International Research Journal of Basic and Clinical Studies Vol. 2(1) pp.1-8, January 2014
DOI: http:/dx.doi.org/10.14303/irjbcs.2014.015
Available online http://www.interesjournals.org/IRJBCS

Full Length Research Paper

Studying the pattern of food meals and prevalence of overweight, Obesity and its related diseases among Saudi population in Makkah and Jeda Regions

[*1]Amr A Rezq, [1]Aml F Elgazar, [2]Mona F Masoud

[1]*Department of Clinical Nutrition, College of Applied Medical Sciences, Um Al-Qura University.
[2]Department of Food and Nutrition, College of Home Economics, King Abdul Aziz University, King of Saudi Arabia.

***Corresponding author: Email:** dr.amr_rezq@yahoo.com

ABSTRACT

Overweight and obesity is a result of positive energy balance over an extended period of time, where energy intake exceeds energy expenditure. The present investigation aimed to study the pattern of food meals, prevalence rate of overweight and obesity and its related diseases among population in Makkah and Jada regions, KSA. A cross sectional study was conducted to achieve the present study. A total number (400 subjects) of both genders were participated in the study, while 300 subjects was response. Interviewer questionnaire, anthropometric measurements, dietary assessment was used for data collection. Results indicated that BMI, body fat (%), visceral fat (%), abdominal, waist and hip circumference were higher in females than that of males. Overweight and obesity subjects were higher in age from 20 to 30 years. Overweight and obese subjects had higher rate of heart, high blood pressure, diabetes millets, arthritis and respiratory diseases as compared to those of non- overweight or obese subjects. The higher rate of these diseases was found in obese subjects. Consumption of snack food per day and fast food per week was higher in overweight and obese subjects. Overweight and obese females and male had increased in macronutrients and total caloric intakes as compared to that of non-overweight or obese. Collectively, Overweight and obesity was higher among aged group of 20 to 30 years and females than that of males. Higher rates of heart, high blood pressure, diabetes millets, arthritis and respiratory diseases were found in overweight and obese subjects.

Keywords: Obesity-Overweight-Anthropometric measurements.

INTRODUCTION

Overweight refers to an excessive amount of body weight that may come from muscles, bone, adipose tissue, and water. Obesity specifically refers to an excessive amount of adipose tissue (WHO, 2000). Overweight is defined as having a BMI (weight in kg/height in m^2) of 25 to 29.9.A BMI of 20 to 24.9 is considered normal weight, and a BMI under 20 is considered underweight. Obesity is defined as having a body mass index of 30 or more. Morbid obesity is defined as having a BMI of 40 or more (Haslam et al., 2005).

Overweight and obesity is a result of positive energy balance over an extended period of time, where energy intake exceeds energy expenditure. While, there are specific genetic disorders that give rise to overweight and obesity, recent epidemiological trends indicate that the rise in overweight and obesity is a result of environmental and behavioral changes. Overweight and obesity are the most common nutritional disorder in the developed countries and is assuming a significant proportion in the developing countries. The etiology of obesity is complex and multifactorial, both genetic and environmental factors play an important role in its development (National Institutes of Health, 1998).

The prevalence of obesity varies in different populations and further variations depend on age and sex (Schneider, 2000). According to the World Health Organization (2008) who revealed that 1.5 billion adults and older, were overweight. Of these over 200 million men and nearly 300 million women were obese worldwide. Obesity increases the risk of chronic diseases such as diabetes mellitus, cardiovascular disease, stroke and some cancers. It is a serious public health problem

that is growing in countries with low or middle income. In Arab Gulf countries, chronic diseases such as diabetes, hypertension and cardiovascular diseases are major causes of morbidity and mortality among adults (Musaiger and Miladi, 1996). In Saudi Arabia, Al-Attas et al. (1990) found that obesity was associated with insulin resistance and impaired lipid metabolism. Therefore, the present study aimed to investigate the pattern of food meals and the prevalence of overweight and obesity and its related diseases among population in Makkah region, KSA.

SUBJECTS AND METHODS

SUBJECTS

A cross sectional study was conducted in Makkah and Jeda regions. A total number (400 subjects) of males and females aged 20-45 years are participated in the present study. All of the participants were Saudi of the Arabian ethnicity and were chosen by the stratified random sampling method. The number response among participants was 300 subjects.

