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RELATIONSHIP BETWEEN DIET AND LIPID PROFILE OF HEALTHY INDIVIDUALS

Muhammad Arif[*1], Kainat Rehman[2], Raees Khan[3], Touseef Tahir[4], Wajdan Rehmat[5], Kainat Ahmad[6], Muhammad Yasir[7]

[*1,2,3,5,6,7]*Department of Human Nutrition, The University of Agriculture, Peshawar, Pakistan*
[4]*Department of Nutrition and Dietetics, Lady Reading Hospital, Peshawar, Pakistan*

[*1]*arif123@aup.edu.pk*

ABSTRACT

A community based cross-sectional study was conducted to explore a possible link of diet and lipid profile among the healthy female adults (N=100) aged 20-60 years of District Peshawar. Socio-demographic, anthropometric, dietary and biochemical data were collected from the concerned females. Socio-demographic data indicates that majority of the subjects were educated, married, unemployed. Anthropometric measurements indicate that 34% of the female were of normal weight, 7% were underweight and 59% were overweight and obese. Only 20% of the subjects had normal waist circumference. Serum samples investigated for lipid profile indicate that TG, TC, VLDL and LDL were significantly (P<0.05) correlated with weight, WC and BMI. HDL was negatively correlated with BMI, weight and WC. Mean TC, LDL, TG and VLDL were significantly different while mean HDL was non-significantly different in all groups of BMI. Moreover, on the basis of WC, mean TG, TC, HDL and LDL was significantly (P<0.05) different in at risk and normal groups. No statistical difference (P>0.05) was observed among the mean intake of calories, fats, protein and CHO of at risk and normal individuals. TC and LDL were positively correlated with fats and proteins while TG and HDL were negatively correlated (P>0.05) with fats. Milk and milk products, eggs, beverages and fats consumed higher in at risk women while fruits, vegetables, and nuts were highly consumed by normal subjects. The study provides base line information about nutritional status, dietary intake and lipid profile of the individuals of this region.

INTRODUCTION

Prevalence of chronic diseases like diabetes, obesity and cardiac heart diseases are rapidly increasing worldwide. In 2008, about 57 million of people died globally. Chronic diseases contribute around 58% (33 million) of it mostly obesity, CVD, and respiratory conditions (Abegunde et al., 2007). In lower earnings and middle wages countries the load of these diseases are increasing rapidly which already caused negative health, economic and social effects (WHO, 2005; Horton et al., 2007). In past few decades the urbanization of rural people continued. Pakistan's population is increasing with increase in movement of rural to urban population and hence it causes a rapid increase in the newly rising lower middle class communities. Pakistan is an emergent country with a people of more than 130 million, near 1/3rd of which is urban (Pakistan Population Census, 2000). According to national health survey there is increase in deaths due to cardiac heart diseases (Pakistan Medical Research Council, 1998). Globally, one of the major health problems is cardiovascular diseases and in South Asian developing countries it reaches to pandemic

proportion. The well known risk factors for cardio vascular diseases are diabetes, high blood pressure and abdominal obesity (WHO, 2005).

Excess body weight is considered as overweight while the occurrence of excess body fat is known as obesity. Obese people are overweight but it is not necessary that all overweight people will be obese because the excessive body weight might be from bone, muscles or water content of the body. The negative health effects of obesity and overweight include increases in the risks of death and non-fatal devastating diseases (WHO, 1998). Cardiovascular diseases can easily be determined by abdominal fats which are considered as the most important determinant in CVD's as well as type 2 diabetes mellitus (Megnien et al., 1999, Williams et al., 1997). The most significant fats in human body are intra-abdominal fats. In hypertriglyceridemia, high levels of TC, low HDL and high LDL are commonly observed (Lemos-Santos et al., 2004). Waist and hip circumferences and body mass index (BMI) are considered as most important indicators for CVD's (WHO, 2008). The most common and simple technique used to calculate body size and to identify the occurrence of obesity in the population is BMI (Colditz et al., 1995). To estimate metabolic risk factors and abdominal fats waist circumference is the best anthropometric predictor (Ledoux et al., 1997; Lemos-Santos et al., 2004).

