

Body Mass Index, Percent Body Fat and Visceral Fat in Relation to Dietary Fat and Fiber Intake among University Females

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ABSTRACT

Recent economic upliftment has brought many changes in the food choices and eating habits from home made to fast foods. This shift in the area of nutrition has given rise to overweight and obesity. Considering this the present study was planned to 1) determine the prevalence of overweight and obesity in a sample of university students 2) Find the relationship between the body composition and dietary fat and fibre intake. A total of 300 university females, 18-30+ years were randomly selected from all the colleges at the University of Hail for the present study. A Self-administered questionnaire was given, and the Body composition were measured with the help of bio-electric impedance analysis technique. Data were analysed using SPSS -17 software. The results indicated that 22% of the students were overweight and 21.3% were obese. The mean percent body fat as well as visceral fat exceeded its normal limits in around 44% of the participants. Vegetables and fruits, except dates, were not frequently consumed by most of the participants with a mean intake of fibre as 14g/day. Significant positive correlations were found among Body Mass Index (BMI), Body Fat% and Visceral Fat level. Strong positive correlation was also found between BMI and fat intake ($P < 0.01$), whereas the body composition and fiber intake was found to be inversely correlated ($P < 0.01$). Findings of present study suggest that there is need for coordinated efforts at all levels to reduce the prevalence of obesity and high percentage of body fat, and to develop healthy eating habits in young generation.

Key words: Body mass Index, Percent Body Fat , Visceral Fat, Fiber, Bioelectric Impedance.

INTRODUCTION

The term Obesity is often used to define a condition of abnormal and excessive deposition of fat in the adipose tissue to that much extend that it leads to adverse and often irreversible health effects.¹ Overweight and obesity are generally considered as a rapidly growing threat to the health of populations in a daily increasing number of countries. In fact they are now becoming so popular that they are replacing the traditional health problems such as malnutrition and infectious diseases as the most significant causes of adverse health. Most common types of chronic diseases resulting from obesity include

coronary heart disease, hypertension and stroke, some types of cancer, diabetes mellitus, gallbladder disease, dyslipidaemia, osteoarthritis and gout, and pulmonary diseases, including sleep problems.¹

Researches from different parts of the world have revealed that the basic causes of the obesity problems are sedentary lifestyles and high-fat energy-dense foods, both resulting from the increasing changes taking place in community and the modified behavioural patterns of societies as a result of fast growing urbanization and industrialization and also probably due to the disappearance of traditional lifestyles. A reduction in

fat intake to around 20-25% of energy is necessary to minimize energy imbalance and weight gain in sedentary individuals.^{1,2}

The rapid cultural and social changes that have occurred in the Arabian Gulf region, since the discovery of oil and the economic upliftment during the 1970's and 1980's, were found to be associated with an alarming increase in prevalence of obesity.³⁻⁶ In the Kingdom of Saudi Arabia (KSA), recent researches have demonstrated rise in the consumption of animal products and also for refined and fast foods in the diet and a reduction of fiber, vegetables and fruits.⁷⁻⁹ These changes in their diets could possibly be the reason for prevalence of both overweight and obesity observed which is found to be increasing gradually among Saudi population.¹⁰⁻

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While there is strong evidence that genetic predisposition have an influence on body mass and body fat, it is not always the case, i.e. genes that cause obesity whenever two copies of the defective allele are present; it is likely to be many years before the results of genetic research can be applied to the problem. Methods for the treatment of obesity are already described, which generally include dietary management, physical activity and exercise, and sometimes anti-obesity drugs, and lastly gastrointestinal surgery, when there is no other option left, being reserved for extreme cases.¹

Researches from different parts of the globe have revealed that college students are highly exposed to unhealthy eating habits leading to body

Table 1: Anthropometric and body composition characteristics of subjects

Variables	Mean	Standard Deviation
Age (yr)	22.3	4.8
Height (cm)	157.9	4.9
Weight (kg)	64.1	16.4
BMI (kg/m ²)	25.3	8.6
Percent Body Fat (%)	37.9	9.1
Visceral fat	92.3	43.5
Mean intake of fibre	14.3 gm	4.3
Mean intake of fat	35 – 40% of total calories	

weight gain.¹⁴ According to WHO, obesity is found to be more common among females than in males.¹ Studies done in different parts of Saudi Arabia have documented that around 30-50% female college students were either overweight or obese.¹¹⁻¹⁴

There are very few studies from Hail reporting the correlation of dietary fat and fiber intake with body composition. Therefore the present study was formulated to find out the relationship between body composition and dietary intake of fat, fruits and vegetables.

