

THE RELATIONSHIP BETWEEN OBESITY AND DIETARY INTAKE OF OBESE AND PRE-OBESE FEMALE STUDENTS – AJA CAMPUS HAIL UNIVERSITY

Sohair A. M. Shommo , PhD

Ibtihaj Mardi A. Aslami

Iman R. F. Al-Tamimi

Gamilah F.K. Anzi

Rana S. Al Turki

Khadija M.Al-Tamimi

Hail University, KSA

Abstract

Globally obesity has reached to epidemic proportions, and the people of the Gulf countries have also affected, especially high income, oil-producing countries. Recent data clearly indicate a high prevalence of adult obesity particularly in women in the Kingdom. This paper aims to identify the relationship between obesity and dietary intake of obese and pre-obese female students in Hail University–KSA. Descriptive analytical approach was used in this paper. BMI was calculated and related to dietary intake using food frequency questionnaire. Results shows prevalence of obesity grades was n(%); 43(43%) obesity grade I, 17(17%) obesity grade II, and 8(8%) were grade III obesity. Thirty one subjects were pre-obese and only one subject was overweight. Basic food groups consumption as stated in frequency per week revealed that: female students consumed more servings (>6 times/ week) of fruits; vegetables; and dairy products, alternatives, sweets and candies, eggs, legumes, rice macaroni and other starch foods, non-alcoholic beverages. Whereas they consumed less servings (\leq Once/week) of breads, fruit juices, carbonated drinks and potato. The majority of the subjects 65% ate chicken with rice (Kabsa) as staple food, whereas 4% ate other starchy food. High consumption of energy dense foods might be responsible for increased deposition of calories in the form adipose tissue.

Conclusion: It is crucial to enumerate awareness programs to modify dietary behavior and eating habits of female students and Hail community with respect to food intake. This will be effective in the treatment of obesity, especially in Saudi Arabia.

Keywords: Obesity, dietary intake , relationship, Saudi Arabia , Hail.

Introduction

Overweight and obesity are potent risk factors for cardiovascular diseases and type 2 diabetes and are major contributors to premature deaths.

These metabolic disorders are dramatically increasing among adults in the Eastern Mediterranean Region. Data for adults aged 15 years and older from 16 countries in the Region show the highest levels of overweight and obesity in Egypt, Bahrain, Jordan, Kuwait, Saudi Arabia and United Arab Emirates. The prevalence of overweight and obesity in these countries ranges from 74% to 86% in women and 69% to 77% in men. These data indicate a much higher prevalence of obesity among adult women, while overweight is more marked among adult men. Escalating levels of overweight and obesity among children and adolescents is of particular concern given recent evidence linking childhood and adolescent obesity to increased risk of obesity and morbidity in adulthood (WHO, 2014).

Because of these changes in dietary and lifestyle patterns, chronic NCDs including obesity, diabetes mellitus, cardiovascular disease (CVD), hypertension and stroke, and some types of cancer are becoming increasingly significant causes of disability and premature death in both developing and newly developed countries, placing additional burdens on already overtaxed national health budgets (Madani, 2000) and WHO, 2003)

Al-Othaimen et al.; 2007, had conducted a study to document the prevalence of obesity in Saudi Arabia, we used data from a cross-sectional study on 19,598 individuals in 2837 households. Body mass index, skinfold thickness and mid-arm circumference were measured. Prevalence of obesity ranged from 33.9% in Ha'il to 11.7% in Jizan. More women than men were obese, 23.6% compared to 14.2%. Prevalence of overweight was 30.7% for males and 28.4% for females. Obesity was present in all age groups. It is clear that changes must be made to the lifestyle of the Saudi population in order to reduce the prevalence of obesity.

The modernization and affluence in Saudi Arabia over the last three decades has probably caused the problems of obesity in vulnerable persons to surface (Khashoggi, 1994).

There are several factors contributing to the high incidence of obesity amongst women. Watching television and eating snacks are the main activities during their leisure time, especially when the majority of women are not employed. Excessive food intake is also responsible for obesity in the country (Madani, 1995).

The attitude towards obesity is another important factor (Musaiger, 1987).

The traditional, long, comfortable, and wide clothes worn by women prevents them from noticing the gradual gain in Weight (Musaiger, 1987).

This aim of this paper is to identify the relationship between obesity and dietary intake of obese and pre-obese female students in Hail University–KSA.

