women in the food insecure households were about twice as likely to report their health as fair, poor or very poor, as well as longstanding

health conditions or activity limitations [75]. In a food insecure household parents are highly vulnerable to feelings of anxiety and helplessness, loss of control, family dysfunction, and psychological impairment, all of which accompanied by the concern how to get the food or resources for the food that may engage them in undesirable activities such as borrowing money, selling possessions or stealing [36]. The ongoing psychological stress linked with food insecurity may increase the risk of depression, particularly for single mothers who are more likely to report poorer mental health than married or partnered mothers. Single, unemployed mothers are twice as likely to report a high level of distress compared with other groups. Single mothers in general, regardless of employment status, are more likely to report high personal and chronic stress [12]. This interpretation is consistent to our results, in which single mothers constitute 60% of all respondents.

The study showed that the social functioning and social interaction is associated with food insecurity status and the results reported here agree with the results of in which the parents of the food insecure children compromised their diet to protect children and seek out socially stigmatized means of food acquisition, their own health, along with a positive sense of self and outlook on life, can suffer, leading to negative physical and/or mental health outcomes, these parents were unhappy and feeling bad of the way they are feeding their children such as using food banks or borrowing money or food or sending to charities where they can offer free meals. The feelings of shame or embarrassment about not being able to offer food to his/her children can be translated to sense of social exclusion, a feeling of isolation from their neighbors and the community at large. Different studies have also confirmed the negative relationship between food insecurity and the quality of life.

In general; we found that the scores for the quality of life domains in our study were higher than other studies and this might be attributed to the fact that rural communities have a tendency to social cohesion within and outside the family more than other communities and these findings agreed with other studies where the association between living in rural areas and better overall mental health was reported [76], moreover, the average health in the rural areas appears to be better; premature mortality and are less prevalent [74,77] and rural dwellers are less or (equally) likely to rate their health as fair or poor [76,78].

Conclusion and Recommendations

Conclusion

Our study showed that food insecurity in low income households from Bachok' is highly prevalent and associated with poor living conditions and it highlighted the pervasive vulnerability of individuals living in food insecure households. In addition to food problems, food insecure households in Bachok- Kelantan struggle with a broad spectrum of health- related problems [79].

Our result indicated that Radimer/Cornell food security instrument has some validity in this population of low income households in Bachok, but further testing is needed. As proposed by the conceptual frame work, significant association between food insecurity and household size, number of children total income, total income per capita, the expenditure and Diet diversity scores. Although, the dietary patterns of both types of households showed low consumption of expensive foods, but the dietary behavior of food secure household was much better than the food insecure and there was evidence that subjects who were food insecure, or who were unable to afford to eat a balanced diet, were less likely to consume fruits and vegetables or

animal source foods frequently [80-82]. Food variety score is associated with dual burden of malnutrition in Orang Asli (Malaysian indigenous peoples) households: implications for health promotion. *Asia Pacific Journal of Clinical Nutrition*. The association between food insecurity and nutritional outcomes (Stunting and Underweight) among children and non-nutritional consequences among adults was reported in this study. The association between food insecurity and adults' poor health and mental status, regardless of the causal direction, demonstrates the harmful risks that poor Malaysians face.

Overweight and obesity among mothers were frequent in both the households, but there were no clear associations between food insecurity and obesity. The overall results of our study almost supported Campbell model, the model we have adapted in our conceptual frame work. Our study had several limitations. The sample was restricted to subjects receiving welfare monthly allowance. As such the records of Welfare department may under-represented the poor families in Bachok District due to different reasons. Conversely, some of the families included in these records have generated new incomes which brought them out of the poverty circle. In view of these potential biases, our results are not suitable for estimating the prevalence of food insecurity in the general population. Nevertheless, they provide a strong indication that population based studies of food security are needed. In spite of these limitations, we feel it is safe to conclude that food insecurity may represent an appreciable problem in rural and low income household in Malaysia.