METHODS

Data collection

In the first, the participants were informed about aim of the study and were given instructions on how to fill out the questionnaire completely and truthfully. Interviewer-administrated questionnaire, anthropometric measurements, dietary assessment was used for data collection.

Questionnaire

The questionnaire was designed to study socioeconomic characteristics including, medical history and life style as described by (Yahia et al., 2008) with some modification according to the data collection.

Anthropometric measurements:

Anthropometric measurements including height, weight, body mass index (BMI), body fat percent (BF %), and visceral fat level (VFL), were conducted. Weight, BMI, BF%, and VFL were determined using a bioelectrical impedance analysis (BIA) device: Omron body composition monitors (BF500, Omron Healthcare Co. Ltd., Kyoto, Japan) (Bosy-Westphal et al., 2008).

Digital Physician Scale (MDW-250L, Adam Equipment Co. Ltd., UK) was used for measuring height, where students were asked to take off their shoes and socks and stand straight, with the head in the Frankfurt plane, feet together, knees straight, and heels, buttocks, and shoulder blades are in contact with the vertical surface of the scale (Gibson, 1993).

Body mass index (BMI), which is the ratio of weight in kilogram to height in meter square, was used to assess body weight status. According to the National Institutes of Health (NIH), adults were classified based on their BMI to underweight (BMI < 18.5), normal (BMI = 18.5- 24.9), overweight (BMI = 25-29.9), or obese (BMI ≥ 30) (National Institutes of Health, 1998).

Dietary assessment

A dietary recall is a retrospective method of dietary assessment where an individual is interviewed about their food and beverage consumption during a defined period of time. In 24 hour recall, participants were asked to recall foods and beverage they consumed in the twenty-four hours prior to the interview. Nutritional information from twenty-four hour diet recalls is best analyzed by using a computer-based nutritional assessment program as described by (Brustad et al., 2003).

Food frequency was designed as described by (Cade et al., 2002) with some modification to assess habitual diet by asking about the frequency with which food items or specific food groups was consumed over a reference period (week-month).

Statistical Analysis

Statistical analysis was performed by using computer program statistical package for social science (SPSS. All obtained results were tabulated). Statistical analysis has been achieved using IMB-P-C computer by SPSS, program version 16.0. Universal analysis was conducted using analysis of variance for continuous variable and person's Chi- square test or T-test and ANOVA test for categorical variables. $P < 0.05$ values were considered to be statistically significant**.**

RESULTS

Anthropometric measurements

Results of anthropometric measurements in non-overweight or obese, overweight and obese are recorded in Table 1. It illustrated that there was no significant differences at $p<0.05$ in height among non-overweight or obese, overweight and obese females and males.

Obese females and males had significant increase in actual body weight (kg), BMI (kg/m^2), body fat (%), visceral fat (%), abdominal circumference (cm), waist circumference (cm) and hip circumference (cm) as compared to non- overweight or obese and overweight individuals. Mean ± SE values of the percentage of body muscle were significant increase in non-overweight or

Table 1. Anthropometric measurements
(n=300 subjects)