Methodology

A descriptive analytical approach was use in the methodology of this study .The study included 100 overweight female students aged 19-25 years In Aja Campus, Hail University, Hail city, Northern Region, Saudi Arabia.

The Subjects

Selected students were interviewed by a questionnaire, which included: personal, socio-economic, health, and nutrition data. Dietary intake was assessed using food frequency questionnaire. Anthropometric measurements were done.

The weight was measured using commercial bathroom scale scale “Seca, Germany” with an accuracy of ± 100 g. subjects.

Body Mass Index (BMI) = Weight (kg) / Height (m^2); was used as an indicator of obesity.

Standing body height was measured with the use of Measuring tape with the shoulder in relaxed position, free arms and bare feet to the nearest 0.5 cm. Scales were re-calibrated after each measurement, three readings were taken and average was calculated. Body mass index (BMI) was calculated “Body weight in kg/Height in meters square, we applied the cut-off points recommended by World Health Organization (WHO) reference as follows: Overweight ≥ 25.00 , pre-obesity 25.00 - 29.99, obesity ≥ 30.00 , obesity grade I 30.00 - 34.99, obesity II 35.00 - 39.99, obesity grade III ≥ 40.00 (WHO, 1995, WHO, 2000 and WHO, 2004).

Data analysis

Statistical analysis was done by the use of the program SPSS Version 16 by analyzing variables to see relationships and percentage .

Ethical considerations

Permission was obtained from the students of Hail University. Before commencing the procedures of interviewing and measurements, the students undergone a brief orientation.

Results

A total of 100 overweight female students were included with their age ranging from 18 to 29 years (mean age, 21.35 ± 1.99 years).

Mean income was 6993.45±7198.97; mean BMI was 32.42 ±4.68, it ranged between 20.82 and 43.56 (Table 1).

Table 1. Descriptive statistics of socio-demographic and anthropometric characteristics of Hail female students

	Descriptive Statistics				
	N	Minimum	Maximum	Mean	Std. Deviation
General Characteristics					
Age(years)	100	18	29	21.35	1.99
Income(SR/month)	100	3	42000	6993.45	7198.97
Family size	100	2	16	9	2.94
Food expenditure(SR/month)	100	200	20000	2281.00	2106.20
Anthropometric Measurements					
Height(cm)	100	140	174	158.18	6.10
Weight(Kg)	100	56	106	81.01	11.67
BMI (wt(kg)/Ht(m) ²)	100	20.82	43.56	32.42	4.68

Table 2. Educational level and occupation of parents of the included female students

	Education	No.	%
Father's education			
	Illiterate	6	6
	Primary	23	23
	Junior	27	27
	Senior	23	23
	University	20	20
	Postgraduate	1	1
Mother's education			
	Illiterate	36	36
	Primary	32	32
	Junior	6	6
	Senior	11	11
	University	15	15
Father's occupation			
	Governmental employee	54	54
	Merchant	22	22
	Other private business	24	24
Father's occupation			
	Governmental employee	12	12
	Other private business	2	2
	Housewife	86	86

Table 2. shows educational level and occupation of parents of the included female students. Illiteracy among mothers was six times compared to that of fathers (36 vs. 6). The highest percentage of fathers were

governmental employee, whereas most of the mothers were housewives; 54 % and 83%, respectively.

Table 3. Prevalence of Obesity among female students according to WHO Body Mass Index Indicators

Classification	No. (%)	BMI (kg/m ²)	
		Principal cut-off points	Additional cut-off points
Overweight	1(1.0)	≥25.00	≥25.00
Pre obesity	31(30.7)	25.00 - 29.99	25.00 - 27.49
			27.50 - 29.99
Obesity		≥30.00	≥30.00
			30.00 - 32.49
Obesity grade I	43(42.6)	30.00 - 34.99	32.50 - 34.99
			35.00 - 37.49
Obesity grade II	17(16.8)	35.00 - 39.99	35.00 - 37.49
Obesity grade III	8(7.8)		37.50 - 39.99
Total	100(100)		

BMI Cut-off points Source: Adapted from WHO, 1995, WHO, 2000 and WHO 2004.

Prevalence of obesity is Results shown in table 3. The highest percent was recorded for obesity grade I (43 %), 31 subjects were pre-obese, 17 were second grade obese and 8 were grade III obesity. Only one subject was overweight.