Recommendations

The high prevalence of food insecurity in this population supports the need for continuing programs aimed at improving food security and nutritional status of children and their families. Given the negative association found between child food insecurity and animal protein intake, an increase in the lean animal protein content of food supplementation programs for children should be considered

More research is required to fully understand the occurrence of food insecurity, and findings indicate the importance of broadening the discussion of responses to food insecurity beyond short-term food-based intervention.

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References

1. FAO (2002) *The State of Food and Agriculture*. Rome: FAO.
2. Sen A (1983) *Poverty and famines: an essay on entitlement and deprivation*, New York: Oxford University Press, USA.
3. Baer RD, Madrigal L (1993) Intra-household allocation of resources in larger and smaller Mexican households. *Soc Sci Med* 36: 305-310.
4. Emmons L (1986) Food procurement and the nutritional adequacy of diets in low-income families. *J Am Diet Assoc* 86: 1684-1693.
5. Kendall A, Olson CM, Frongillo EA Jr (1996) Relationship of hunger and food insecurity to food availability and consumption. *J Am Diet Assoc* 96: 1019-1024.
6. Kennedy E, Peters P (1992) Household food security and child nutrition: the interaction of income and gender of household head. *World Development*, 20: 1077-1085.
7. Immink MD, Payongayong E (1999) Risk analysis of poor health and growth failure of children in the central highlands of Guatemala. *Soc Sci Med* 48: 997-1009.
8. Kaiser LL, Melgar-Quifonez HR, Lamp CL, Johns MC, Sutherlin JM, et al. (2002) Food security and nutritional outcomes of preschool-age Mexican-American children. *J Am Diet Assoc* 102: 924-929.
9. Oh SY, Hong MJ (2003) Food insecurity is associated with dietary intake and body size of Korean children from low-income families in urban areas. *Eur J Clin Nutr* 57: 1598-1604.
10. Wasito E, Pritasari, Susilowati D, Iswarawanti DN, Schultink W, et al. (2001) Temporary stability of urban food and nutrition security: the East Jakarta study. *Asia Pac J Clin Nutr* 10 Suppl: S29-33.
11. Campbell CC (1991) Food insecurity: a nutritional outcome or a predictor variable? *J Nutr* 121: 408-415.
12. Vozoris NT, Tarasuk VS (2003) Household food insufficiency is associated with poorer health. *J Nutr* 133: 120-126.
13. Zamaliah M, Mohd Nasir MT (1998) Socio-economic determinants of nutritional status of children in rural Peninsular Malaysia. *Asia Pacific Journal of Clinical Nutrition*, 7: 307-310.
14. Khor G, Tee ES (1997) Nutritional assessment of rural villages and estates in Peninsular Malaysia II. Nutritional status of children aged 18 years and below. *Malays J Nutr* 3: 21-47.
15. Chee H, Khor G, Tee ES (1997) Nutritional assessment of rural villages and estates in Peninsular Malaysia: I Socio-economic profile of households. *Malays J Nutr* 3: 1-19.
16. Chee HL (1992) Prevalence of malnutrition among children in an urban squatter settlement in Petaling Jaya. *Med J Malaysia* 47: 170-181.
17. Baig-Ansari N, Rahbar MH, Bhutta ZA, Badruddin SH (2006) Child's gender and household food insecurity are associated with stunting among young Pakistani children residing in urban squatter settlements. *Food Nutr Bull* 27: 114-127.
18. Haemamalar K Jr, Zalilah MS, Neng Azhanie A (2010) Nutritional status of orang asli (che wong tribe) adults in krau wildlife reserve, pahang. *Malays J Nutr* 16: 55-68.
19. Zulkifli A, Khairul Anuar A, Atiya AS (1999) The nutritional status of children in resettlement villages in Kelantan. *Southeast Asian J Trop Med Public Health* 30: 122-128.
20. Malaysia Five Year Plans (2002) *Malaysia Five Year Plans*. Malaysia quality of life index. The Government Press: Kuala Lumpur.
21. Ministry of Health Malaysia, Annual Report (2000) Kuala Lumpur: MOH.
22. Foster P, Lynne Rienner Boulder (1999) *The world food problem: Tackling the causes of undernutrition in the third world*. Boulder, Colo., USA Lynne Rienner Publishers.
23. Watts M, Bohle H (1993) Hunger, famine, and the space of vulnerability. *Geo journal* 30: 117-126.
24. Chambers R (1989) Editorial introduction: vulnerability, coping and policy. *Institute of Development Studies Bulletin IDS bulletin*, 20: 1-7.
25. Maxwell DG (1996) Measuring food insecurity: the frequency and severity of «coping strategies». *Food Policy*, 21: 291-303.
26. Riely Mock, Cogill Bailey, Kenefick E (1999) Food security indicators and framework for use in the monitoring and evaluation of food aid programs. *IMPACT: Food security and nutrition monitoring project*, Arlington, Virginia., USA.
27. Smith LC, Haddad L (1999) Explaining child malnutrition in developing countries: a cross-country analysis. Washington, DC, International Food Policy Research Institute, (Food Consumption and Nutrition Division, Discussion Paper No. 60).
28. Radimer KL, Olson CM, Campbell CC (1990) Development of indicators to assess hunger. *J Nutr* 120 Suppl 11: 1544-1548.
29. [No authors listed] (1995) Physical status: the use and interpretation of

