Impact of Physical activity and Intake of fiber and fat on the anthropometric indices of university females in Hail city of Saudi Arabia

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ABSTRACT

Objectives of the present study were to find out the correlation of physical activity and dietary intake of fiber, fat with the anthropometric measurements of the female students and staff of the university of Hail. A total of 237 participants (age 18 – 30+ years) were included in the study. Information on physical activity was obtained using IPAQ – 2004. The intake of fats and fiber was measured by online screening using Nutrition Quest, 2009. All the anthropometric measurements were collected by using In-Body 720 machine. Results were analyzed using SPSS- 17.0, and were checked at 0.05 level for significance. Results of the study concluded that around 22 per cent of the subjects were overweight whereas, 20 per cent were found obese, 57.4 per cent of the participants were found to be physically inactive. BMI was significantly correlated with daily fiber intake P<0.05 and fat intake (P<0.005). Strong positive correlation was found between the age and per cent body fat as well as visceral fat whereas amount of protein and minerals in the body were inversely correlated with age. (P=0.000). BMI was significantly correlated with dietary intake of fat and fiber. Mean intake of fiber was low (14.6±4.3 grams) and average intake of fat provides 35-40 per cent of total calories.Prevalence of obesity was found to be alarming with high percentage of subjects being inactive, which is a matter of great concern. Intake of fruits and vegetables and daily intake of fiber was also found to be very low. Results of this study will help to provide evidences that increase in physical activity coupled with increased intake of dietary fiber can prevent obesity.

Key words: Anthropometry, Body mass index, Physical activity, Fiber intake, obesity.

INTRODUCTION

Obesity is a fastest growing problem and of great concern throughout the world and especially in the developed countries. Current prevalence rates are about 20-25 per cent in American adults and 15-20 per cent in Europeans.[1] Although this problem is to a lesser extent in many developing countries, but is rapidly increasing there also. This increase is the leading cause of sharp increase in the incidence of type 2 diabetes mellitus and cardiovascular diseases.[2]

With recent inventions and new technologies coming up daily, physical activity (PA) levels are decreasing among young people in countries around the world, especially in the urban areas, and it is estimated that less than one-third are having Health enhancing physical activity, which has impact on their present and future health status. (World Health Organization, 2006).[3]

Overweight and obesity are the greatest challenges of health that are gain in weight than what is generally considered healthy for a particular height. According to the Centre for Disease Control

and Prevention, 2006, these conditions also identify ranges of weight that have been shown to increase the risk of certain diseases and a lot of other related health problems.[3]

Body fat distribution is also related to cases of mortality and morbidity. The people develop obesity as a result of chronic and sustained energy imbalance as it happens when energy intake exceeds energy expenditure. Therefore, it is necessary to take both sides of the energy equation simultaneously into account. Both energy-dense diets and sedentary lifestyles are now proved to be responsible for energy imbalance as well as prevalence of obesity.[4]

Different Strategies should be planned to improve nutritional intake and to increase physical activity as these are the keys to prevent and force back overweight, which in turn will greatly help in restricting present and future health-care costs.[5] Among the different strategies to combat obesity and to improve nutrition is to increase consumption of whole grains. Due to their high satiety value, whole grains might help in preventing overweight and obesity, although according to the Institute of Medicine, 2002 the evidence for the effect of fiber was considered insufficient.[5,6]

The correlation between fiber intake and prevalence of different diseases like DM and HTN has been documented by various studies.[7,8,9], but only a few studies have shown a significant correlation between fiber intake , change in body weight and BMI [10,11,12,13]

It is now a well-known fact that a balanced diet rich in fiber, fruits and vegetables is crucial for health, whereas, the importance of daily moderate-intensity PA could not be ignored as another important determinant for good health. Studies from different parts of the world have shown that moderate physical activity goes a long way helping to lower blood pressure, reduce body fat, and improve glucose metabolism. There is strong scientific evidence that when change in dietary habits and physical activity are made, these can help to reduce the effect of several risk factors for chronic diseases.[14]

