

## FOOD SECURITY STATUS AND CHILDHOOD OBESITY IN KUANTAN PAHANG

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**ABSTRACT**

**Introduction:** Food insecurity has become one of the concerning issues in public health. The purpose of this study was to investigate household food security status and its relationship with childhood obesity in Kuantan, Pahang. **Methods:** This comparative cross sectional study was conducted in Kuantan, Pahang among 128 mothers aged 18 to 55 years with the children aged 7 and 13 years. Data on food security status was collected using Radimer/Cornell hunger and food insecurity instrument through telephone survey while children's height and weight as well as socio-demographic data were measured and obtained during schools visits. **Results:** A total of 23% of the respondents were food secure. However, 77% experienced food insecurity where 52% were household food insecure, 9% women were individual food insecure and 16% fell into the child hunger category. Income ( $p=0.04$ ), income per capita ( $p=0.033$ ), household size ( $p=0.032$ ) and area of living ( $p=0.001$ ) were the significant risk factors for household food insecurity. The prevalence of overweight and obesity among children were 60.6% in food insecure households which was higher compared to food-secure households (38.4%). However, there were no significant association between childhood obesity and food security status. **Conclusion:** This study demonstrates that the prevalence of food insecurity and childhood obesity in Kuantan, Pahang is a major concern. The results warrant the need for further investigation to identify complex interaction between food insecurity and childhood obesity.

**Keywords:** Schoolchildren, obesity, food insecurity, prevalence

## INTRODUCTION

Food is one of the most fundamental human needs. Food is not just important for growth and health maintenance, but also represents status and way of life. The most critical stage in human development occurs during early years of life. Thus, when the food supply is insufficient, children are the most vulnerable group that will be affected.

Household access to food depends on many factors particularly income and the ability to get food. Household food availability determines individual food intakes and the issue becomes crucial when children are concerned. People who are constantly living in inequality environment may be highly exposed to poverty and hunger. In fact, researchers had documented that children who were growing up in poverty too often, were susceptible to have poor nutritional status, unhealthy development and poor school performances (Alaimo et al 2001; Kaiser et al; 2002; Oh & Hong, 2003). Food security is the availability of and accessibility to food, acquired in an acceptable means at any given time and place in a way that could maintain health and wellbeing, while food insecurity is the limited or uncertain ability to acquire good nutritious food via socially acceptable means (Food and Agricultural Organization, 2002). Not having consistent access to food sources that are nutritious and affordable is indeed a denial of basic needs.

One of the common perceptions is that food insecurity or not having enough foods always leads to under nutrition. On the other hand, not having enough foods may also lead to obesity. However, the association between food insecurity and obesity remains unclear. A pocket of literatures shows that relationship between household food insecurity and childhood obesity provides mixed results (Food Research and Action Centre, 2011). A number of studies in the U.S. have found positive associations between food insecurity and overweight or obesity (Nguyen et al., 2015; IOM, 2011; Larson & Story, 2011). Several studies found that food insecurity was associated with obesity for women but not men (Mohammadi et al., 2014; Morales-Ruan et al., 2014). Other studies have found no relationship, or even a lower risk of obesity, with food insecurity (Gundersen, Garasky & Lohman, 2009; Jones & Frongillo, 2007; Rose & Bodor, 2006). Although the result for children is not as consistent as it is for adult women (Morales & Berkowitz 2016), several studies did find significant association between food insecurity and overweight or obesity among children and adolescents (Kaur, Lamb & Ogden 2015; Eisenmann et al., 2011; Franklin et al., 2011). The association between household food insecurity and obesity in children has not been studied well in developed countries, much less in developing countries including Malaysia.

In Malaysia, studies on food insecurity were focusing on women with aim to assess the socio-economic profile, nutritional status and dietary intake of the households as the indirect indicators of food insecurity (Zalilah & Tham, 2002; Shariff & Khor, 2005; Ihab et al., 2014, Mohadmadpour et al., 2012; Norhasmah et al., 2010). The most recent study on food insecurity and the metabolic syndrome (MetS) rates among

reproductive aged women in low income households in Malaysia showed that the prevalence of food insecurity and Mets was 78.4%. (Shariff et al., 2014).