One of the well-established risk factor for obesity is considered as the common food practices. Food intake plays a vital task in enhancing the life of a person (WHO, 2003). In present situation, diet and life style alteration is thought to be a good approach to reduce chronic diseases and obesity (Tuomilehto et al., 2000; Diabetes Prevention Program Group, 2002). Studies showed that inadequate diet and poor lifestyle are the main reasons for many human chronic diseases. High caloric diet and physical inactivity contribute to high level of serum cholesterol. Moreover high consumption of vegetables and fruits decreases the prevalence of CVD's and other chronic diseases. In the few decades there is a remarkable increase in the acceptance of serum lipid significance as it plays an important part in the advancement of atherosclerosis which is another major cause responsible for cardiovascular diseases (Fuster et al., 1996). Earlier studies showed that high intake of dietary fiber, vegetables and unsaturated fatty acids while lower consumption of trans and saturated fatty acids can decreases the prevalence of cardiovascular diseases mainly coronary heart disease (Lloyd-Jones et al 2009). It is well known fact that the role of dietary consumption is important in diseases and health. Dietary components of an individual must be focused as it plays a significant role in obesity (Schrager et al., 2005, Simpson et al., 2005, Slavin et al., 2005).

Common food practices and food intake plays an important role in the development of cardiac diseases. Studies shows that increase consumption of fruits, dietary fiber, vegetables and decrease consumption of trans and saturated fatty acids and sweets can cause decrease in the prevalence of chronic diseases. Keeping in view the above facts, this study was designed to explore the relation of dietary intake and anthropometric indicators with the lipid profile of a small segment of Pakistani population.

MATERIALS AND METHODS

1. Study location

The study was conducted in District Peshawar of KPK.

2. Study design and sample selection

In a cross-sectional population based study we randomly selected a convenient sample of 100 healthy females from the community of District Peshawar. Apparently healthy females of age 20-60 years free from infections during the past 6 months were enrolled in the study. While subjects with history of hypertension, diabetes, gastrointestinal problems, medication or other medical conditions and those with a weight loss or weight gain during the last six months were excluded from the study.

3. Data collection

Data were collected from the concern subjects through a questionnaire that had the following aspects:

3.1. Socio demographic data

Socio-demographic characteristics such as age, occupation, income level, family size, family type and marital status were asked through face to face

interview and the responses of the subjects were recorded.

3.2. Anthropometric data

Height, weight, BMI and waist circumference were measured to assess the nutritional status of the participants. These measurements were taken by standard WHO anthropometric assessment procedures (WHO, 2008). Height was measured without shoes using a moveable stadiometer to the nearest 0.1 cm and body weight was weighed through digital scale and measured to the nearest 0.1 kg without heavy clothing and shoes A broadly accepted measure of weight for height, the body mass index (BMI) i.e. weight in kilograms divided by the square of the height in meters (kg/m^2) was used. Participants were than classified into the BMI groups. WC was measured with a non-stretchable measuring tape that was positioned around the iliac crest and midway between the lower ribs margins reading were recorded to the nearest 0.5cm.

3.3. Dietary data

Dietary data were recorded through face to face interview from the participants by using 24-hour dietary recall method and food frequency questionnaires. The common household utensils were used as a standard for the intake of food. The kind and amount of food eaten were used for estimation of nutrients intake. A food composition table for Pakistan was used for this purpose.

3.4. Biochemical data

An approximately 5ml of blood was taken in a disposable syringe after 12 hour of fasting from all the study subjects to determine their serum lipid profile (HDL, LDL, TC, TG and VLDL).The blood samples were transferred into a EDTA tubes. The collected samples were transported to the Department of Human Nutrition Laboratory in the icebox for further analysis. The blood was centrifuged at 3000 rpm for 3-4 minutes in order to obtained serum. Lipid serum profile was determined by using DAILAB Company kits**,** Austria through Micro lab 300.

4. Statistical analysis

Data regarding anthropometric, biochemical and dietary intake were entered into the computer for advance analysis. SPSS (version 20) was used in which descriptive statistics like mean, frequency and standard deviation were determined. Student's t-test, correlations and ANOVA were run on the data to determine the mean differences in anthropometric, dietary and biochemical variables.

RESULTS

The study was conducted in different areas of District Peshawar in order to evaluate the relationship between diet and lipid profile of healthy female individuals.

4.1. Socio demographic characteristics of the subjects

Table 1 shows socio demographic characteristics of the subjects. The mean age of the studied group was 32.76±11.11 years, 50% of the participants were in the age group of 21-30 years. 58% of the subjects were married and 42% were unmarried. Out of total 28% of subjects were employed and majority of them were unemployed (72%). 20% of the females were illiterate while 80% were recorded to have some degree of education. 42% were living in joint and 58% in nuclear families.