Table 4. Descriptive statistics of dietary intake of Hail female students according to food groups

Dietary intake(servings/day)	Descriptive Statistics				
	N	Minimum	Maximum	Mean	Std. Deviation
Milk and dairy products	100	.00	24.10	4.15	5.16
Meats	100	.00	17.38	3.55	3.87
Legumes	99	.00	19.28	2.91	3.57
Eggs	100	.00	9.00	1.14	2.54
Macaroni rice and other starchy foods	100	.38	28.00	6.38	6.231
Sweets(sugars, chocolates, candies, ..etc)	100	.00	38.00	9.82	8.75
Breads	100	.00	9.00	.42	1.29
potato	100	.00	1.00	.15	.26
Green leafy vegetables	98	.00	20.00	2.08	3.39
Other vegetables	100	.20	49.42	6.94	8.72
Fruits	100	.00	28.42	4.40	5.64
Fruits and vegetables	98	.20	73.62	13.48	14.88
Fruit juices	100	.00	10.00	.76	2.37
Non- alcoholic beverages	100	.00	31.00	13.13	10.63
Carbonated drinks	100	.00	10.00	.50	1.87

Descriptive statistics of dietary intake of Hail female students according to food groups and other selected obesogenic foods is revealed in Table 4. High mean intake was recorded for fruits and vegetables and nonalcoholic beverages, 13.48 and 13.13, respectively .

Table 5. Basic food groups consumption as stated in frequency per week among included female students

Food group	Frequency of Intake	
	No.	%
Green Leafy Vegetables		
≤Once/ week	11	11
2-4 times/week	13	13
5-6 times/week	5	5
>6 times/week	69	69
Milk, cheese and other dairy products		
≤Once/ week	3	3
2-4 times/week	5	5
5-6 times/week	8	8
>6 times/week	84	84
Meat and alternatives (animal protein)		
≤ Once/ Week	2	2
2-4 times/week	6	6
5-6 times/week	7	7
>6 times/week	85	85
Sweets		
≤Once/ week	3	3
2-4 times/week	5	5
5-6 times/week	3	3
>6 times/week	89	89
Eggs		
≤Once/ week	51	51
2-4 times/week	28	28
>6 times/week	21	21
Legumes		
≤Once/ week	2	2
2-4 times/week	10	10
5-6 times/week	3	3
>6 times/week	84	84
Macaroni and other cereal foods		
2-4 times/week	5	5
5-6 times/week	6	6
>6 times/week	89	89
Fruits and vegetables		
2-4 times/week	1	1
5-6 times/week	2	2
>6 times/week	95	95
Fruits		

≤Once/ week	3	3
2-4 times/week	2	2
5-6 times/week	9	9
>6 times/week	86	86
Other vegetables		
2-4 times/week	4	4
5-6 times/week	5	5
>6 times/week	91	91
Potato		
≤Once/ week	79	79
2-4 times/week	15	15
>6 /Week	6	6
Carbonated Drinks		
≤Once/ week	84	84
2-4 times/week	3	3
>6 times/week	13	13
Fruit juices		
≤Once/ week	81	81
2-4 times/week	4	4
>6 times/week	15	15
Non-alcoholic beverages		
≤Once/ week	3	3
2-4 times/week	2	2
5-6 times/week	1	1
>6 times/week	94	94
Breads		
≤Once/ week	69	69
2-4 times/week	12	12
5-6 times/week	2	2
>6 times/week	17	17

Table 6. Basic food groups consumption as stated in frequency per week among included female students distribution according to their BMI classification

Food group	BMI classification			Total
	Overweight & preobese	Obese		
Green Leafy Vegetables				
≤Once/ week	1	5		11
2-4 times/week	1	1		13
		2		
5-6 times/week	2	3		5
>6 times/week	23	4		69
		6		
Milk, cheese and other dairy products				
≤Once/ week	1	2		3
2-4 times/week	1	4		5
5-6 times/week	3	5		8
>6 times/week	27	5		84
		7		