- anthropometry. Report of a WHO Expert Committee. *World Health Organ Tech Rep Ser* 854: 1-452.
30. Reaburn JA, Krondl M, Lau D (1979) Social determinants in food selection. *J Am Diet Assoc* 74: 637-641.
31. Chee S Jr, Zawiah H, Ismail M, Ng K (1996) Anthropometry, dietary patterns and nutrient intakes of Malaysian estate workers. *Malays J Nutr* 2: 112-126.
32. ZaLilah S, Khor LK (2004) Indicators and Nutritional Outcomes of Household Food Insecurity among a Sample of Rural Malaysian Women. *Pakistan Journal of Nutrition*, 3: 50-55.
33. Shariff ZM, Khor GL (2005) Obesity and household food insecurity: evidence from a sample of rural households in Malaysia. *Eur J Clin Nutr* 59: 1049-1058.
34. Ware JE, Gandek B, Kosinski M, Aaronson NK, Apolone G, et al. (1998) The Equivalence of SF-36 Summary Health Scores Estimated Using Standard and Country-Specific Algorithms in 10 Countries Results from the IQOLA Project. *Journal of clinical epidemiology*, 51: 1167-1170.
35. Ware Jr J, Sherbourne C (1992) The MOS 36-item short-form health survey (SF-36): I. Conceptual framework and item selection. *Medical care*, 30: 473-483.
36. Sararaks S, Azman AB, Low LL, Rugayah B, Aziah AM, et al. (2005) Validity and reliability of the SF-36: the Malaysian context. *Med J Malaysia* 60: 163-179.
37. Department of Statistics Malaysia (2002) National Nutrition Survey. Government press, Kuala Lumpur.
38. Olson C, Rauschenbach B, Frongillo Jr E, Kendall A (1997) Factors contributing to household food insecurity in a rural upstate New York county. *Family Economics and Nutrition Review*, 10: 2-17.
39. McIntyre L, Glanville NT, Raine KD, Dayle JB, Anderson B, et al. (2003) Do low-income lone mothers compromise their nutrition to feed their children? *CMAJ* 168: 686-691.
40. Campbell C, Desjardins E (1989) A model and research approach for studying the management of limited food resources by low income families. *Journal of nutrition education (USA)*. 21: 162-171.
41. Bartfeld J, Wang L (2006) Local-level Predictors of Household Food Insecurity. Institute for Research on Poverty Discussion Paper No, 131706, pp: 1-23.
42. Basiotis PPLM (2002) Food Insufficiency and Prevalence of Overweight Among Adult Women, United States Department of Agriculture Center for Nutrition Policy and Promotion, Virginia, USDA, CNPP.
43. Rose D, Gundersen C, Oliveira V (1998) Socio-economic determinants of food insecurity in the United States: Evidence from the SIPP and CSFII datasets. Technical Bulletin.
44. Isanaka S, Mora-Plazas M, Lopez-Arana S, Baylin A, Villamor E (2007) Food insecurity is highly prevalent and predicts underweight but not overweight in adults and school children from Bogotá, Colombia. *J Nutr* 137: 2747-2755.
45. Tingay RS, Tan CJ, Tan NC, Tang S, Teoh PF, et al. (2003) Food insecurity and low income in an English inner city. *J Public Health Med* 25: 156-159.
46. Molano WL, Guller AA, Belina MA, Nones CA, Tarrayoe R, (2003) Socio-economic determinants of household food insecurity, Science and Technology Project. FNRI-DOST
47. Zerafati Shoae N, Omidvar N, Ghazi-Tabatabaie M, Houshiar Rad A, Fallah H, et al. (2007) Is the adapted Radimer/Cornell questionnaire valid to measure food insecurity of urban households in Tehran, Iran? *Public Health Nutr* 10: 855-861.
48. Hackett M, Melgar-Quinonez H, Álvarez MC (2009) Household food insecurity associated with stunting and underweight among preschool children in Antioquia, Colombia. *Revista Panamericana de Salud Pública*, 25: 506-510.
49. Daponte BO, Stephens M (2004) "The Relationship between Food Assistance, the Value of Food Acquired, and Household Food Supply." Joint Center for Poverty Research, Working Paper 351. Chicago, IL: The Center.
50. Vinck P (2006) Republic of Uganda: Comprehensive food security and vulnerability analyses (CFSVA). World Food Programme, Vulnerability Analysis and Mapping Branch, Rome.
51. Weigel MM, Armijos RX, Hall YP, Ramirez Y, Orozco R (2007) The household food insecurity and health outcomes of U.S.-Mexico border migrant and seasonal farmworkers. *J Immigr Minor Health* 9: 157-169.