Data from a study done in UK have suggested that leisure time physical activities such as time spend in sitting while watching television and number of cars in the household were strongly associated with obesity prevalence rates and differences between socio-economic classes, on the other hand they have also concluded that the contribution of energy intake by dietary fat was not related to obesity.[15]

During the process of literature review, it was observed that there is lack of available literature regarding this area from Saudi Arabia and especially from Hail. Keeping all these facts in mind, the present study was planned with an objective to know correlation of the fat and fiber intake and the amount of physical activity done among the university staff and students population with obesity.

MATERIALS AND METHODS

The present cross sectional study was done on university of Hail females age 18 to 30+ years , including staff as well as the students, with an objective to find out the prevalence of obesity and its correlation with the dietary habits and physical activity. Because of the restriction on available free time, the participants were randomly selected from all the colleges. Self-administered questionnaire was used for the purpose of Data collection. The objectives of the study were explained to the subjects and all those who agreed were asked to take part in the study. All the subjects who were either pregnant, lactating or in their menstrual periods were excluded from the study. Final questionnaire was given to 250 participants, of which a total of 237 completed ones were analyzed after correction of errors.

Assessment of Physical Activity

Short version of Last 7 Days' International Physical Activity Questionnaire (IPAQ) was utilized for the purpose of getting the level of physical activity among the participants. According to Craig et al, 2003[16], the IPAQ instrument has acceptable measurement properties for monitoring levels of physical activity among 18 to 65 year old adults. According to them it has a test-retest reliability and criterion validity of r= 0.8 and r=0.3, respectively. The questionnaire was interpreted and scoring was done using the criteria given by IPAQ research committee, 2005[17].

Assessment of dietary fiber and fat intake

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. All the participants were requested to fill all the questions in order to get the reliable results. They were asked to fill the lowest frequency in front of the food items they did not take instead of completely leaving the question unmarked. Depending on these the intake of fruits and vegetables were categorized as the amount of servings eaten per day. Intake of fibers was measured in terms of grams per day and the responses were divided among three groups as very low (<15 grams), low (<20 grams) and normal (> or = 20 grams).

Anthropometric Measurements

Height was measured using standard Stadiometer. Weight, and other body composition analysis like total body proteins, minerals and fat were done using In-Body 720 machine (Bio space, Korea). The BMIs of the participants were calculated from their respective heights and weights using the quetelet index which is calculated as weight/height^2. After getting the BMI values, underweight, normal, overweight, and obese subjects were classified according to the values given by the World Health Organization (WHO) criteria for body weight determination (WHO, 2006).[18]

Statistical analysis

All the data obtained was coded and entered into SPSS – 17.0 software for analysis. Frequency and percentages were used to present the general and health characteristics of the study population. Means, Chi square test and ANOVA was used to assess the correlation between BMI, physical activity, dietary intake of fats and fibers and other study variables.

Table 1 : General characteristics of the population

Variable	Categories	Frequency	Percentage
Age group	18-21	158	66.7
	22-23	49	20.7
	24-26	14	5.9
	27-30	7	3.0
	>30	9	3.8
Marital status	Married	57	24
	Unmarried	180	76
Working status	Academic staff	3	1.3
	Administration	8	3.4
	Security staff	7	3.0
	Student	219	92
BMI	Underweight	29	12.2
	Normal	110	46.4
	Overweight	51	21.5
	Obese	47	20
History of chronic illness	CVD	2	0.8
	HTN	11	4.6
	DM	4	1.7
	GID	24	10.1
Physical activity	HEPA	5	2
	Moderate	96	41
	Inactive	136	57

RESULTS

The general characteristics of the study population is presented in table 1. Majority of the population was in the younger age group of 18 – 23 years (around 88%). Among the respondents 76 per cent of the subjects were unmarried, whereas 24 per cent were found to be married, 92 per cent of the participants under the present study were the undergraduate students of university, and the rest were either security, academic or administrative staff.