Meat and alternatives (animal protein)					
≤ Once/ Week	0	(0.0)	2	(100.0)	2
2-4 times/week	4	(66.7)	2	(33.3)	6
5-6 times/week	3	(42.9)	4	(57.1)	7
>6 times/week	25	(29.4)	6	(70.6)	85
			0		
Legumes					
≤Once/ week	0	(0.0)	2	(100.0)	2
2-4 times/week	3	(30.0)	7	(70.0)	10
5-6 times/week	0	0.0	3	(100.0)	3
>6 times/week	28	(33.3)	56	(66.7)	84
Macaroni and other cereal foods					
2-4 times/week	3	(60.0)	2	(40.0)	5
5-6 times/week	1	(16.7)	5	(83.3)	6
>6 times/week	28	(31.5)	6	(68.5)	89
			1		
Fruits					
≤Once/ week	1	(33.3)	2	(66.7)	3
2-4 times/week	0	0.0	2	(100.0)	2
5-6 times/week	1	(11.1)	8	(88.9)	9
>6 times/week	30	(34.9)	5	(65.1)	86
			6		
Other vegetables					
2-4 times/week	1	(25.0)	3	(75.0)	4
5-6 times/week	1	(20.0)	4	(80.0)	5
>6 times/week	30	(33.0)	6	(67.0)	91
			1		
Breads					
≤Once/ week	22	(31.9)	4	(68.1)	69
			7		
2-4 times/week	6	(50.0)	6	(50.0)	12
5-6 times/week	1	(50.0)	1	(50.0)	2
>6 times/week	3	(17.6)	1	(82.4)	17
			4		

Dietary intake of the included students was measured as frequency of eating ≤Once/ week, 2-4 times/week, 5-6 times/week and >6 times/week. Basic food groups consumption as stated in frequency per week in the questionnaire revealed that: female students consumed more servings (>6 times/ week) of fruits; vegetables; and dairy products, including milk, alternatives , sweets and candies, eggs, legumes, rice macaroni and other starch foods, non-alcoholic beverages. Whereas they consumed less servings (≤Once/ week) of breads, fruit juices, carbonated drinks and potato (Table 5).

Comparison of intake of basic food groups(Table 6) and selected foods items(Table 7) as servings per week) in students and its association with their BMI classification was shown in(Table 6 and Table 7) . Moreover, the frequency of eating selected food groups revealed that obese, pre-obese, and overweight students frequently consumed milk and dairy

products, green leafy vegetables, meat and alternatives(animal protein), sweets / candies, legumes, macaroni and other starchy food, fruits, other vegetables, and non- alcoholic beverages, while less frequently consumed eggs, potato, carbonated drinks, fruit juices, and breads.

Table 7. Obesogenic foods consumption as stated in frequency per week among included female students distribution according to their BMI classification

Food group	BMI classification				Total
	Overweight and preobese		Obese		
Sweets and Candies					
≤Once/ week	2	(66.7)	3	(33.3)	3
2-4 times/week	2	(40.0)	3	(60.0)	5
5-6 times/week	1	(33.3)	2	(66.7)	3
>6 times/week	27	(30.3)	62	(69.7)	89
Eggs					
≤Once/ Week	18	(35.3)	33	(64.7)	51
2-4 times/week	6	(21.4)	22	(78.6)	28
>6 times/week	8	(38.1)	13	(61.9)	21
Potato					
≤Once/ week	27	(34.2)	52	(65.8)	79
2-4 times/week	4	(26.7)	11	(73.3)	15
>6 /Week	1	(16.7)	5	(83.3)	6
Carbonated Drinks					
≤Once/ week	30	(35.7)	54	(64.3)	84
2-4 times/week	0	(0.0)	3	(100.0)	3
>6 times/week	2	(15.4)	11	(84.6)	13
Fruit juices					
≤Once/ week	28	(34.6)	53	(65.4)	81
2-4 times/week	0	(0.0)	4	(100.0)	4
>6 times/week	4	(26.7)	11	(73.3)	15
Non-alcoholic beverages					
≤Once/ week	2	(66.7)	1	(33.3)	3
2-4 times/week	0	(0.0)	2	(100.0)	2
5-6 times/week	0	(0.0)	1	(100.0)	1
>6 times/week	30	(31.9)	64	(68.1)	94

Table 8. Source of Nutrition Education of female students

Source of Nutrition Education	No.	Percent(%)
Doctor	12	15.6
Nutritionist	20	26.0
others	45	58.4
Total	77	100.0

Table 8 shows source of nutrition education of female students. Only twenty subjects $n(\%)$, 20 (26.0%) were by educated by nutritionist, 20 (26.0%) were educated by doctors , the highest number of subjects 45(58.4%) were educated by other paramedicals .