Measurements	Parameters as Mean ± SE	
	Female	Male
Height (cm):		
- Non overweight or non-obese.	157.36±0.59	170.47 ±1.65
- Overweight.	158.20 ±0.70	170.36 ±0.97
- Obese.	156.94 ± 0.69	167.75 ±1.29
Actual weight (kg):		
- Non overweight or non-obese.	52.94 ±0.75 [c]	66.52 ±1.37 [c]
- Overweight.	67.37 ±0.83 [b]	76.14 ± 1.39 [b]
- Obese.	86.51 ± 1.41[a]	97.81 ±3.74 [a]
BMI (kg/m^2):		
- Non overweight or non-obese.	21.13 ± 0.24 [c]	22.70 ± 0.28 [c]
- Overweight.	27.00 ± 0.15 [b]	26.55 ±0.24 [b]
- Obese.	35.16 ± 0.53 [a]	34.80 ± 0.90 [a]
Body fat (%):		
- Non overweight or non-obese.	31.56 ±0.76 [c]	23.39 ± 0.92 [c]
- Overweight.	39.96 ±0.74 [b]	27.63 ± 1.15 [b]
- Obese.	50.38 ±0.71 [a]	37.87 ± 1.08 [a]
Visceral fat (%):		
- Non overweight or non-obese.	9.59 ± 1.90 [b]	4.28 ±0.42 [c]
- Overweight.	8.45 ± 0.70 [b]	6.00 ±0.30 [b]
- Obese.	15.54 ± 1.55 [a]	9.19 ± 0.35 [a]
Body muscle (%):		
- Non overweight or non-obese.	25.40 ±0.37 [a]	36.77 ± 0.84 [a]
- Overweight.	22.88 ±0.41 [b]	34.62 ± 0.84 [a]
- Obese.	21.80 ±0.38 [c]	28.51 ± 0 .90 [b]
Abdominal circumference (cm):		
- Non overweight or non-obese.	85.15 ± 2.27 [b]	83.86 ±1.01 [c]
- Overweight.	90.55 ± 2.74 [b]	91.05 ± 1.92 [b]
- Obese.	108.71 ± 3.01 [a]	106.43 ± 1.91[a]
Waist circumference (cm):		
- Non overweight or non-obese.	82.73 ± 1.92 [b]	69.45 ±0.72 [c]
- Overweight.	86.25 ± 2.14 [b]	75.75 ±2.27 [b]
- Obese.	106.61 ± 3.32 [a]	92.16 ±1.69 [a]
Hip circumference (cm):		
- Non overweight or non-obese.	96.71 ±1.24 [c]	89.18 ± 2.67 [c]
- Overweight.	102.24 ±2.23 [b]	97.77 ± 1.87 [b]
- Obese.	115.93 ±1.42 [a]	114.89 ± 2.27 [a]

The different letters mean that the mean difference is significant at the 0.05 level in the same column.
SE: stander error

obese subjects as compared to that of the overweight and obese.

Mean values of height, actual weight, BMI, body fat (%), visceral fat (%), and abdominal, waist and hip circumferences, were higher in non-overweight or overweight and obese females as compared to that of males, except abdominal circumference was lower in overweight females than that of males.

Prevalence of overweight and obesity categorized by age

Tabulated results of prevalence of overweight and obesity categorized by age indicated that the prevalence of overweight and obesity in the total population was significantly increase ($p<0.05$) in age from 20 to 30 years as compared to other age categories as showed in Table 2.

Prevalence of diseases related to overweight and obese subjects

As shown in Table 3, data indicated that overweight and obese subjects had higher rate of heart, high blood pressure, diabetes millets, arthritis and respiratory diseases as compared to those of non- overweight or obese subjects. The prevalence rate of these diseases was higher in obese subjects as compared to that of overweight subjects.

Meals pattern

Results of meals pattern in non- overweight or obese, overweight and obese persons are founded in Table 4. It illustrated that there were no significant differences with regard to meal numbers per day. The lowest number of meals per day (two meals) was eating by 13.7% and

Table 2. Prevalence of overweight and obesity categorized by age **(n=300 subjects)**

Categories	Age groups (years)						Total	%	*P* values
	20-30		31- 40		41 - 45				
	*No	%	No	%	No	%			
Non-overweight or obese	80.00	26.67	19.00	6.33	7.00	2.33	106.0	35.33	0.00
Overweight	53.00	17.67	26.00	8.67	15.00	5.00	94.00	31.34	
Obese	44.00	14.67	36.00	12.00	20.00	6.67	100.00	33.34	
Total	177.00	59.00	81.00	27.00	42.00	14.00	300	100.0	

The mean difference is significant at the 0.05 level in the same row.
*Number of males and females investigated.

Table 3. Prevalence of diseases related to overweight and obesity **(n=299 subjects)**