Analysis of the Body mass index showed that the percentage of participants under study with normal BMI was 46.4 per cent , and approximately 12 per cent were underweight. The percentage of overweight and obese subjects were found to be 22

and 20 respectively, which seems to be the matter of great concern.

Assessing the physical activity pattern revealed that a very small proportion (2%) was involved in Health Enhancing Physical Activity (HEPA), 41 per cent of the participants have reported doing moderate physical activity and a high percentage (57%) was found to be inactive.

Table 2 shows the eating habits of the study population. Results of the study indicated that a very low percentage (12.2%) of the subjects had the appropriate servings of fruits/vegetables per day. The intake of fiber was very low (i.e. less than 15g/day) for more than half (54%) of the study group. On the other hand just 15% took proper amount of fiber (e"20g/day) in their daily diet.

Table 2: Eating habits of the participants

Variables	Categories	Frequency	Percentage
Total servings of fruits/vegetables	1-2	58	24.5
	2-3	75	31.6
	3-4	62	26.2
	4-5	29	12.2
	>5	13	5.5
Intake of fiber/day (gms)	Very low (<15g/d)	127	54
	Low (15-19g/d)	74	31
	Normal (e" 20g/d)	36	15
Fat intake /day(%age from total calories)	20 – 25%	13	5.5
	25 – 30%	25	10.5
	30 – 35%	112	47.3
	35 – 40%	49	20.7
	More than 40%	38	16.0

Table 3 : Correlation of age group with BMI and other in body compositions

Age group	Mean In body measurements				
	BMI	% Body Fat	Visceral fat	Protein	Mineral
18-21	23.5±5.2	36.3±8.2	82.3±36.9	1.63±0.48	1.43±0.49
22-23	25.8±5.0	38.7±9.1	95.5±36.0	1.50±0.5	1.21±0.42
24-26	28.1±6.8	42.6±8.2	114.3±50.1	1.49±0.5	1.20±0.40
27-30	33.4±5.2	46.9±4.3	147.3±50.0	1.00±0.00	1.00±0.00
>30	33.2±4.9	43.2±7.3	141.0±39.0	1.00±0.00	1.00±0.00
P value (ANOVA)	0.000***	0.000***	0.000***	0.000***	0.001***

Results of the screening on fat intake shows that the intake of fat /day was quite high. A considerably high percentage (47.3%) of subjects were found taking 30-35 per cent of their daily calorie intake from fat. Whereas 16% of the participants were taking more than 40 per cent of fat. A very low percentage of population (approximately 15%) were taking 20 – 30 per cent of fat from their daily calorie intake.

Table 3 shows the correlation of age group of the participants under study with the means of different in body measurements. Results clearly indicate that the correlation was strongly significant at $P< 0.005$. It was found from the table that as the age increased the mean BMI, body fat and visceral fat also increased showing a strong positive correlation between age in above mentioned in body measurements. Whereas , the case was reverse for the amount of protein and minerals, which showed a decreasing trend with increasing age, showing a strong negative correlation.

Correlation of BMI and dietary intake of fruits, vegetables, fat and fiber is depicted in table 4. It is clear from the table that there was an inverse correlation found between BMI and mean intake of fiber, and fruits/vegetables ($P = 0.04$ and 0.03 respectively). The mean intake of fiber was highest (15.7g) for the underweight group, followed by normal (14.6g) and lastly lowest (11.2g) for the obese II subjects. Similarly underweight group took the highest mean servings of fruits and vegetables (2.6) followed by 2.48 servings for normal BMI, and just 1.42 servings for Obese II subjects.