Table 9. Staple food of female students distribution

Staple food	No.	Percent(%)
Varied	4	4.0
Chicken Kabsa	65	65.0
Meat Kabsa	16	16.0
Other meals	15	15.0
Total	100	100.0

Staple food of female students is shown in Table 9. Results reveals that 65% eat Chicken Kabsa 65 (65.0%), Meat Kabsa 16(16.0%), Other meals 15(15.0%) mostly were fast foods outside the home, and only 4(4.0%)ate varied staple food(rice ,bread and other starchy food)

Discussion

Globally obesity has reached to epidemic proportions, and the people of the Gulf countries have also affected, especially high-income, oil-producing countries. The prevalence of obesity in Gulf Countries among children and adolescents ranges from 5% to 14% in males and from 3% to 18% in females. In adult females there is a significant increase of obesity with a prevalence of 2%-55% and in adult males 1%-30% in countries of gulf region(ALNohair, 2014). The available data indicate that the prevalence of adult obesity in the Kingdom is high, and affects women in particular (WHO, 2014; Madani, 2000; WHO, 2003; Al-Othaimen et al., 2007; (Ogbeide, et al.;1996, Binhemd, et al.;1991, Al-Attas et al.;1990, Al-Nuaim, 1997, Al-Nuaim et al.; 1996, Al-Shammari et al.; 1994).

A total of 100 overweight female students were included in our study their age ranging from 18 to 29 years, mean age, 21.35 ± 1.99 years.

Economical status in our study was measured by mean monthly income was found 6993.45 ± 7198.97 . Most of the fathers were governmental employee, whereas most of the mothers were housewives; 54 % and 83%, respectively. Income is also an important factor that can lead to obesity, especially in the Arabic-speaking oil-exporting countries. For example, meat consumption in Saudi Arabia increased by 500 % while that in other gulf states increased by 97 % during the 1973 to date. High-income families in Kuwait consume more meat, eggs, and milk than families with low incomes Al-Othaimen et al., 2007 .

In another study, Al-Nuaim et al., conducted a community-based national epidemiological household survey to estimate the prevalence of

overweight and to examine its association with the socio-demographic characteristics for 10,657 Saudi subjects aged 20 years and over. They found out that the prevalence of obesity was lower in subjects living in rural areas with traditional life-styles than those in more urbanized environments (Al-Nuaim et al.; 1996).

Economic development of Saudi Arabia during the last 3 decades has changed the nutritional and lifestyle habits;(Madani 1995) food has become more affordable to a larger number of people with the substantial decrease in the price relative to income, and the concept of food has changed from a means of nourishment to a determinant of lifestyle and a source of pleasure, coupled with physical inactivity have likely contributed to the increase in the prevalence of overweight and obesity in the children(Al-Nuaim, 1997).

There was a high record of illiteracy among mothers of subjects in this study. Illiteracy was six times compared to that of fathers (36 vs. 6). This finding goes in line with Madani, 2000, who found out that the nutritional problems in Saudi Arabia are mainly due to a change in food habits, illiteracy and ignorance, rather than a shortage of food supply or low income.

Education also plays a role in obesity prevalence since there is evidence that illiteracy increases the level of obesity in the Gulf countries (ALNohair, 2014)

Mean BMI was 32.42 ± 4.68 , it ranged between 20.82 and 43.56. Our study revealed that the combined prevalence of obesity and overweight was the highest for obesity grade I (43 %), 31 subjects pre-obese, 17 second grade obese, and 8 were grade III obesity. Only one subject was overweight. Our result was higher for obesity 99% vs. 18% but lower for overweight 1% vs. 16% than Al-Rashidi 1999 this might be attributed to our selection criteria which included .

In another study, Al-Nuaim et al. observed prevalence and pattern of overweight and obesity with age and gender is similar to those observed in the Arab community and some Western nations (Al-Nuaim et al., 1996).

Highest mean dietary intake was recorded for fruits and vegetables and nonalcoholic beverages, 13.48 and 13.13, respectively . Less frequent but still more than 6 times per week was mean intakes of macaroni rice and other starchy foods, sweets (sugars, chocolates, candies, .etc) , and other vegetables. Dietary intake of the included students was measured as frequency of eating \leq Once/ week, 2-4 times/week, 5-6 times/week and >6 times/week.