52. Piaseu N, Mitchell P (2004) Household food insecurity among urban poor in Thailand. *J Nurs Scholarsh* 36: 115-121.
53. Gulliford MC, Mahabir D, Rocke B (2003) Food insecurity, food choices, and body mass index in adults: nutrition transition in Trinidad and Tobago. *Int J Epidemiol* 32: 508-516.
54. Myntti C (1993) Social determinants of child health in Yemen. *Soc Sci Med* 37: 233-240.
55. Radimer KL, Allsopp R, Harvey PW, Firman DW, Watson EK (1997) Food insufficiency in Queensland. *Aust N Z J Public Health* 21: 303-310.
56. Hanson KL, Sobal J, Frongillo EA (2007) Gender and marital status clarify associations between food insecurity and body weight. *J Nutr* 137: 1460-1465.
57. Frongillo EA Jr, de Onis M, Hanson KM (1997) Socioeconomic and demographic factors are associated with worldwide patterns of stunting and wasting of children. *J Nutr* 127: 2302-2309.
58. Higgins PA, Alderman H (1992) Labor and women's nutrition: A study of energy expenditure, fertility, and nutritional status in Ghana. In: *World Bank Policy Research Working Paper WPS 1009*, World Bank, Washington, DC.
59. Moe JK, Johnson RK, Kolodinsky J (1995) The impact of conditions associated with maternal employment on the diet quality of young children. *Journal of Consumer Studies & Home Economics*, 19: 219-233.
60. Dachner N, Ricciuto L, Kirkpatrick SI, Tarasuk V (2010) Food purchasing and food insecurity among low-income families in Toronto. *Can J Diet Pract Res* 71: e50-56.
61. Melgar-Quinonez HR, Zubieta AC, MKNelly B, Nteziyaremye A, Gerardo MF, et al. (2006) Household food insecurity and food expenditure in Bolivia, Burkina Faso, and the Philippines. *J Nutr* 136: 1431S-1437S.
62. Thorne-Lyman AL, Valpiani N, Sun K, Semba RD, Klotz CL, et al. (2009) Household Dietary Diversity and Food Expenditures Are Closely Linked in Rural Bangladesh, Increasing the Risk of Malnutrition Due to the Financial Crisis. *The Journal of Nutrition*, 140: 182S-188S.
63. Pérez-Escamilla R, Segall-Correa AM, Kurdian Maranhã L, Sampaio MFA, Maranh-LeAn L et al. (2004) An adapted version of the US Department of Agriculture Food Insecurity module is a valid tool for assessing household food insecurity in Campinas, Brazil. *The Journal of nutrition*, 134: 1923-28.
64. Che Asiah T, Zulkifli A, Mohd Hashim, Halim S (2004) The prevalence and risk factors of malnutrition among primary one school children in Tumpat and Bachok, Kelantan. *Malaysian Journal of Public Health Medicine*, 4: 66-71.
65. Monteiro CA (1991) Counting the stunted children in a population: a criticism of old and new approaches and a conciliatory proposal. *Bull World Health Organ* 69: 761-766.
66. Cheah WL, Wan Muda WA, Mohd Hussin ZA, Thon CC (2012) Factors associated with undernutrition among children in a rural district of Kelantan, Malaysia. *Asia Pac J Public Health* 24: 330-342.
67. Jones SJ, Frongillo EA (2007) Food insecurity and subsequent weight gain in women. *Public Health Nutr* 10: 145-151.
68. Whitaker RC, Sarin A (2007) Change in food security status and change in weight are not associated in urban women with preschool children. *J Nutr* 137: 2134-2139.
69. Doak CM, Adair LS, Monteiro C, Popkin BM (2000) Overweight and underweight coexist within households in Brazil, China and Russia. *J Nutr* 130: 2965-2971.
70. Khor GL, Sharif ZM (2003) Dual forms of malnutrition in the same households in Malaysia--a case study among Malay rural households. *Asia Pac J Clin Nutr* 12: 427-437.
71. Saibul N, Shariff Z, Lin K, Kandiah M, Ghani N, et al. (2009) Food variety score is associated with dual burden of malnutrition in Orang Asli (Malaysian indigenous peoples) households: implications for health promotion. *Asia Pacific Journal of Clinical Nutrition*, 18: 412-422.
72. Hamelin AM, Beaudry M, Habicht JP (2002) Characterization of household food insecurity in Québec: food and feelings. *Soc Sci Med* 54: 119-132.
73. Connolly S, O'Reilly D, Rosato M (2007) Increasing inequalities in health: is it an artefact caused by the selective movement of people? *Soc Sci Med* 64: 2008-2015.
74. Tarasuk VS (2001) Household food insecurity with hunger is associated with