On analyzing the mean percentage of fat intake per day , it was found to be positively correlated with the BMI ($P<0.005$). The results show that the mean fat intake increased with increasing BMI. Accordingly, strong positive correlation was found between BMI of the participants and their respective mean of percent body fat as well as the mean visceral fat ($P = 0.000$) . It is very clear from the table number 4 that as the BMI increased from underweight to normal and finally obese II,

Table 4 : Correlation of BMI with dietary intake of fiber and fat

Dietary intake	BMI					
	Under wt.	Normal	Over wt.	Obese I	Obese II	P value
Fiber g/d	15.7±5.4	14.6±3.9	14.8±4.1	14.5±4.9	11.2±1.9	0.047*
Servings of fruits/veg	2.6±1.3	2.48±1.1	2.45±1.13	2.42±1.14	1.42±1.14	0.030*
% fat/day	33.1±19.1	36.3±20.0	38.2±21.2	34.2±19.0	36.1±19.0	0.001***
% body fat	25.1±6.8	34.7±5.1	42.3±4.2	47.2±5.4	49.2±5.7	0.000***
Visceral fat	48.1±11.6	72.2±18.6	101.8±24.9	135.3±22.3	194.5±38.6	0.000***

Table 5 : Correlation of BMI with history of chronic illness

History of chronic illness	BMI				
	Normal	Under wt.	Over wt.	obese	Total
CVD	0 (0)	1(50)	0(0)	1(50)	2(100)
HTN	2(18)	0(0)	2(18)	7(64)	11(100)
DM	1(25)	1(25)	0(0)	2(50)	4(100)
GID	11(46)	9(37)	4(17)	0(0)	24(100)
No Disease	96(49)	18(9)	45(23)	37(19)	196(100)

$\chi^2 = 63.4$ at df 16   P=0.000***

Numbers in ( ) show percentage

the percent body fat increased from 25.1 to 34.7 and finally 49.2 respectively. The same trend was observed for mean visceral fat. It increased gradually from 48.1 to finally 194.5 with increasing BMI.

Table 5 shows the correlation between BMI and history of any chronic illnesses. On applying chi square test, the association was found to be highly significant (P = 0.000). The table clearly shows that under each disease category (except GID) the percentage was highest among obese subjects. For Gastrointestinal disorders, Normal BMI subjects had the highest percentage (46%) followed by underweight (37%).

Table 6 analyses the correlation between working status of the study participants and the different physical activity variables, as well as the history of chronic illness. A strong significant correlation was found between the working status and level of physical activity (P=0.000) and mean minutes of walking per day (P = 0.002). The correlation between working status and history of chronic illness and mean continuous score of Physical activity was also found significant (P = 0.035 and 0.047 respectively). On the other hand the correlation of working status with mean hours of sitting was found insignificant.

Results of the study from table 6 indicated that the security staff did not have any history of chronic illness and the mean continuous score of physical activity was highest for them (1485 MET min), along with the highest minutes of walking per day (90 minutes/day). Side by side the students had the lowest mean score for physical activity (602 MET min) , and lowest minutes of walking per day (24.5 minutes/day) and they were found to have highest prevalence of chronic disease history.

DISCUSSION

The present study was done to find out the interrelationship between dietary intake of fiber, fruits and vegetables and fat , Physical Activity and difference in body measurements including BMI among the university of Hail staff and students. Results of the study found that a large proportion of the subjects were overweight and obese and also an approximately same percentage of participants took high amount of fat (35% - 40% or more) in their diets. Few researches have shown direct correlation between dietary fat intake and body fat.[19,20]

The higher fat consumption and low consumption of fiber along with minimal physical activity in the present study could be the possible reason for the over weightiness and obesity. Results of studies from various researchers have proved the crucial role of physical activity and energy expenditure the prevention of obesity. [3,21,] Moreover, the participants having increased consumption of fruits, vegetables and fiber have reduced probability of being obese.[22] The present study also shows similar results that overweight and obese subjects have lesser intake of fruits, vegetables and fiber as compared to normal and underweight subjects, and also their fat consumption was higher.