Basic food groups consumption as stated in frequency per week in the questionnaire revealed that: female students consumed more servings (>6 times/ week) of fruits; vegetables; and dairy products, including milk, alternatives , sweets and candies, eggs, legumes, rice macaroni and other

starch foods, non-alcoholic beverages. Whereas they consumed less servings (\leq Once/ week) of breads, fruit juices, carbonated drinks and potato.

Our results reveal high consumption of energy dense foods which is responsible for increased deposition of calories in the form adipose tissue.

Our results agree with Gillis and Bar, 2003 reported that obese children and adolescents consume significantly more servings of meat and alternatives, grain products, fast foods, sweetened soft drinks and potato chips, which contribute to increased deposition of calories, fat and sugar intake than that in non-obese children and adolescents. Our results go in line with Amin et al., 2008 who found in their study that obese and overweight students more frequently consumed meat and alternatives, soft drinks, sweets/candy and potato chips and less frequently consumed milk and dairy products those in the lean group; however, both groups consumed less fruits and vegetables, which was considerably less among the students in the obese group.

Another study agrees with our findings ALNohair, 2014, reported that traditional dependence on locally grown natural products such as dates, vegetables, wheat and has also shifted.

On the contrary to our results another cross sectional study on obesity and eating habits among college students in Saudi Arabia: a study by Al-Rethaiaa et al., 2010 who found out that with the exception of dates which are taken at least three times weekly by 60.5% of students, vegetables and fruits were not frequently consumed. In fact the percentage of students who rarely eat vegetables and fruits were respectively 32.2 and 36.1, and those who eat them once or twice per week were 32.2% and 40.3%.

Different from our findings are other studies (Manson & Bassuk, 2003; Merchant et al.; 2007) have reported that overweight and obese children consumed more fats and less vegetables, fruits, legumes and dairy products.

Results shows 77% of the subjects received some sort of nutrition education despite their being pre-obese and obese, but more than 50% ; 45(58.4%) were from paramedicals and not nutritionist that. Only twenty subjects $n(\%)$, 20 (26.0%) were by educated by nutritionist. Although they were educated but not from specialized person. This might justify being obese and pre-obese.

Chicken Kabsa was the mostly (65%) consumed staple food –it is a traditional Saudi food from rice and chicken serving of 200g caloric content is about 356 Kcal(Musaiger & Al-Othiameen, 1988). Only 4(4.0%) ate varied staple food(rice, bread and other starchy food). Other meals mostly were fast foods outside the home or delivery encountered for 15.0%. Such food habits might play an important role of in incidence of obesity and increased weight in our subject.

Conclusion

High consumption of energy dense foods might be responsible for increased deposition of calories in the form adipose tissue. Change in dietary habits toward those practiced in Western communities,

It is crucial to enumerate awareness programs to modify dietary behavior and eating habits of female students and Hail community with respect to food intake. This will be effective in the treatment of obesity, especially in Saudi Arabia. It is also essential for all people to eat a balanced diet which will provide the dietary requirements of all nutrients. Perhaps behavior modification with respect to food intake, will be effective in the treatment of obesity, especially in Saudi Arabia. Physical activity should be greatly encouraged as an important strategy directed towards weight reduction in the obese, as well as prevention of obesity in the Saudi Arabia

References:

- Al-Attas OS, Laajam MA, Khan MS, et al.,(1990). *Obesity and major metabolic Indices in newly diagnosed Saudi diabetic patients*. Trop Geogr Med;42:140-5.
- Al-Dossary, S. S., Sarkis, P.E. , Hassan, A., M. Ezz El Regal, M. and Fouda, A. E.(2010). *Obesity in Saudi children: a dangerous reality*. EMHJ; 16 (9):1003-8.
- ALNohair, S. (2014).*Obesity in gulf countries*. Int J Health Sci (Qassim). Jan;8(1):79-83. <http://www.ncbi.nlm.nih.gov/pubmed/24899882>
- Al-Nuaim A, Al-Rubeaan K, Al-Mazrou, et al. (1996). *High prevalence of Overweight and obesity in Saudi Arabia*. Inter J Obesity; 20:547-52.
- Al-Nuaim A. (1997). *Population – based epidemiological study of the prevalence of overweight and obesity in Saudi Arabia, regional variation*. Ann Saudi Med;17:195-9.
- Al-Othaimen, A. I., Al-Nozha, M., Osman, A. K. (2007). *Obesity: an emerging problem in Saudi Arabia. Analysis of data from the National Nutrition Survey*. East Mediterr Health J, vol.13, no.2, pp 441-8. Mar-Apr.
- Al-Rashidi AE (1999). *Studying the effect of social level and food habits on the increasing number of overweight and obese female students of home economics and art education college*. General Presidency of Girls College, Home Economics and Art Education, Girls College, Jeddah, Saudi Arabia, (unpublished M.Sc.thesis).
- Al-Rethaiaa, A. S., Fahmy, A. A., and Al-Shwaiyat, N. M. (2010). *Obesity and eating habits among college students in Saudi Arabia: a cross sectional study*. Nutrition Journal; 9:39
- Al-Shammari A, Khoja TA, Al-Maatoug MA, et al. (1994). *High prevalence of Clinical obesity among Saudi females: a prospective cross-sectional study in the Riyadh region*. J Trop Med Hygiene;97:183-8.