Table 1. Socio demographic characteristics of the subjects

Variables		Frequency(%)/Mean ± SD
Age(years)		32.76±11.11
Age categories(years)	21-30	50 (50%)
	31-40	26 (26%)
	41-50	15 (15%)
	51-60	9 (9%)
Marital status	Married	58 (58%)
	Unmarried	42 (42%)
Occupation	Employed	28 (28%)
	Unemployed	72 (72%)
Education	Illiterate	20 (20%)

	Matric/lower	15 (15%)
	FA/F.Sc	10 (10%)
	BA/BSc	28 (28%)
	MA/MSc/Higher	27 (27%)
Income (Rs)	<40,000	47 (47%)
	41,000-90,000	36 (36%)
	≥ 91,000	17 (17%)
Family type	Joint	42(42%)
	Nuclear	58(58%)

SD= standard deviation, Rs= rupees, %= percentage

4.2. Anthropometric characteristics of the subjects

Table 2 shows the anthropometric data of the subjects. Mean weight of the studied subjects was 64.75±13.07 kg and mean height was 157.61±4.52 cm while mean BMI calculated was 26.37±5.34. BMI was classified into four groups. According to WHO classification of BMI, 7% of the subjects were underweight, 34% were normal, 37% fall in the category of overweight and 22% were obese. Mean waist circumference was 85.09±9.24 cm. 20% of subjects had a normal waist circumference (<80cm) and 80% were at risk (WC ≥80 cm).

Table 2. Anthropometric characteristics of the Subjects

Variables		Frequency(%)/ Mean± SD
Weight(kg)		64.75±13.07
Height(cm)		157.61±4.52
Body Mass Index		26.37±5.34
BMI groups	Underweight (<18.5)	7 (7%)
	Normal (18.5-24.9)	34 (34%)
	Overweight(25-29.9)	37(37%)
	Obese (>30)	22 (22%)
Waist circumference(cm)		85.09±9.24
WC categories (cm)	Normal (<80cm)	20 (20%)
	At risk (≥80cm)	80 (80%)

SD= standard deviation, %= percentage, cm= centimeter, kg= kilogram, BMI= body mass index, WC= waist circumference.

4.3. Biochemical parameters of the studied subjects

Table 3 indicates the biochemical parameters of the subjects. The mean triglycerides of the studied subjects were 164.16±45.80 mg/dl. 37% had a normal serum triglycerides level while 63% were at risk. The mean high density lipoprotein was 35.0±3.91 mg/dl. 85% were at risk and 15% lies in the category of normal high density lipoproteins. The mean value of low density lipoprotein was 100.47±23.97 mg/dl. 93% of the subjects had normal low density lipoprotein and 7% was at risk. The mean value of very low density lipoprotein was 32.5±9.1. 40% observed were normal while 60% of the subjects VLDL were at risk. Mean value of total cholesterol was 167.39±32.23 mg/dl. 84% of the subjects were normal and 16% were at risk.

Table 3. Biochemical parameters of the studied subjects

Variables		Frequency(%)/Mean±SD
Triglycerides (mg/dl)		164.16±45.80
TG groups(mg/dl)	Normal (<150)	37(37%)
	At risk (≥150)	63(63%)
High density lipoproteins(mg/dl)		35.0±3.91
HDL groups(mg/dl)	Normal (≥40)	15 (15%)
	At risk (<40)	85(85%)
Low density lipoproteins(mg/dl)		100.47±23.97
LDL groups(mg/dl)	Normal (<130)	93 (93%)
	At risk (>130)	7 (7%)
Very low density lipoproteins(mg/dl)		32.5±9.1
VLDL groups(mg/dl)	Normal (≤30)	40 (40%)
	At risk (>30)	60 (60%)
Total cholesterol(mg/dl)		167.39±32.23
TC groups(mg/dl)	Normal (<200)	84 (84%)
	At risk (≥200)	16 (16%)

SD= standard deviation, %= percentage cm= centimeter, kg= kilogram, BMI= body mass index, WC= waist circumference, TG= triglycerides, HDL= high density lipoproteins, LDL= low density lipoproteins, VLDL= very low density lipoproteins, TC= total cholesterol, mg/dl= milligram per deciliter

4.4. Energy and macronutrients intake of the subjects

Table 4 shows the mean intake of energy and macronutrients of the studied subjects calculated from 24-hour dietary recall method. The mean caloric intake of the studied group was 1701.82±400.68 kcal/day while mean value of fats was 74.99±18.72 gm/day and proteins were 62.50±22.24 gm/day. The mean intake of carbohydrates was observed as 74.99±18.72 gm/day of the subjects.