Diseases	Non-overweight or obese		Overweight		Obese		Total	%	*P* values
	No	%	No	%	No	%			
Heart diseases									
- Yes	0.00	0.00	4.00	1.34	13.00	4.35	17.00	5.69	0.00
- No	106.0	35.45	89.00	29.76	87.00	29.1	282.00	94.31	
Total	106.0	35.45	93.00	31.10	100.0	33.45	299.00	100.0	
High blood presser									
- Yes	3.00	1.00	5.00	1.67	23.00	7.70	31.00	10.37	0.00
- No	103.0	34.45	88.00	29.43	77.00	25.75	268.00	89.63	
Total	106.0	35.45	93.00	31.10	100.0	33.45	299.00	100.0	
Diabetes millets									
- Yes	1.00	0.33	5.00	1.67	12.00	4.01	18.00	6.01	0.01
- No	105.0	35.12	88.00	29.43	88.00	29.43	282.00	93.98	
Total	106.0	35.45	93.00	31.10	100.0	33.44	299.00	100.0	
Arthritis.									
- Yes	4.00	1.34	19.00	6.35	29.00	9.70	52.00	17.39	0.00
- No	102.0	34.11	74.00	24.75	71.00	23.75	247.00	82.61	
Total	106.0	35.45	93.00	31.10	100.0	33.45	299.00	100.0	
Respiratory diseases:									
- Yes	1.00	0.33	4.00	1.34	14.00	4.68	19.00	6.35	0.00
- No	105.0	35.12	89.00	29.77	86.00	28.76	280.00	93.65	
Total	106.0	35.45	93.00	31.11	100	33.44	299.00	100	

The mean difference is significant at the 0.05 level in the same row.
*Number of males and females.
Some individuals some people did not give an answer

14.00% overweight and obese, respectively as compared to 17.30% non- overweight or obese subjects. Eating the three meals per day was found to be some extant in all subjects. In contrast, eating more than three meals per day was higher in overweight and obese subjects as compared to those eat by non- overweight or obese subjects.

Finally, overweight and obese subjects eating three meals per day were higher than that eating two or three meals per day.

Data also indicated that 11.00% overweight and obese subjects eat breakfast as compared to9.00% non-overweight or obese subjects. In contrast, 19.30 % non-overweight or obese subjects was eat lunch as compared to 19.00% and 15.70% of overweight and obese, respectively. Percent of total number of obese subjects (9.70%) consumed dinner, which was higher than those of non- overweight or obese and overweight subjects (9.00% and 5.30%, respectively).

With regard to the number of snack foods, data showed that there were significant differences with regard to the frequencies of eat snack foods. The higher percent 7.70 and 16.70% non-overweight or obese doesn't and eat only one of snack food, respectively compared to

Table 4: Meals pattern in non- overweight or obese, overweight and obese subjects
(n=300 subjects)

Meals	Non-overweight or obese		Overweight		Obese		Total	%	*P* values
	No*	%	No*	%	No*	%			
Meal numbers:									
- Two.	52.00	17.30	41.00	13.70	42.00	14.00	135.00	45.00	
- Three.	44.00	14.70	44.00	14.70	45.00	15.00	133.00	44.40	0.79
- > three	10.00	3.30	9.00	3.00	13.00	4.30	32.00	10.60	
Total	106	35.30	94.00	31.40	100	33.30	300.00	100	
Eat Breakfast:									
- Yes	27.00	9.00	33.00	11.00	33.00	11.00	93.00	31.00	
- No	79.00	26.30	61.00	20.40	67.00	22.30	207.00	69.00	0.81
Total	106	35.30	94.00	31.40	100	33.3	300.00	100	
Eat lunch:									
- Yes	58.00	19.30	57.00	19.00	47.00	15.70	162.00	54.00	
- No	48.00	16.00	37.00	12.30	53.00	17.70	138.00	46.00	0.16
Total	106	35.30	94.00	31.30	100	33.40	300.00	100	
Eat dinner:									
- Yes	27.00	9.00	16.00	5.30	29.00	9.70	72.00	24.00	
- No	79.00	26.30	78.00	26.00	71.00	23.70	228.00	76.00	0.14
Total	106	35.30	94	31.30	100	33.40	300.00	100	
Number of snack food/day:									
- None.	23.00	7.70	9.00	3.00	9.00	3.00	41.00	13.70	
- Once.	50.00	16.70	42.00	14.00	35.00	11.70	127.00	42.40	
- Twice.	30.00	10.00	30.00	10.00	34.00	11.30	94.00	31.30	0.00
- > two times.	3.00	1.00	13.00	4.30	22.00	7.30	38.00	12.60	
Total	106	35.40	94	31.30	100	33.30	300.00	100	
Number of fast food/week:									
- None.									
- Once.	38.00	12.67	16.00	5.30	17.00	5.67	71.00	23.60	
- Twice.	62.00	20.67	56.00	18.67	53.00	17.67	171.00	57.10	
- Three times.	5.00	1.67	13.00	4.30	14.00	4.67	32.00	10.60	0.00
- > three times.	1.00	0.33	6.00	2.00	10.00	3.33	17.00	5.70	
	0.00	0.00	3.00	1.00	6.00	2.00	9.00	3.00	
Total	106.0	35.34	94.00	31.33	100.0	33.33	300.00	100	

The mean difference is significant at the 0.05 level in the same row.