Due to the fact that the cause of obesity is complex, there is a need to explore different angles when searching for the evidence. It is possible that food insecurity could be related to obesity as indirect relationship through dietary pattern and low socio economic and demographic factors. Several studies suggest that relationship between food insecurity and overweight or obesity is bidirectional (Mohamadpour et al., 2012; Adams et al., 2003; Townsend et al., 2001). It is suggested that households at risk of running out of food may be more likely to consume more energy dense foods which are cheaper compared to nutritious food (Drewnoski & Specter, 2004). This subsequently increased the prevalence of overweight and obesity among low income households and those who were living below poverty line (Dietz, 1995; Drewnoski & Specter, 2004; Shariff & Khor, 2005). In addition, hunger is the most severe condition that many adult experienced as a consequence of food insecurity since there is not enough money for food, resulting in them not eating the whole day (Adams et al., 2003). Unpredictable availability of food may leads to overeating subsequently cause obesity.

According to Food Research and Action Centre (2011), some of the key factors that may explain why low-income and food insecure people are vulnerable to overweight and obesity include; 1) limited resources and lack of access to healthy, affordable foods; 2) few opportunities for physical activity; 3) cycles of food deprivation and overeating; 4) high level of stress; 5) high exposure to marketing of obesity-promoting products and; 6) limited access to healthcare. The emerging problem of food insecurity and obesity in Malaysia and its consequences as reported in the literature have been a great concern among public health practitioners.

## **METHODOLOGY**

### **Study background and subjects**

This cross-sectional study was conducted in Kuantan district, Pahang. A total of 726 schoolchildren aged 7 and 13 years old were screened where their weight and height were measured during school visits. From this list, a total of 200 households were recruited randomly for the food security telephone survey where 128 participants finally completed the survey.

Three interviewers were involved in the telephone survey. They were briefed about the research objectives and supplied with a copy of telephone survey protocol. To carry out the telephone survey, the interviewers were equipped with a telephone and list of participant's phone number. Calls were made from 9 am to 6 pm. In case of busy number or unanswered calls, a second attempt was made 30 minutes later. After three unsuccessful attempts, the number was called again on another day. Up to five attempts were made for each unanswered number before it was considered as an unsuccessful call.

For every successful call, the interviewer first introduced himself/herself and explained the purpose of the call. The interviewer then asked to speak to the mother. The respondent was assured about the confidentiality and privacy of information collected from the survey. Before the survey commenced, respondents were asked whether they were willing to continue with the survey.

The study protocol was approved by the IIUM Research Ethics Committee (IREC). Permission was obtained from Ministry of Education Malaysia and Pahang State Department of Education to access the selected schools.

## **Instrument and data collection**

### Food security survey

Radimer/Cornell food insecurity scale was used for the Food Security Survey, which was validated and translated into Malay version (Zalilah & Merlin 2001). The Radimer/Cornell scale was intended to differentiate among household, adult and child food insecurity. The categorization was based on responses to 10 items where the respondents were then categorized into food secure, household food insecure, individual food insecure and child hunger as suggested by Kendall et al. (1996). Food security status is collapsed into two categories; food secure and food insecure, for the purpose of analysis for this study.

### *Anthropometric measurement*

Anthropometric measurements were taken using standard techniques. Height was measured using SECA stadiometer 213. The respondents were barefooted and wearing minimal clothing. The respondents stood with heels together, arm to the side, legs straight, shoulder relaxed and head in the Frankfort horizontal plane. Heels, buttocks, scapula and back of the head were against the vertical surface of the body meter. Hair ornamentation had to be removed. The measurement taken was read twice to the nearest 0.1 cm and the average value was used for data entry.

Body weight was measured with a portable Tanita Solar Power Digital Scale (Tanita model HS302). The respondents stood still in the middle of the scale's platform without touching anything and with body weight equally distributed on both feet. The reading was taken twice to the nearest 0.1 kg and the average was used for data entry. Nutritional status of the participants was identified based on anthropometric component namely BMI-for-age (BMIAZ). Z-score was used to distinguished between normal and overweight (BMIAZ >1) or obese (BMIAZ >2). Z-score of each component was obtained using AnthroPlus® software and was later used to classify the various categories of nutritional status. Categories of nutritional status were based on World Health Organization (WHO) Child Growth Standard (WHO, 2007).

