

## Prevalence of Food Insecurity among Low-income Women in Saudi Arabia

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**Abstract:** Food insecurity is a major public health concerns that have influences at the individual and environmental levels. The objectives of our study were to measure the prevalence of food insecurity among low income women and to determine the factors related to food insecurity such as weight status, socioeconomic status and dietary factors. A cross-sectional study, was conducted in Al-Ahsa among 147 low-income women were interviewed to collect data about socioeconomic and nutritional status. Fifty seven percent of the women reported as food insecure (21% household food insecure, 12% individual food insecure and 24% child hunger), the majority of them were married and housewives. Women in child hunger group reported the lowest mean years of education (4.64 years) with significantly higher mean of weight and BMI ( $p = 0.03$ ,  $p = 0.024$ , respectively) compared to other groups. The recommended daily serving intakes of all food groups were adequate only fruit and vegetable group was inadequate (two serving). While women in the food insecure groups had higher mean intakes of energy, fat, protein and carbohydrate. This present study showed that food insecurity is present in Saudi Arabia and associated with nutritional status and that highlight the importance of more researches about food insecurity and public health in the community.

**Keywords:** Diet, food insecurity, obesity, overweight, Saudi Arabia

### INTRODUCTION

Food insecurity is a core indicator of nutritional status and defined as "Limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways" (Anderson, 1990). Food insecure adults are more likely to have lower dietary quality as low nutrient and less varied diets, hypertension, diabetes and other mental health problems (Gunderson *et al.*, 2011). Zizza *et al.* (2008) study meal and snack behaviors among food secure and insecure adults in the United States, they reported energy intakes did not differ between the two groups, but meal and snack behaviors differed, with food insecure adults consuming fewer but larger meals and more snacks, which may compensate for the reduced meal frequency and that increasing the risk of poor health and chronic disease (Zizza *et al.*, 2008). Several cross sectional studies found that food insecurity is positively associated with overweight and obesity especially among women (Townsend *et al.*, 2001; Adams *et al.*, 2003; Chaput *et al.*, 2007; Hanson *et al.*, 2007; Olson and Strawderman, 2008).

Adams *et al.* (2003) examined the relationships between food insecurity and obesity among 8169 women aged 18 years and more. Food insecurity without hunger affected 13.9% of the women and food insecurity with hunger 4.3%. Almost one fifth (18.8%) of the women was obese and it was more prevalent in

food insecure (31.0%) than in food secure women (16.2%). Food insecurity without hunger was associated with increased risk of obesity in whites (odds ratio = 1.36) and others (odds ratio = 1.47). Food insecurity with hunger was associated with increased risk of obesity for Asians, Blacks and Hispanics (odds ratio = 2.81) and they conclude that food insecurity is associated with increased likelihood of obesity. As studies reported, food insecure women possess nutrient deficiencies (McIntyre *et al.*, 2003; Tarasuk and Beaton, 1999), when they adopt variety strategies to prevent their families and children from food insecurity and hunger (Stevens, 2010), such as skip the meals, or eat less to spare other family members especially children, (McIntyre *et al.*, 2003; Dinour *et al.*, 2007), which affect their health and put them at risk of obesity, overweight and several diseases.

Saudi Arabia is undergoing drastic nutrition transitions, the prevalence of obesity and overweight, especially in women, is a feature that is turning into a major public health problem. Al-Baghli *et al.* (2008) found the prevalence of overweight was 32.8% and obesity was 45.5% in Al-Ahsa city, also they reported married women and unemployed, low education level with low income had higher prevalence of obesity and overweight. The rising prevalence of obesity and overweight in Saudi Arabia should be drawn attention to the disparities burden between groups of varying socioeconomic status especially low income food insecure adult. The objectives of our study were to

measure the prevalence of food insecurity among low income women and to determine the factors related to food insecurity such as weight status, socioeconomic status and dietary factors.

## MATERIALS AND METHODS

**Study location and subjects:** This is an across-sectional study, conducted in Al-Ahsa located at The Eastern Province of Saudi Arabia. Al-Ahsa is the largest oasis in The Eastern Province which is divided into five districts (Alhofuf, Almoubaraz, East villages, North villages and Alhejar). Participants were recruited from community societies (Ftat Al-Ahsa and Al-Ber) that primarily serve low income families. The number of women needed for this study was calculated based on the prevalence of the obesity among women in The Eastern Province of Saudi Arabia (50%) (Al-Baghli *et al.*, 2008), because there is no previous study conducted on the food insecurity in Saudi Arabia there is no reported prevalence.