METHODS

A cross sectional study was conducted in college of Applied Medical Sciences at university of Hail during the semester of 2014-15. Posters were pasted throughout college informing the days of data collection and who ever visited labs were included in the study. A total number of 300 female students and staff aged 18-30+ years had participated. The participants were randomly selected from all the colleges. Self administered questionnaire was used for the purpose of data collection. All the subjects who were either pregnant, lactating or in their menstrual periods were excluded from the study. Final analysis was done on a total of 300 subjects. The study was approved by the committee of research ethics at university of hail, KSA.

Ethical issues

The present study has been approved by the research deanship of University of Hail. All the participants had been given an informed consent prior to the study. Only those subjects who were willing to participate in the study were included.

Food Intake Questionnaire

Information on the total dietary intake of fat, fiber, fruits and vegetables was obtained by using the online free assessment tool for individuals (Nutrition Quest, 2009). For this purpose, all the participants filled the online screeners for fat, fruits, vegetables and fiber. These screeners included food frequency questionnaire. Height was measured using standard stadiometer (seca 206 Body meter Measuring Tape). Weight, and other body composition analysis like total body proteins, minerals and fat were done using a bioelectrical impedance analysis (BIA) device

(In-Body 720; Bio space, Korea). The BMIs of the participants were calculated from their respective heights and weights using the quetelet index which is calculated as $\text{weight}/\text{height}^2$. After getting the BMI values, subjects were classified as underweight ($<18.5 \text{ kg/m}^2$), normal ($18.5\text{--}24.9 \text{ kg/m}^2$), overweight ($25\text{--}29.9 \text{ kg/m}^2$), obese I ($30\text{--}34.5 \text{ kg/m}^2$) and obese II ($35\text{--}40 \text{ kg/m}^2$) according to the values given by the world health organization (WHO) criteria for body weight determination. (WHO, 2006)¹⁵

Statistical Analysis

The statistical package for social sciences (SPSS) version 17 (Chicago, IL, USA) was used to enter and analyze the data on a personal computer. Descriptive statistics such as means and standard deviations were calculated for the continuous variables and frequencies for qualitative data. Variance analysis (ANOVA), Chi-square (χ^2) and regression analysis was performed to find out the statistical differences among the different variables. The measure for statistical significance was established as $P < 0.05$.

RESULTS

A total of 300 female participants were included in the present study with a mean age of 22.24 ± 4.8 years (Table I). The mean height and weight was found to be $157.9 \pm 4.97 \text{ cm}$ and $63.0 \pm 16.09 \text{ kg}$ respectively. Whereas the mean BMI was found to be $25.27 \pm 8.56 \text{ kg/m}^2$, with around 43% of the participant in overweight and obese category, showing that on an average the participants were at risk of overweight. The mean Percent of body fat was found to be 37.87 ± 9.07 , and visceral body fat was 92.26 ± 43.59 . The average intake of fiber was low ($14.3 \pm 4.3 \text{ g/day}$), while on the other hand the average intake of fat was found to be quite high (35–40% of total calories/day), with around 82% of the participants taking above 30% fat.

Table II shows the correlation between BMI and body composition through ANOVA. The BMI categories indicate that less than half (44.7%) of the participants had a normal BMI. 22% were overweight, whereas 15% and 6.3% of the subjects were in the class I and class II obesity degrees respectively.