## **Statistical analysis**

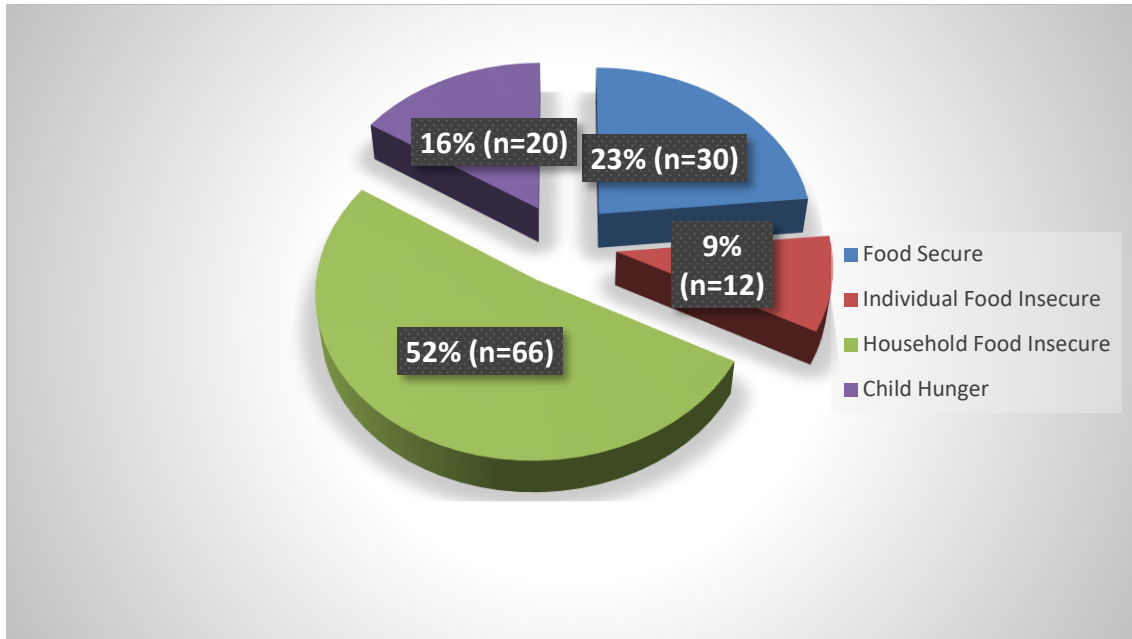
Data in this study was analysed using Statistical Package for the Social Sciences Version 12.0 (SPSS 12.0). Independent T-test was used to identify mean difference of nutritional status of the participants against gender, area of living, income, income percapita and parents' employment status. One-way ANOVA test was applied to compare mean differences between BMI z-scores and food security level. Pearson Chi-Square test were used to find significant association between participants' food security status and socio-demographic characteristics.

## RESULT

Initially, 200 mothers aged between 18 to 55 years old were recruited for food security survey. A total of 128 mothers successfully completed the survey. All of them were from Malay descendants. The mean age of the mother was  $40.1 \pm 6.70$  years and the age ranged from 21 to 59 years.