Table 6 : Correlation of working status with study variables

Variables	Categories	Working status				P value
		Academic	**Admin.**	**Security**	**Student**	
History of chronic illness	CVD	0	1	0	1	0.035*
	HTN	1	2	0	8	
	DM	0	1	0	3	
	GID	0	0	0	24	
Level of activity	HEPA	0	8	50	1	0.000***
	Moderate	100	31	0	41	
	In active	0	62	50	58	
Mean Continuous score of PA		1058±447	770±788	1485±2100	602±620	0.047*
Mean hours of sitting/day		5.7±0.6	5.9±1.8	6.0±0.00	5.7±2.1	0.974
Mean minutes of walking/day		55±56.8	37.7±44.8	90.0±127	24.5±26.4	0.002***

Researchers have also found that patients with CVD , who are on low calorie, high fiber diet rich in fruits and vegetables for around six months have a greater reduction in central obesity.[23]

In various studies BMI has been used extensively as an indicator of body fat and often it correlates strongly with body fat.[24] The present study also shows similar correlation between BMI and body fat. It is also often found that a greater BMI is not always due to high body fat, but it can also be due to more muscles and heavier bones. Therefore, the correlation between BMI and body fat is not very perfect.

In contrast to the present study, few studies have shown an inverse significant correlation between physical activity and BMI.[15] The researchers have proved in their study that the prevalence of obesity was related to the hours of televi

sion watching which is an indicator of physical inactivity. However, in the present study the higher percentage of overweight and obese subjects could be due to the high percentage of subjects being physically inactive, and long hours spend in sitting, although the correlation was found to be statistically insignificant. The pattern of physical activity along with sedentary life style of majority of the population and in addition a high fat and low fiber diet could be the contributory factors of the present trends in BMI. It is also well known that diets with a high fat content usually have a high energy density, fat intake is not the sole determinant of energy density of the diet; fiber intake is another important one.[19]

Results from different cross sectional studies a have demonstrated that high fiber and whole grain consumption is associated with lower Body mass Index and adiposity.[8,25] Similar to the present study these researchers also found that the increased fiber consumptions was inversely associated with BMI, percent body fat and percent trunk fat.

The present study also shows a significant correlation between the working status and level of physical activity as well as the history of chronic illness. The participants who were involved in the

jobs which require less physical activity were more prone to CVDs, Diabetes and hypertension. Kind of job was also found to be significantly correlated to the minutes of walking per day. Studies from different parts of the world has shown that physical activity during work is rapidly diminishing , particularly in developed nations and urban areas.[26] At the same time it is leading to increased intake of fast foods, fat and decreased consumption of fruits, vegetables and fiber. Results of these studies as well as the present study indicates that reduced energy expenditure due to the job and the decreased fiber intake could be strong determinants of increasing body fat, and higher BMIs in the population.

CONCLUSION

It is now a well-known fact proved by different studies that inadequate or reduced consumption of fruits, vegetables and fiber along with minimal physical activity is associated with obesity related health problems such as CVD and diabetes.[10,27] In view of these as well as the findings of the present study, reducing obesity and overweight is the major concern. Increasing levels of body fat in the population could be considered as the normal response to decreased level of physical activity and change in the lifestyle behavior including the dietary pattern, although individual variations in weight gain could also be attributed to the genetic susceptibility. Therefore, along with the development of intervention programs to promote healthy eating, including fruits, vegetables and fiber in the diets, importance should also be given to modify lifestyle behaviors through counseling and education.

Decreased physical activity and reduced consumption of dietary fiber along with high intake of fat not only contribute to high percentage of body fat, but also gives way to different chronic diseases like coronary heart diseases, diabetes and different types of cancers. More extensive studies should be done to find out the possible relation between these factors and the body fat, so that intervention programs could be designed for the population. These will help provide evidences that increase in physical activity and dietary fiber can prevent obesity.

Ethical Issues: This study has been approved By the University of hail, Hail, Saudi Arabia. All the participants were given an informed consent before the beginning of the study.

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