- women's food intakes, health and household circumstances. *J Nutr* 131: 2670-2676.
75. Riva M, Bambra C, Curtis S, Gauvin L (2011) Collective resources or local social inequalities? Examining the social determinants of mental health in rural areas. *Eur J Public Health* 21: 197-203.
76. Levin KA (2003) Urban-rural differences in self-reported limiting long-term illness in Scotland. *J Public Health Med* 25: 295-302.
77. Kelleher C, Friel S, Nic Gabhainn S, Tay JB (2003) Socio-demographic predictors of self-rated health in the Republic of Ireland: findings from the National Survey on Lifestyle, Attitudes and Nutrition, SLAN. *Social Science & Medicine*, 57: 477-486.
78. Hamelin AM, Habicht JP, Beaudry M (1999) Food insecurity: consequences for the household and broader social implications. *J Nutr* 129: 525S-528S.
79. McIntyre L, Tarasuk V (2002) Food security as a determinant of health. Published by Public Health Agency of Canada, 1-4.
80. UNICEF (2006) Progress for Children: A Child Survival Report Card, Volume 1. New York: UNICEF, 2004; 21 pp.
81. Newnham EA, Harwood KE, Page AC (2007) Evaluating the clinical significance of responses by psychiatric inpatients to the mental health subscales of the SF-36. *J Affect Disord* 98: 91-97.
82. Shariff ZM, Khor GL (2008) Household food insecurity and coping strategies in a poor rural community in Malaysia. *Nutr Res Pract* 2: 26-34.