The calculation of the sample size was based the formula by Cochran (1996):

$$N = Z^2 \frac{1-\alpha/2 (P) (1-P)}{(d)^2}$$

$\alpha = 0.05$ ,  $Z = 1.98$  if the level of the significance is 5%,  $d = \pm 10\%$  accuracy level is allowed for estimating the prevalence of food insecurity ( $d = \pm 10\%$ ):

$$N = (1.98)^2 (50) (100-50) / (10)^2 = 98 \text{ women}$$

The inclusion criteria were women 18 years and above, non pregnant, none lactating and receiving financial aids. A final sample of 147 women was achieved, women were assured of absolute anonymity; the author explained that nothing they told her would be shared with workers in Ftat Al-Ahsa Society and Al-Ber Society. The permission to conduct the study was obtained from the Ftat Al-Ahsa Society and Al-Ber Society. This study protocol was approved by the Ethic Committee of College of Agriculture and Food Science, King Faisal University. In consideration of possible literacy issues, the author verbally highlighted the main points of the consent form for participants, who read the consent form silently to themselves and were given the opportunity to ask any study related questions. Willing participants then signed the informed consent form.

**Instrument:** A pretested interview questionnaire was used to collect the data, six questions assessed socioeconomic data as age, marital status, level of education, employment status, number of children and household income" the total household income earned by all household members". Weight was measured to the nearest 0.1 kg using digital weighting scale with the participants wearing light clothing and no shoes. Height without shoes was measured to the nearest 0.1 cm using a wall-mounted stadiometer. Body Mass Index (BMI)

calculation as weight (kg) /height (m<sup>2</sup>) and classified according to World Health Organization (1998). Waist circumference was measured three times by the author with a flexible tape between the costal margin and iliac crest and the average of measures was taken,  $\geq 80$  cm was considered as high risk for abdominal obesity in women (World Health Organization, 1998).

A ten-item Radimer/Cornell food insecurity measure was translated to Arabic and pretested for clarity of meaning in community with similar characteristics to the study subjects. The internal consistency (reliability) of the items  $\alpha = 0.81$  which was deemed acceptable. The Radimer/Cornell hunger and food insecurity instrument has been developed to assess household hunger and food insecurity by Radimer *et al.* (1992). Further studies were conducted to establish validity and reliability of the instrument around the world (Radimer *et al.*, 1992; Shariff and Khor, 2005; Chaput *et al.*, 2007). The dietary intake assessment was undertaken with two 24-h recalls. The household measures (teaspoon, tablespoon, glass, soup cup and plate) were used to help women to estimate the portion intakes, which were then converted to metric measurements (g). As most of the women cooked meals themselves they had a very good ability to remember foods and estimate portion size. The 24-h dietary recall describes reported intakes from midnight to midnight, meal after meal, for mixed dishes, food groups were calculated according to their ingredients. The Nutritional Health Balance Program software was used to analyze the dietary intake.

**Statistical analysis:** Descriptive statistics, including frequencies, percentages, means and stander deviation were used. One-way analysis of variance was used for continues variable and Chi square for categorical data as socioeconomic variable, anthropometric measurement and indicator. The Statistical Package for Social Sciences SPSS program version 19 was used to analysis the collected data.

## RESULTS

Forty three percent of women were reported as food secure, 21% household food insecure, 12% individual food insecure and 24% child hunger. The mean age of women was 41.8 years, the majority of them were married and housewives with a mean of five children in all groups and five years as mean year of education (Table 1). The mean BMI was 26.5 (kg/m<sup>2</sup>) for all women which is in the overweight category with significant difference between groups (food secure and child hunger). The mean weight and mean BMI were significantly higher for women from child hunger (66 kg, BMI 27) compared to other groups. Women in the individual food insecure group had the lowest waist circumference (82.7 cm) with significant difference