Table 2 : Mean body compositions based on BMI categories and dietary intake of fiber

BMI Categories	Total (%)	Body Mass Index	Means \pm SD Body Fat %	Visceral Fat
Underweight	36(12)	17.3 \pm 1.0	23.9 \pm 7.08	46.7 \pm 11.5
Normal	134(44.7)	21.9 \pm 1.95	34.5 \pm 5.2	71.4 \pm 18.6
Overweight	66(22)	27.1 \pm 1.46	42.2 \pm 4.03	100.1 \pm 24.5
Obese I	45(15)	32.4 \pm 1.52	47.4 \pm 5.05	135.5 \pm 23.4
Obese II	19(6.3)	39.9 \pm 2.85	50.1 \pm 4.89	196.1 \pm 39
Total	300	25.3 \pm 6.1	37.9 \pm 9.07	92.3 \pm 43
ANOVA		$P < 0.001^{***}$	$P < 0.001^{***}$	$P < 0.001^{***}$
Intake of fibre/day Mean intake of fiber = $14.3 \pm 4.3 \text{ g/day}$				
Very low	53.6%	25.8 \pm 6.7	38.1 \pm 9.7	94.1 \pm 48.6
Low	31.2%	24.8 \pm 5.5	37.8 \pm 8.3	92.56 \pm 38.0
Normal	15.2%	23.9 \pm 4.6	37.2 \pm 7.7	84.9 \pm 31
	ANOVA - P Value	0.012 **	0.001 ***	0.005 ***
Intake of fat/day				
20-25%	6%	21.5 \pm 3.9	33.6 \pm 8.8	64.02 \pm 20.3
25-30%	11.7%	24.2 \pm 6.5	35.4 \pm 9.8	85.32 \pm 42.5
30-35%	46%	25.5 \pm 6.5	38.2 \pm 9.5	95.8 \pm 48.0
35-40%	21%	25.8 \pm 5.6	38.3 \pm 7.9	92.29 \pm 37.8
>40%	15.3%	26.1 \pm 5.3	39.52 \pm 7.9	97.9 \pm 40.7
	ANOVA - P Value	0.030 **	0.028 **	0.034 **

The degree of correlation among BMI and percent body fat as well as the visceral fat was found to be positive and highly significant. ($P < 0.005$). Table II clearly indicates that the BF% and VF levels are much more than the average limits for all overweight and obese classes.

The correlation of mean body composition values and Eating habits with respect to dietary intake of fiber and fat per day are depicted in table II. The table shows that the correlation between intake of fiber and mean body composition as well as BMI was significant and inverse. ($P < 0.05$)

Table II also shows the correlation between mean body composition and percentage of per day intake of fat. Here the correlation was found to be significant and positive. ($P < 0.05$). For all the three measures of body composition, the mean values showed an increasing trend with increasing percentage of fat intake.

Table III demonstrates the correlation between eating habits and BMI categories using chi square test. The P value indicates that the correlation of BMI with fat intake, total servings of fruits and

vegetables and mean fiber intake in grams was significant ($P < 0.05$). While on the other hand, the relationship of intake of fiber category and BMI was found to be insignificant ($P = 0.108$)

Stepwise multiple regression was performed to find out the group of variables best predicting the BMI grades (Table IV). For BMI of the participants, Visceral fat in body was the single best predictor entered at the first step ($R^2 = 56.9\%$, $P = 0.000$), percentage of fat was the second best predictor (step 2, $R^2 = 58.0\%$, $P = 0.000$). ANOVA table shows that the results were overall highly significant for both steps.

DISCUSSION

Objectives of the present study were to assess overweight and obesity prevalence rates among female college students in Saudi Arabia and to correlate their body mass index and body composition as measured by PBF and VF levels with their eating habits. Data of the present study demonstrated that nearly half (44%) of the students were above the ranges of normal body mass index (BMI). Overweight participant represented 22% of

Table 3 : Correlation of Eating habits with BMI according to Chi square test

Variables % of Fat g/d	BMI					P value
	Underweight	Normal	Overweight	Obese I	Obese II	
20-25	5	9	4	0	0	0.001***
25-30	10	8	12	2	3	
30-35	18	57	29	23	11	
35-40	3	34	12	11	3	
>40	0	26	9	9	2	
Intake of fibre						
Very low	18	78	31	25	17	0.108
Low	11	35	25	14	2	
Normal	7	21	10	6	0	
Servings of fruits, veg/day						
1-2	10	31	13	9	13	0.019**
2-3	8	42	25	15	4	
3-4	10	39	18	10	2	
4-5	4	17	7	9	0	
>5	4	5	3	2	0	
Mean fibre intake/day	15.06±5.6	14.13±3.9	14.7±4.1	14.7±5.1	11.58±1.7	0.04*