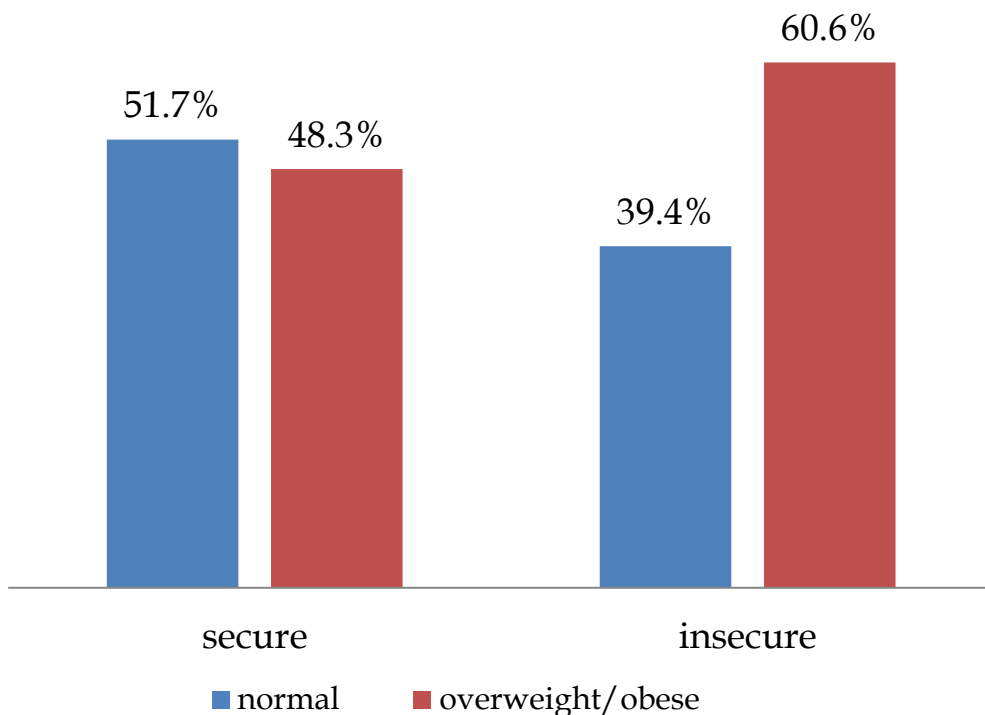
The Figure 1 depicts the distribution of food security status. In general, 23% of the respondents were categorized as food secure and 77% were food insecure. Fifty two percent (52%) were experiencing the least severe level of food insecurity and were designated as 'household food insecure'. The other 9% were categorized as 'individual food insecure' which is the moderate level of food insecurity. Individual food insecure is actually referring specifically to the mother. Lastly, the most severe level of food insecurity is 'child hunger' which affected 16% of the respondents.

The majority of the parents of food secure and food insecure households received formal education up to secondary level. Forty five percent ( $n=45$ ) of the mothers of the food insecure were working mothers whereas the rest (54%,  $n=54$ ) were housewives. Most of the fathers of food secure and food insecure households were working fathers. The average household size in food insecure group was  $5.7 \pm 1.7$  with most of the households (68.7%) occupied by more than five people. This average was higher than the average household size of 4.31 reported for households in Malaysia (National Population and Family Development Board 2010). On a contrary, in food secure household, majority of households (58.6%) were occupied by one to five people per household. The average monthly household income of the food insecure group was significantly lower (RM 2392, IQR $\pm$ RM 1730,  $p=0.04$ ) compared to the food secure household (RM3281, IQR $\pm$ RM 2830). As the poverty level income percapita in Pahang is RM 220, approximately 53.3 % ( $n=53$ ) of the food insecure households in this study can be assumed were living in poverty. Majority of food insecure households were located in urban area (83.8%,  $n=83$ ).



**Figure 1** Distribution of food security status.

The proportion of overweight/obesity in food secure was 48.3% and the proportions of overweight/obesity in food insecure households were 60.6% (Figure 2). This indicates that the higher prevalence of overweight/obesity in food insecure group, however it did not attest a significant association between household food insecurity and childhood obesity.



**Figure 2** BMI categories according to food security status

The Table 1 presents the means and standard deviation of BMI-for age Z-scores for each of household according to the four level of food security. The ANOVA test was used to examine the differences of BMI-for-age among the schoolchildren between all levels of food security. As the severity of food insecurity increased, it shows the inclining trends in the mean of BMIAZ but the differences were not significant.

**Table 1.** Mean z-score of BMIAZ according to household food security level

Variable level	z-score (BMIAZ)	SD	F-stat	p-value
Food secure	1.28	2.13	0.414	0.743
Household food insecure	1.43	2.11		
Individual food insecure	1.46	2.14		
Child hunger	1.91	1.31		

\* p<0.05, ANOVA test

The relationship between socio-demographic characteristics and food security status is shown in Table 2. Income (p=0.032), income percapita (p=0.033), area of living (p=0.001) and household size (p=0.032) were associated significantly with food insecurity.