Table 1: Demographics characteristic according to food security status

Characteristic	All (n%)	Food secure (n = 63)	Household food insecure (n = 31)	Individual food insecure (n = 17)	Child hunger (n = 36)	<sup>a</sup> p-value
Age (years) mean (S.D.)	41.89	42.2	42.32	42.52	38.58	0.510
<40 years	66 (44.90)	27 (42.90)	11 (35.50)	10 (58.80)	18 (50.00)	0.400
≥40 years	81 (55.10)	36 (57.10)	20 (64.50)	7 (41.20)	18 (50.00)	
Marital status						
Married	141 (95.90)	62 (98.40)	29 (93.50)	16 (94.10)	34 (94.40)	0.190
Divorced, widow	6 (4.10)	1 (1.60)	2 (6.50)	1 (5.90)	2 (5.60)	
Number of children mean (S.D.)	5.53 (3.65)	5.9 (3.88)	5.06 (3.70)	4.17 (2.72)	5.91 (3.50)	0.270
Household size	7.4 (3.70)	7.9 (3.90)	7.6 (4.10)	5.8 (2.60)	7.5 (3.30)	0.320
Education (years) mean (S.D.)	5.27 (2.20)	5.63 (2.70)	5.16 (2.10)	5.47 (2.20)	4.63 (2.40)	0.830
No schooling	46 (31.30)	21 (33.30)	9 (29.00)	5 (29.40)	11 (30.60)	0.290
Primary	50 (34.00)	19 (30.20)	11 (35.50)	7 (41.20)	13 (36.10)	
Secondary	42 (28.60)	15 (23.80)	11 (35.50)	4 (23.50)	12 (33.30)	
University	9 (6.10)	8 (12.70)	-	1 (5.90)	-	
Employment status						
Housewife	137 (93.20)	60 (95.20)	29 (93.50)	15 (88.20)	33 (91.70)	0.750
Working	10 (6.80)	3 (4.80)	2 (6.50)	2 (11.80)	3 (8.30)	
Household income (SR <sup>b</sup> ) mean (S.D.)	1989.63 (623.88)	2073.88 (647.80)	2132.85 (641.75)	1871.11* (675.94)	1790.00** (425.57)	0.042*

p<0.05; <sup>a</sup>: One-way ANOVA or  $\chi^2$  analysis; <sup>b</sup>: Saudi Riyal; 1 USD = 3.75 SR; \*: Significant difference between food secure and individual food insecure; \*\*: Significant difference between food secure and child hunger

Table 2: Anthropometric measurement and indicators according to food security status

Measurement	All (n = 147)	Food secure (n = 63)	Household food insecure (n = 31)	Individual food insecure (n = 17)	Child hunger (n = 36)	<sup>a</sup> p-value
<sup>b</sup> Weight (kg) mean (S.D.)	63.57 (12.00)	58.93 (8.970)	64.37 (13.840)	62.1 (15.610)	66.22 (10.830)	0.030*
Height (m) mean (S.D.)	1.55 (2.40)	1.54 (0.071)	1.54 (0.076)	1.54 (0.079)	1.55 (0.066)	0.530
<sup>b</sup> BMI (kg/m <sup>2</sup> ) mean (S.D.)	26.56 (5.36)	24.38 (3.770)	27.16 (6.350)	25.96 (7.130)	27.68 (4.770)	0.024*
18.5-24.9	76 (49.00)	30 (47.600)	15 (48.400)	11 (64.700)	16 (44.400)	0.002*
25-29.9	52 (35.40)	21 (33.300)	7 (22.600)	4 (23.500)	20 (55.600)	
≥30	23 (15.60)	12 (19.000)	9 (29.000)	2 (11.800)		
<sup>b</sup> Waist circumference (cm)	92.67 (16.60)	90.55 (17.170)	91.64 (15.760)	82.7 (15.950)	97.07 (15.700)	0.009*
Normal 80<	46 (31.30)	18 (28.600)	8 (25.800)	9 (52.900)	11 (30.600)	0.008*
At risk ≥80	101 (68.70)	45 (71.400)	23 (74.200)	8 (47.100)	25 (69.400)	

<sup>a</sup>: One-way ANOVA or  $\chi^2$  analysis; <sup>b</sup>: Significant difference between food secure and child hunger; <sup>c</sup>: Significant difference between food secure and individual food insecure; <sup>d</sup>: Significant difference between individual food insecure and child hunger; \*: p<0.05