the sample whereas, 21.3% were obese of varying degrees. The present findings were consistent with the results of similar studies from other parts of the world in middle east and some western countries. One of the study done in Lebanon found the prevalence of overweight and obesity among male college students as 37.5% and 12.5%, respectively.¹⁶ Similarly, in Kuwait the corresponding percentages were 32% and 8.9%¹⁷, while in the United States and the United Arab Emirates overweight and obese accounted for about 35% of the male college students.¹⁸⁻²⁰ On the other hand, only 7.9% of Iranian male college students were found to be above the normal body weight.²¹ All of these studies used small sample sizes and irrespective of the fact that self reported height and weight were employed, their findings revealed differences in the severity of obesity problems among young adults across different nations of the . Researches now a days, define obesity as adiposity, rather than the relation of body weight to height and thus body composition in terms of PBF and VF became more important variables to measure obesity rather than BMI.^{22,23} This is well in accordance to the results of the present study which confirmed that a higher percentage of students are obese according to their BF% compared to a lower number on basis of their BMI.

The results of the present study show a linear correlation between PBF and VF levels.

Recently studied literature has shown that visceral fat is found to be closely linked to non-communicable diseases like type II diabetes mellitus and coronary heart disease.^{24,25} That is why, dietary management along with regular medical checkups should be followed to prevent or, at least, reduce the risk of the chronic diseases in Saudi females with high levels of PBF and VFL.²⁶

Results of the present study demonstrated that most of the university females have irregular meals generally with two main meals each day. Besides the consumption of dates, which is the staple food of Saudis, the majority of the participants eat vegetables and fruits twice per week in maximum, with the average intake of just 14.3 grams of fiber per day. Consumption of uncooked vegetables and fruits as a snack or salad with the main meal is not common among Saudi population. Also approximately 82% of the subjects took more than 30% of calories from fat. These objectionable food habits need to be addressed using educational counseling to promote healthy eating habits in young generation. Comparing the results of the present study with similar studies from other parts of the world^{16,17,27} for participants of the same age and sex, demonstrated variations in eating habits among college students in different nations.

It is well known fact that vegetables and

Table 4: Multiple regression analysis for BMI (Body Mass Index)

Model		R	R Square	F	ANOVA Sig
1	Visceral fat in body	.570	.569	395.603	0.000***
2	Visceral fat in body, percentage of fat from total calories eaten per day	.583	.580	207.866	0.000***

Model		Un standardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)visceral fat in body	.135	.118		1.140	.255
		.023	.001	.755	19.890	.000
2	(Constant)visceral fat in body	.715	.224		3.193	.002
	percentage of fat from total	.024	.001	.770	20.386	.000
	calories eaten per day	-.145	.048	-.115	-3.036	.003

fruits tend to be low in energy density due to high water and fiber content found in these foods. As a result, making them as a regular part of your diet reduces the total energy intake, thus, helps in weight management.²⁸ Accordingly, the results of present study revealed a significant ($P < 0.05$) inverse correlation between BMI, BF% or VFL and vegetables and fruits consumption as well as the mean fiber intake in the diet.

CONCLUSION

The vegetable content in most of the traditional Saudi dishes (e.g. Kabsa, Margog, Mandy) is very little to have an impact on the total energy content of the diet. The fruits which are eaten usually

are consumed as a dessert at the end of main course of foods, and therefore unable to give benefit of their "satiety values" which is supposed to reduce the overall energy intake of the diet. Results of the present study revealed a positive correlation of BMI, PBF and VF with fat intake and inverse correlation with fruits, vegetables and overall mean fiber intake. Reduction in the intake of fruits, fresh and cooked vegetables, seafood and pulses along with significant extra intake of sugar, refined and fast foods were the major changes in the diet pattern of the university students. In addition, it was also documented that the lack of expertise in planning meals, lack of proper knowledge were also among the few other factors responsible for the unhealthier dietary choices of the university young students.^{29,30}

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