**Table 2.** Association between socio-demographic characteristics with food security status

Demographic characteristics		Food Secure	Food Insecure	$\chi^2$	P alue
		N (%)	N (%)		
<b>Mother's education</b>	Primary	6 (11.5)	46 (88.5)	0.53	0.650
	Secondary	12 (21.8)	43 (78.2)		
	Higher education	11 (52.8)	10 (47.6)		
<b>Mother's working status</b>	Working	14 (48.3)	45 (45.5)	0.72	0.789
	Housewife	15 (51.7))	54 (54.5)		



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<b>Father's education</b>	Primary	7 (30.4)	16 (69.6)	2.03	0.367
	Secondary	14 (18.7)	61 (81.3)		
	Higher education	8 (28.6)	20 (71.4)		
<b>Father's working status</b>	Working	26 (22.4)	90 (77.6)	0.04	0.839
	Not working	5 (25.0)	9 (75.0)		
<b>Household size</b>	1 to 5	17 (32.1)	36 (67.9)	7.14	0.032*
	>6	12 (16.0)	63 (84.0)		
<b>Income</b>	<720	5 (17.2)	5 (5.1)	4.63	0.040*
	>720	24 (82.8)	94 (94.9)		
<b>Income percapita</b>	<220	9 (14.5)	53 (85.5)	4.55	0.033 *
	>220	20 (30.3)	46 (69.7)		
<b>Area of living</b>	Urban	9 (31.1)	83 (83.8)	30.91	0.001*
	rural	20 (69.0)	16 (16.2)		

\* p<0.05,  $\chi^2$ test

## DISCUSSION

### Food security assessment

Food insecurity was indicated by an affirmative response to at least one of the three questions indicating worry about not having enough to eat, compromise in the quality or variety of food eaten and not having enough to eat (Chen & Che, 2001). For the present study, in response to the food security instrument, 83.8% of the households living in urban area reported to be food insecure. This is consistent with previous studies of urban low income households where the reported prevalence of overall food insecurity was higher than the rural counterparts (Ihab et al., 2014; Zalilah & Merlin 2001; Zalilah, 1998). These disparities might be due to the higher standard of living in the urban areas compared to rural counterparts.

The fixed income and the high price of foods in urban market might put urban households at more risk of food insecurity compared to the rural counterparts (Kendall et al., 1996; Mohadmadpour et al., 2012). Even though rural households has no fix income but they are less likely to experience food insecurity due to lower standard of living and the ability to depend on non-market foods such as home-grown fruits and vegetables, fish from the river and home-reared animals. This practice may help the villagers to reduce their expenditure on foods. Besides that, less expenditure on non-food items (e.g tab, movie players, and toys) also gave an advantage to the rural villagers (Zalilah & Merlin, 2001). Moreover, the cultural perception may also explain the differences between the urban and rural areas. For example, salted fish and egg with rice may be sufficient for rural household but not for urban dwellers.

Thus, given the same type and amount of foods, it is more likely for urban household to report for food insecurity compared to rural households.

According to level of severity in food security, a least severe effect was experienced by 52% of the households. It was noted that 9% experienced the moderate type while 16% experienced the severe effect of food insecurity than the moderate group. The present study found similar findings described by Ihab and his colleagues (Ihab et al., 2014). They reported that child hunger in their study was higher than maternal.

### **Factors Associated With Food Insecurity**

While cultural perception may explain the differences between urban and rural areas, it is believed that the percentage of food insecurity may actually be higher than what has been reported by the mothers. This is because mothers may not report the truth about food situation in the family. The sensitivity of the issue may cause the mothers to feel embarrass to answer those questions. Previous studies also reported the same problem in their research (Zalilah, 1998; Zalilah & Khor, 2004; Zalilah & Tham 2002).

It was agreed that the cross sectional nature of a particular study makes it impossible to draw causal inferences (Vozoris & Tarasuk, 2003). Different kinds of methodologies including differences in the study population, sample size, food security measurements and control of potentially confounding variables resulted in inconsistency of the outcome (Vozoris & Tarasuk, 2003). To date, many previous studies across the world have emphasized the association between low educational level and household food insecurity (Zalilah & Khor, 2008; Olson et al., 2004).

By contrast, the findings in this study did not support the association between low educational level and household food insecurity, which consistent with Tingay et al. (2003). The non-significant association between educational level and food insecurity might be explained by the fact that majority of the respondents were moderately educated, and the educational level was almost similar between the two groups. Any increase in the educational level among the mothers will not decrease the risk of the households being food insecure because educational level did not have any significance when the family was under economic constraints. This could be the outcome of the Malaysian government's continuous effort to bridge the educational gap between the urban and rural areas. For example, the government has allocated RM41.3 billion for education and training in 2016 budget. Zalilah and colleagues also did not find any significant difference in the schooling years of the mothers between food secure and food insecure households (Zalilah & Khor 2004).