Table 3: Dietary intake according to food security status

Measurement	All (n = 147)	Food secure (n = 63)	Household food insecure (n = 31)	Individual food insecure (n = 17)	Child hunger (n = 36)	<sup>a</sup> p-value
Energy and nutrient mean (S.D.)						
Energy intake (kcal)	1613.62 (360.50)	1575.13 (334.90)	1620.23 (402.50)	1618.14 (330.30)	1626.5 (362.20)	0.93
Fat intake (g)	48.4 (8.70)	44.4 (8.70)	48.7 (8.90)	50.1 (6.80)	50.3 (9.50)	0.65
Protein intake (g)	55.2 (7.30)	55.9 (7.80)	55.5 (9.10)	54.6 (6.00)	54.4 (7.20)	0.27
Carbohydrate intake (g)	239.2 (90.90)	237.9 (83.10)	239.8 (81.50)	237.2 (81.10)	238.8 (85.10)	0.41
Percentages of calories from fat	27.1 (8.70)	25.4 (9.30)	27.1 (8.90)	27.9 (6.70)	27.7 (6.30)	0.37
Percentages of calories from protein	13.7 (7.80)	14.2 (7.80)	13.7 (5.80)	13.5 (5.30)	13.4 (5.10)	0.41
Percentages of calories from Carbohydrate	59.3 (3.10)	60.4 (7.90)	59.2 (7.80)	58.6 (8.40)	58.9 (8.10)	0.50
Calcium (mg) ( <sup>b</sup> DRI = 1000 mg)	871.87 (507.70)	938.87 (486.43)	901.69 (515.03)	855.72 (556.85)	603.44 (404.10)	0.11
<sup>c</sup> PA%	(34.70%)	(36.50%)	(35.50%)	(32.40%)	(33.40%)	
Iron (mg) (DRI = 18 mg)	13.76 (8.21)	13.91 (7.82)	13.56 (7.15)	14.25 (8.21)	12.31 (6.89)	0.06
PA%	(48.30%)	(49.20%)	(54.80%)	(52.90%)	(47.20%)	
Vitamin C (mg) (DRI = 60 mg)	85.21 (47.10)	87.35 (52.40)	89.31 (46.50)	79.93 (53.40)	64.59 (33.50)	0.47
PA%	(41.50%)	(49.20%)	(44.40%)	(28.40%)	(29%)	
<sup>d</sup> Food group serving/day Mean (S.D.)						
Cereals (6-12)	7.54 (5.27)	7.85 (5.82)	7.44 (5.09)	7.08 (4.85)	7.28 (4.75)	0.63
Fruits and vegetables (3-5)	2.67 (0.93)	2.66 (.82)	2.47 (0.78)	2.78 (0.94)	2.72 (1.91)	0.40
Meat and legumes (2-4)	3.7 (1.30)	4.3 (1.70)	3.2 (1.50)	2.9 (1.30)	3.4 (1.40)	0.53
Milk and milk products (2)	2.47 (1.70)	2.36 (1.20)	2.65 (1.90)	2.32 (1.20)	2.19 (1.60)	0.22

<sup>a</sup>: One-way ANOVA; <sup>b</sup>: Dietary reference intake is based on the national research council, Institute of Medicine (2000); <sup>c</sup>: Prevalence of adequacy; <sup>d</sup>: Recommended number of serving for each food group is based on Saudi dietary guidelines

between individual food insecure and child hunger. However more than 60% of women in each group were in at risk of waist circumference category, but in individual food insecure more than half of women were in normal waist circumference category with significant differences between the groups (Table 2).

On average all women consumed 27% of calories from fat with lower mean in the food secure group (25.4%). The mean percentage of calories from carbohydrate was similar in individual and child hunger groups (58%) compared to other groups, the mean percentage of calories from protein was 14% in food secure group. More than half of all the groups had an inadequacy intake of iron and more than two third of all groups had an inadequacy intake of calcium, the mean intake of vitamin C was higher than recommended daily intake (60 mg) in all the groups with 42% inadequacy intake for all women. The recommended daily serving intakes of all food groups were adequate based on the Saudi dietary guidelines\_(MOH, 2013) only fruit and vegetable group was inadequate (two serving). No significant difference was observed between the groups (Table 3). More than half of all the groups had an inadequacy intake of iron and more than two third of all groups had an inadequacy intake of calcium, the mean intake of vitamin C was higher than recommended daily intake (60 mg) in all the groups with 42% inadequacy intake for all women (Table 3).

## DISCUSSION

Approximately two third (57.2%) of the women in the present study were food insecure. Several studies were almost similar to our findings, (Kaiser *et al.*, 2004; Shariff and Khor, 2005; Martin and Ferris, 2007). However, this prevalence is considerably higher than that found for 290 women in Trinidad (26%) (Gulliford *et al.*, 2003) and for 500 Jordanian women (32%) (Bawadi *et al.*, 2012). That due to these women had more years of education and employed. In the present study, only nine women had university degree eight of them were in food secure group and more than 90% of women didn't work. In our study we found the prevalence of individual food insecure was the lowest percentage (12%) compared to household food insecure (21%) and child hunger (24%) that could be under reporting, while women may not report the truth as they may be embarrassed to answer three questions that are directly related to them. However, we find a significant difference between the groups for household income with the lowest income in child hunger group, the findings are supported by several studies in developed and developing countries that found income is an important determinant of household food insecurity (Bawadi *et al.*, 2012; Bhattacharya *et al.*, 2004), other studies reported a significant association between marital status and food (Gulliford *et al.*, 2003) and

education (Shariff and Khor, 2005; Bawadi *et al.*, 2012; Zalilah and Tham, 2002).