Amin, T.T., Al-Sultan AI, Ayub A. (2008) *Overweight and obesity and their relation to dietary habits and socio-demographic characteristics among male primary school children in Al-Hassa, Kingdom of Saudi Arabia*. Eur J Nutr 47:310–318. DOI 10.1007/s00394-008-0727-6

Available at :

Available at: <http://www.nutritionj.com/contents/6/1/1>

Binhemd, T., Larbi, E.B., Absood, G. (1991). *Obesity in primary health care centres: a study*. Ann Saudi Med;11:163-6.

doi:10.1186/1475-2891-9-39.

Gillis, L. J., Bar-Or O. (2003). *Food away from home, sugar-sweetened drink consumption and juvenile obesity*. J Am Coll Nutr 22(6):539–545.

<http://www.emro.who.int/health-topics/obesity/> Accessed 21-7-2014

Khashoggi, R., Madani, K., Ghaznawi, H. et al.; (1994). *Socioeconomic factors affecting prevalence of obesity among adult females in Saudi Arabia*. Ecol Food Nut;(9)31:277-83.

Madani, K. A. (1995). Food consumption patterns in Saudi Arabia. In: Musaiger, A. O., Miladi, S.S. , eds. *Food Consumption Patterns and Dietary Habits in the Arab Countries of the Gulf*.(pp.50-58) FAO/ RNEA, Cairo: Egypt.

Madani, K. A. (2000). *Obesity in Saudi Arabia*. Bahrain Medical Bulletin, Vol. 22, No. 3, September.

Manson, J.E., Bassuk, S.S. (2003). *Obesity in the United States. A fresh look at its high toll*. JAMA 289:229–230.

Merchant, A.T., Dehghan, M., Cook, D.B., Anad, S.S. (2007). *Diet, physical activity, and adiposity in children in poor and rich neighborhoods: a cross-sectional comparison*. Nutr J 6:1.

Musaiger, A.O. (1987). *The state of food and nutrition in the Arabian Gulf Countries*. Wld Rev Nutr; 54:105-73.

Musaiger, A. O. and Al-Othiameen, A. E. (1988). *Traditional Dishes in Bahrain and Saudi Arabia*. Arab Printing and Publishing House, Bahrain. 100 pp. (in Arabic).

Ogbeide, D.O., Bamgboye, E.A., Karim, A. et al. (1996). *The prevalence of overweight and obesity and its correlation with chronic diseases in Al-Kharj adult outpatients, Saudi Arabia*. Saudi Med J;17:327-32.

Rockett, H. R. , Wolf, A. M. , Colditz, G.A. (1995). *Development and reproducibility of a food frequency questionnaire to assess diets of older children and adolescent*. J Am Diet Assoc 95:336– 340

Triches, R. M. , Giugliani, E. R. J. (2005). *Obesity, eating habits, and nutritional knowledge among school children*. Rev Saude Publica 39(4):1–7.

WHO expert consultation(2004). *Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies*. The Lancet ; 157-163.

WHO (1995). *Physical status: the use and interpretation of anthropometry*. Report of a WHO Expert Committee. WHO Technical Report Series 854. Geneva: World Health Organization.

WHO (2000). *Obesity: preventing and managing the global epidemic*. Report of a WHO Consultation. WHO Technical Report Series 894. Geneva: World Health Organization.

WHO (2014). Health topics: *Obesity*.

World Health Organization (WHO) (2003). *Diet, Nutrition and Chronic Disease*. WHO Technical Report Series no. 916; WHO Geneva.