The present study found a significant association between household size and household food insecurity. This result is consistent with studies in Nigeria by Titus & Adetokunbo (2007). They found that as the household size increased, the probability of being food insecure also increased. It was believed that household size have lower food consumption of all food types due to lower incomes to purchase food (Baer & Madrigal, 1993). Moreover, the findings are not surprising because the means

household size in the current study (5.7) was higher than the average household size (4.3) reported for households in Malaysia (National Population and Family Development Board 2010).

This present study did not find any statistically significant difference between the proportion of working mothers in the food secure (48.3%) and food insecure households (45.5%). The researchers also did not find any association between household food insecurity and employment status of the mother, in contrary to the previously existing evidence (Zalilah & Khor, 2008). Generally, working mothers are expected to have better access to food and food security conditions. However, Horton & Campbell (1991) indicated that maternal employment was associated with higher rates of restaurant food consumption and higher calories but less of nutrients of food consumption compared to home prepared food.

This study showed significant difference in monthly incomes between food secure and food insecure households. Households that have better income are less likely to become food insecure compared with households that had no or lower income. Even though the descriptive analysis showed that both food secure and food insecure households live above the poverty line but clearly food insecure households were having issues when it comes to per capita income. The family with bigger household size but less income may alter the food choices and amounts as the parents have to spend more money on foods for the large family members (Kusher et al., 2006). They will start making adjustments to quantity and quality of food being served in the households according to the family food budgets.

### **The Association of Food Insecurity and Obesity**

According to literatures, research on relationship between household food insecurity and obesity of children provides mixed results (Food Research and Action Centre (2011). Moreover, the result for children is not as consistent as it is for adult women (Morales & Berkowitz, 2016). Several studies did find significant association between food insecurity and overweight or obesity among children and adolescents (Kaur et al., 2015; Eisenmann et al., 2011; Franklin et al., 2011). Other studies have found no relationship, or even a lower risk of obesity, with food insecurity (Gundersen et al., 2009; Jones & Frongillo, 2007; Rose & Bodor, 2006).

It is well accepted that household food insecurity is significantly associated with poorer health status (Alaimo et al., 2001; Kaiser et al., 2002). However, we did not find any statistically significant difference between the proportion of overweight/obesity children in food secure and food insecure households, 48.3% and 60.6% respectively. Even though the number of overweight/obese children were much higher in the food insecure group compared to food secure, the considerable proportion discrepancies between the two groups did not provide any significant association.

Substantial analysis was conducted to prove the direct effect of food insecurity to childhood obesity, but there is no association of food insecurity and childhood obesity was found. It is possible that food insecurity could be related to obesity as indirect relationship through dietary pattern and low socio economic and demographic factors. This finding, contradict with the finding of Kaur et al. (2015), Eisenmann et al. (2011) and Franklin et al. (2011) which found significant association between food insecurity and overweight or obesity among children and adolescent.

The relationship between obesity and food insecurity is complicated. While the processes underlying this association are not completely understood, food insecurity can result in lower diet quality and less variety, both of which can contribute to being overweight. In addition, unpredictable availability of food can also lead to overeating.

In contrast, household food insecurity was reported to have an association with stunting and underweight (Ihab et al., 2014). In Colombia, food insecure children were three times likely to be underweight than children in food secure group (Isanaka et al., 2007). Isanaka and colleague stated that household food insecurity is a good predictor of underweight in children in low income communities. In Nepal, household food insecurity was significantly associated with stunting and underweight (Singh et al., 2014) while in Pakistan, the association between food insecurity and child stunting was significantly reported (Baig-Ansari et al., 2006). As stunting reflects past nutrition deficiencies, the findings concluded that these children had experiences with poor diet, repeated infections during the early childhood and continuously living in similar conditions due to poverty.

## CONCLUSION

Based on the findings, the prevalence of food insecurity in Kuantan can be considered as high. The factors influencing food insecurity include income level, income percapita, household size and location (urban/rural). Even though this study did not prove food insecurity as a risk factor for overweight and obesity but the higher prevalence of overweight/ obese children in food insecure group warrant the need for further investigation. This result supported by the literatures confirming that household food insecurity is significantly associated with poorer health status. The co-existence of food insecurity and obesity is also evident. Hence, researches aiming at reducing overweight and obesity should consider food security elements as one of the important factors in their studies.

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