3.00% don't consume and 14.00 and 11.70% eat only one snack of overweight and obese subjects, respectively. The higher consumption of twice or more than two snack food per day was found in overweight and obese subjects.

Tabulated data indicated that there were significant differences with regard to consumption of fast foods. It revealed that 18.67 and 17.67% overweight and obese subjects respectively consumed once fast foods per week, which was lower than that of non-overweight or obese subjects. Overweight and obese subjects consumed once, twice, three times or more of fast foods were higher compared to that of non-overweight or obese subjects.

Macronutrients and total calories intake

Data of macronutrients and total calories intakes are presented in Table 5. It indicated that overweight and obese females had significant increased ($p<0.05$) in total carbohydrate, fat, animal and plant proteins and total calories intakes as compared to that intakes by non-overweight or obese females. There was no significant difference in total carbohydrate, fat, and animal and plant

Table 5. Intake of macronutrients and total calories
(n=300 subjects)

Nutrients	Subjects	Parameters as Mean ± SE	
		Females	**Males**
Carbohydrate (g)		b	
	- Non-overweight or obese.	172.41± 7.51	265.85± 6.18
		a	
	- Overweight.	212.25 ± 8.03	277.73± 9.89
		a	
	- Obese.	242.24±11.83	282.30± 11.62
Fat (g)		b	b
	- Non-overweight or obese.	48.98 ± 2.82	77.40± 22.05
		a	ab
	- Overweight.	68.07± 3.59	98.59 ± 26.28
		a	a
	- Obese	79.77± 5.56	116.93± 14.11
Animal protein (g)		b	b
	- Non-overweight or obese.	29.47 ± 2.73	50.84± 6.78
		a	a
	- Overweight.	44.90 ± 4.98	74.14± 4.84
		a	ab
	- Obese	43.79 ± 3.94	59.04± 8.10
Plant protein (g)		b	ab
	- Non-overweight or obese.	20.05 ± 1.41	33.82 ± 5.27
		a	b
	- Overweight.	28.71 ± 2.36	23.19± 2.64
		a	a
	- Obese	27.70 ± 2.14	38.37 ± 4.21
Calories intake (Kcal)		c	b
	- Non-overweight or obese.	1294.00 ± 54.72	2028.30 ± 1.54
		b	ab
	- Overweight.	1716.20 ± 57.48	2400.30 ± 1.74
		a	a
	- Obese	2012.70 ± 89.32	2585.80 ± 1.51

The different letters mean that the mean difference is significant at the 0.05 level in the same column.
SE: stander error.

proteins intakes between overweight and obese females, while obese females had significant increased in total calories intake as compared to overweight.

There was no significant difference in total carbohydrate intakes between non-overweight or obese, overweight and obese males (265.85± 6.18, 277.73± 9.89 and 282.30± 11.62 g, respectively). Mean ± SE values of total fat intakes were significant increase ($p<0.05$) in obese males (116.93± 14.11g) as compared to non-overweight or obese (77.40± 22.05 g), while there was no significant difference between obese and overweight as well as between non-overweight or obese and overweight males. Mean ± SE values of animal and plant proteins intake was significant increase ($p<0.05$) in overweight and obese males as compared to non-overweight or obese. Overweight males had significant increase ($p<0.05$) in animal protein intake as compared to non-overweight or obese, while there was no significant difference as compared to obese males. Obese males had significant increase in plant protein intake as compared overweight males. There was a no significant change in plant protein intake between non-overweight or obese and overweight males and between overweight and obese males.

Data also showed that mean values of total carbohydrate, fat, animals and plant protein and total calories intake of males was higher than that of females, except plant protein intake of overweight males was lower than that of females.

DISCUSSION

World Health Organization (2008) reported that 1.5 billion adults and older were overweight. Of these over 200 million men and nearly 300 million women were obese worldwide. Overweight and obesity epidemiology is increasing by time significantly. The etiology of obesity is complex and multifactor and both genetic and environmental factors play an important role in its development. Therefore, the main objective of this study was to determine the prevalence of overweight and

obesity and its related diseases among population in Makkah region-KSA.