More women from the food insecure group were overweight and obese compared to food secure group. Similar to findings reported on elsewhere (Anderson, 1990; Townsend *et al.*, 2001; Hanson *et al.*, 2007; Chaput *et al.*, 2007). A study by Townsend *et al.* (2001), examined the relationship between food insecurity and overweight in US women aged 20 years or older, they found the prevalence of overweight increased as food insecurity increased. Hanson *et al.* (2007), found marginally food secure women tended to be overweight ( $p = 0.05$ ), whereas women with low food security were significantly more likely to be obese ( $p = 0.01$ ).

In addition, the percentages of women with at risk waist circumference were highest among household food insecure group (74.2%) and lowest in the individual food insecure group (47.1%). There are several reasons that maybe explain the higher prevalence of overweight, obesity and at risk waist circumference in food insecure women. Firstly, consuming low nutritional quality food (lower intake of fruit and vegetable, lower diet diversity and high in fat and sugar) may contribute to overweight, obesity and abdominal adiposity (Drewnowski and Specter, 2004). Secondly, the traditional dressing may indirectly contribute the weight status the traditional long and wide dress may hide the fatness of women and consequently reduce their motivation to lose weight (Musaiger and Qashqari, 2005).

In our study no significant difference was reported between the groups on nutrients and food groups, despite food insecure groups had higher intake from energy intake and energy from fat, protein and carbohydrate compared to the food secure group who had lower intakes. Calcium and Iron intakes were inadequate for half of women in all groups and two third of women had an inadequate intake from vitamin C, several previous studies reported similar to our findings (Tarasuk and Beaton, 1999; McIntyre *et al.*, 2003).

The mean daily intake of fruit and vegetable group was below the recommended daily intake for all women, Gulliford *et al.* (2003), found women who classified as food insecure less likely to consume fruit ( $p = 0.045$ ) and vegetables ( $p = 0.005$ ) at least 5-6 days a week compared to food secure group. Bawadi *et al.* (2012), they reported lower intake of meat, fruit and milk among food insecure group with significant difference, but no significant difference reported for other food groups. We observed that daily intake of meat and legumes group consumes more than three serving per day, also for milk and milk products group consumption was more than two serving per day and this may be because they are subsidized food items. Wheat, rice, vegetable oil and sugar are also subsidized

by the Saudi Government and these food items are available at lower cost, the low income families can buy these items easily.

The present study had some limitations. First this is a cross sectional study we cannot attribute caused or effect. Second the small sample size (n = 147) limits the generalization of the study finding to the whole women in Saudi Arabia. Third we didn't collect data on physical activity which could contribute to weight status. Fourth, although the Radimer/Cornell hunger and food insecurity instrument has been used in developed and developing countries, but in Saudi Arabia this is the first time with low income women. Fifth, there may be variation in the interpretation of the items which could lead to under or over reporting of food insecurity. Finally, women may be embarrassed to answer the questions that are related to their income and food intake (cultural shame), to overcome this problem the women were interviewed in the absence of any family member and society staff, we explained that nothing they told her would be shared with anyone. Continuing research is needed to study the association between food insecurity and nutritional status different age groups in Saudi Arabia.

#### ACKNOWLEDGMENT

The author is grateful to the women for their excellent collaboration and to all female staff at Ftat Al-Ahsa Society and Al-Ber Society.