Al-Othaimeen et al. (2007) and Mahfouz et al. (2011) reported that the prevalence of obesity is higher among women than men. This result was confirmed with the present results which revealed that BMI, body fat (%), visceral fat (%), abdominal, waist and hip circumference were higher in females as compared to that of males. The high prevalence of obesity among Saudi women could be attributed to limited physical activity, as a result of the wide spread usage of housemaids or the limited availability of exercising facilities for girls and women in Saudi Arabia (Al-Saif et al., 2002).

Obesity is a major risk factor for several chronic diseases. Our data showed increased prevalence rate of heart diseases, high blood pressure, diabetes millets, arthritis and respiratory diseases in overweight and obese subjects, which was higher significantly than that of non-overweight or obese. This result agreed with Al-Nuaim (1997) who found that obesity is an associated or recognized risk factor for other diseases, such as diabetes mellitus, hypertension, coronary heart disease, gallbladder disease, osteoarthritis, endometrial and breast cancer. In Saudi Arabia, Al-Attas et al. (1990) found that obesity was associated with insulin resistance and impaired lipid metabolism. This results was confirmed with Al-Rukban (2003) who demonstrated that the risk of coronary heart disease is doubled if the body mass index (BMI) is >25 and nearly quadrupled if the index is >29. The risk of developing diabetes increases with increasing weight and people with a body mass index >35 have a 40 fold higher risk of developing the disease than non-obese people. Osteoarthritis and respiratory diseases, particularly sleep apnoea is more common in obese people. Obesity was significantly associated with an increase in both systolic and diastolic blood pressure, stroke, and certain forms of cancer. Furthermore, Grassi et al. (1996) reported that hypertension in obese patients appears to be related to increased activity of both the sympathetic nervous and rennin-angiotensin systems. Luc et al. (2006) demonstrated that obesity increases the risk of cardiovascular disease and premature death. Adipose tissue releases a large number of bioactive mediators that influence not only body weight homeostasis but also insulin resistance the core feature of type 2 diabetes as well as alterations in lipids, blood pressure, coagulation, fibrinolysis and inflammation, leading to endothelial dysfunction and atherosclerosis. Recently, CDC (2009) reported that conditions of overweight and obesity correlate with increased risks for coronary heart disease, type 2 diabetes, cancers, high blood pressure, high cholesterol, stroke, liver and gallbladder disease, respiratory difficulties, osteoarthritis and gynecological difficulties.

Non- overweight or obese subjects were found to consume the lowest number of meals per day (two meals) compared to that of the overweight and obese subjects. Overweight and obese subjects eating three meals per day were higher than that eating two or three meals per day. The higher consumption of twice or more than two snack food per day was found in overweight and obese subjects. Overweight and obese subjects consumed once, twice, three times or more of fast foods were higher compared to that of non-overweight or obese subjects.

Overweight and obese subjects had increased in total calories intake as compared to non-overweight or obese subjects. In addition to obese subjects had increased in total calories intake as compared to overweight subjects. This result may be attributed to increase the numbers of meals and/ or snake and fast foods consumed by overweight and obese subjects. Therefore, the present results confirm the existence of a relationship between overweight or obese and the number and type of food intake, which in turn increased calories intakes. The present results to some extent agreed with De Graaf et al. (2006) who reported that snake's consumption may contribute to a positive energy balance and increased body weight. National Institutes of Health (1998) indicated that overweight and obesity is a result of positive energy balance over an extended period of time, where energy intake exceeds energy expenditure. World Health Organization (2003) reported that increased consumption of more energy-dense, nutrient poor foods with high levels of sugar and saturated fats, combined with reduced physical activity, have led to obesity.

CONCLUSION

Overweight and obesity considered to be a problem across Makkah and Jada regions that should be taking in account. Overweight and obesity was higher among aged group of 20 to 30 years in females than that of males. Moreover, increases prevalence rate of heart diseases, high blood pressure, diabetes millets, arthritis and respiratory diseases. Overweight and obese subjects eat three meals and more than two snack and fast foods per day.

REFERENCES

Al-Aattas O, Laajam M, Khan M, Al-Dress A (1990). Endogenous insulin secretion in newly diagnosed diabetic patients in Saudi Arabia. Diabetes Res. Clin.l Practice. Vol. 8: 51-59.

Al-Nuaim A (1997). "Population-based epidemiological study of the prevalence of overweight and obesity in saudi Arabia, regional variation. Annals of Saudi Medicine, Vol. 17 (3): 195-199.

Al-Othaimeen A, Al-Nozha M, Osman A (2007). Obesity: an emerging problem in Saudi Arabia Analysis of data from the National Nutrition Survey. East Mediterr Health J. Vol. 13(2):441–448.

Al-Saif M, Hakim I, Harris R, Alduwaihy M, Al-Rubeaan K, Al-Nuaim A, Al-Attas OS (2002). Prevalence and risk factors of obesity and overweight in adult Saudi population. *Nutr Res*. Vol. 22(22): 1243–1252.

Al-Rukban MO (2003). Obesity among Saudi male adolescents in Riyadh. *Saudi Arabia Saudi Med J*. Vol. 24(1): 27-33.

Bosy-Westphal A, Later W, Hitze B, Sato T, Kossel E, Glüer C, Heller M, Müller M (2008). Accuracy of bioelectrical impedance consumer devices for measurement of body composition in comparison to whole body magnetic resonance imaging and dual X-ray absorptiometry. *Obes Facts*. Vol. 1(6):319-324.

Brustad M, Skeie G, Braaten T, Slimani N, Lund E (2003). Comparison of telephone vs face-to-face interviews in the assessment of dietary intake by the 24 h recall EPIC SOFT program - The Norwegian calibration study. *Eur J Clin Nut*. Vol. 57 (1): 107-113.

Cade J, Thompson R, Burley V, Warm D (2002). Development, validation and utilization of food-frequency questionnaires. a review. *Public Health Nutr*. Vol. 5(4): 567-87.

Centers for Disease Control and Prevention (CDC) (2009). National Center for Chronic Disease Prevention and Health Promotion. Overweight and Obesity. http://www.cdc.gov/obesity/index.html.

De Graaf C (2006). Effects of snacks on energy intake. An evolutionary perspective. Vol. 47(1):18-23.

Gibson R (1993). Nutritional assessment: a laboratory manual. *Oxford university press, New York, USA*. Pp. 79-100.

Grassi G, Cattaneo B, Seravalle G, Colombo M, Cavagnini F, Mancia G (1996). Obesity and the sympathetic nervous system. *Blood Press*. Vol. 1(supp l):43-46.

Haslam D, Phillip W, James T (2005). Obesity. *The Lancet*. Vol. 366(9492):1197-1209.

Luc F, Ilse L, Christophe E (2006). Mechanisms linking obesity with cardiovascular disease. Nature. 444: 875-880.

Mahfouz A, Shatoor A, Khan M, Daffalla A, Mostafa O, Hassanein M (2011). Nutrition, physical activity, and gender risks for adolescent obesity in Southwestern Saudi Arabia. The Saudi Journal of Gastroenterology. Vol. 17(5): 318- 322.

Musaiger A, Miladi S (1996). Diet-related non-communicable diseases in the Arab countries of the Gulf. Miladi, S.S. *(ed.)* /FAO, Cairo, Egypt. Pp. 34-45

National Institutes of Health (1998).Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults. National Heart, Lung, and Blood Institute. http://www.nhlbi.nih.gov/guidelines/obesity/ob_gdlns.htm**.**

Schneider D (2000).International trends in adolescent nutrition. Social Science and Medicine. Vol. 51(6): 955-967.

World Health Organization (2000).Obesity: preventing and managing the global epidemic. Report of WHO consultation. World Health Organ Tech Rep Ser. 894:1–253.

World Health Organization (WHO)(2003).Obesity and overweight. http://www.who.int/dietphysicalactivity/media/en/gsfs_obesity.

World Health Organization (WHO) (2008). Obesity and overweight. Available at: http://www.who.int/mediacentre/factsheets/fs311/en/print.html. Accessed 11 June,

Yahia N, Achkar A, Abdallah A, Rizk S (2008). Eating habits and obesity among Lebanese university students. Nutr. J. Vol. 7(32): 1- 6

How to cite this article: Amr A.R., Aml F.E., Mona F.M. (2014). Studying the pattern of food meals and prevalence of overweight, Obesity and its related diseases among Saudi population in Makkah and Jeda Regions. Int. Res.J. Basic Clin. Stud. 2(1):1-8