#### REFERENCES

- Adams, E.J., L. Grummer-Strawn and G. Chavez, 2003. Food insecurity is associated with increased risk of obesity in Californian women. *J. Nutr.*, 133: 1070-1074.
- Al-Baghli, N.A., A. Al-Gamdi, K. Al-Turki, A. El-Zubaier, M. Al-Ameer and F. Al-Baghli, 2008. Overweight and obesity in eastern province of Saudi Arabia. *Saudi Med. J.*, 29: 319-325.
- Anderson, S.A., 1990. Core indicators of nutritional status for difficult-to-sample populations. *J. Nutr.*, 120: 1559-1600.
- Bawadi, H.A., R. Tayyem, A. Dwairy and A. Al-Akour, 2012. Prevalence of food insecurity among women in Northern Jordan. *J. Health Popul. Nutr.*, 30: 49-55.
- Bhattacharya, J., J. Currie and S. Haider, 2004. Poverty, food insecurity and nutritional outcome in children and adults. *J. Health Econ.*, 23: 839-862.
- Chaput, J.P., J. Gilbert and A. Tremblay, 2007. Relationship between food insecurity and body composition in Ugandans living in urban Kampala. *J. Am. Diet Assoc.*, 107: 1978-1982.
- Cochran, W.G., 1996. *Sampling Techniques*. John Wiley and Sons, Boston, USA, pp: 435.
- Dinour, L.M., D. Bergen and M. Yeh, 2007. The food insecurity-obesity paradox: a review of the literature and the role food stamps may play. *J. Am. Diet. Assoc.*, 107: 1952-1961.
- Drewnowski, A. and S. Specter, 2004. Poverty and obesity: The role of energy density and energy costs. *Am. J. Clin. Nutr.*, 79: 6-16.
- Gulliford, M.S., D. Mahabir and B. Rocke, 2003. Food insecurity, food choices and body mass index in adults: nutrition transition in Trinidad and Tobago. *Int. J. Epidemiol.*, 32: 508-516.
- Gunderson, C., B. Kreider and J. Pepper, 2011. The economics of food insecurity in the United State. *Appl. Econ. Perspect. Policy*, 33(3): 281-303.
- Hanson, K.L., J. Sobal and E. Frongillo, 2007. Gender and marital status clarify associations between food insecurity and body weight. *J. Nutr.*, 137: 1460-1465.
- Kaiser, L.L., M. Townsend, H. Melgar-Quinonez, M. Fujii and P. Crawford, 2004. Choice of instrument influences relations between food insecurity and obesity in Latino women. *Am. J. Clin. Nutr.*, 80: 1372-1378.
- Martin, K.S. and A. Ferris, 2007. Food insecurity and gender are risk factor for obesity. *J. Nutr. Educ. Behav.*, 39: 31-36.
- McIntyre, L., N. Glanvill, K. Raine, J. Dayle, B. Anderson and N. Battaglia, 2003. Do low-income lone mothers compromise their nutrition to feed their children? *Can. Med. Assoc. J.*, 168: 686-691.
- MOH (Ministry of Health), 2013. *Healthy Food Palm*. Retrieved from: <http://www.moh.gov.sa/Portal/WhatsNew/Pages/WatsNews-2013-01-14-001.aspx.pdf>.
- Musaiger, A.O. and K. Qashqari, 2005. The relation between dressing and obesity among women in Saudi Arabia. *Arab. J. Food Nutr.*, 6: 292-302.
- Olson, C.M. and M.S. Strawderman, 2008. The relationship between food insecurity and obesity in rural childbearing women. *J. Rural Health*, 24(1): 60-66.
- Radimer, K.L., C. Olson, J. Greene, C. Campbell and J. Habicht, 1992. Understanding hunger and developing indicators to assess it in women and children. *J. Nutr. Educ.*, 24: 36S-45S.
- Shariff, Z.M. and G. Khor, 2005. Obesity and household food insecurity: evidence from a sample of rural households in Malaysia. *Eur. J. Clin. Nutr.*, 59: 1049-1058.
- Stevens, C.A., 2010. Exploring food insecurity among young mothers (15-24 years). *J. Spec. Pediatr. Nurs.*, 15: 163-171.
- Tarasuk, V. and G. Beaton, 1999. Women's dietary intakes in the context of household food insecurity. *J. Nutr.*, 129: 672-679.

- Townsend, M.S., J. Peerson, B. Love, C. Achterberg and S. Murphy, 2001. Food insecurity is positively related to overweight in women. *J. Nutr.*, 131: 1738-1745.
- World Health Organization, 1998. Obesity: Preventing and managing the global epidemic. Report of a World Health Organization Consultation on Obesity, WHO, Geneva.
- Zalilah, M.S. and K. Tham, 2002. Food security and child nutritional status among orang asli (Temuan) households in Hulu Langat, Selangor. *Med. J. Mal.*, 57: 36-50.
- Zizza, C.A., P. Duffy and S. Gerrior, 2008. Food insecurity is not associated with lower energy intakes. *Obesity*, 16: 1908-1913.