Table 4. Energy and macronutrients intake of the subjects

Variables	Mean± SD
Calories(kcal/day)	1701.82±400.68
Fats (gm/day)	74.99±18.72
Protein (gm/day)	62.50±22.24
Carbohydrates (gm/day)	216.34±72.38

Gm= grams, SD= standard deviation.

4.5. Correlation of anthropometric indicators with lipid profile.

Table 5 represents the correlation between anthropometric parameters and lipid profile of the healthy subjects. HDL was negatively correlated with weight, height, waist circumference and BMI. LDL was positively related with height while a strongly significant correlation was found among LDL, weight, waist circumference and BMI. VLDL was negatively related with height and was strongly significant correlated with weight, waist circumference and BMI. A negative correlation was found between TC and height. Weight, waist circumference and BMI are strongly correlated with TC. A strong significant correlation was found among triglycerides, weight, waist circumference and BMI while TG was negatively correlated with height.

Table 5. Correlation of anthropometric indicators with lipid profile

Variables	HDL	LDL	VLDL	TC	TG	Weight	Height	BMI values	WC
HDL	1	-0.24*	0.08	0.00	0.07	-0.24*	-0.14	-0.19	-0.15
LDL	-0.24*	1	0.59**	0.64**	0.63**	0.34**	0.03	0.41**	0.38**
VLDL	0.86	0.59**	1	0.76**	0.97**	0.41**	-0.13	0.51**	0.29**
TC	0.00	0.64**	0.76**	1	0.78	0.42**	-0.17	0.53**	0.41*
TG	0.07	0.63**	0.97**	0.78**	1	0.42**	-0.10	0.51**	0.31**
Weight	-0.24*	0.34**	0.41**	0.42**	0.42**	1	0.29**	0.90**	0.76**
Height	-0.14	0.03	-0.13	-0.17	-0.10	0.29**	1	0.05	0.09
BMI	-0.19	0.41**	0.51**	0.53**	0.51**	0.90**	-0.05	1	0.76**
WC	-0.15	0.38**	0.29**	0.41**	0.31**	0.76**	0.09	0.76**	1

*Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed). BMI= body mass index, WC= waist circumference, TG= triglycerides, HDL= high density lipoproteins, LDL= low density lipoproteins, VLDL= very low density lipoproteins, TC= total cholesterol.

4.6. Lipid profile in relation with BMI groups

Table 6 signifies the relationship of BMI with lipid profile. There was a significant difference (P<0.05) among the mean TG of all the four groups of BMI. The mean TG of obese individuals was higher than those of normal, underweight and overweight women. A significant difference (P<0.05) among mean LDL of underweight, normal, over weight and obese subjects was observed while no significant difference among mean LDL of normal and underweight individuals was observed. Mean LDL of obese women was higher than the other three groups of BMI. There was non-significant (P>0.05) difference among mean HDL of normal, underweight, overweight and obese subjects. Moreover, a statistical significant difference (P<0.05) was observed in the mean VLDL and TC of underweight, overweight, normal and obese individuals. While no significant difference (P>0.05) among mean VLDL and TC of normal, overweight and underweight was recorded.

Table 6. Lipid profile in relation with BMI groups

Variables (mg/dl)	Mean ±SD				P-value
	BMI				
	Underweight	Normal	Overweight	Obese	
TG	143.57±22.21[a]	143.91±36.57[ab]	163.56±39.75[ac]	204.45±49.31[d]	<0.001
HDL	38.00±2.88	34.61±3.96	35.35±3.71	34.13±4.16	0.120
LDL	78.28±7.40[a]	89.05±22.99[ab]	102.78±22.70[cb]	115.09±22.19[d]	<0.001
VLDL	28.71±4.44[a]	28.52±7.04[a]	32.00±8.09[a]	40.89±9.83[b]	<0.001
TC	148.42±13.92[a]	151.73±28.78[ab]	168.59±26.64[ac]	195.59±31.16[d]	<0.001

P= probability, SD= standard deviation, BMI= body mass index, TG= Triglycerides, VLDL= Very low density lipoproteins, HDL= High density lipoproteins, LDL= Low density lipoproteins, TC= Total cholesterol. *Mean values in rows with different alphabets (superscripts) shows significant (P<0.005) difference among variables.

Table 4.7. Lipid profile in relation with waist circumference

Table 7 indicates the relationship of lipid indicators with waist circumference. There was a significant difference (P<0.05) between mean TG of normal (145.85±26.39 mg/dl) waist circumference subjects and those were at risk (169.13±48.49 mg/dl). Considerably higher difference (P<0.05)

was observed between mean HDL of normal (37.00±3.21 mg/dl) waist circumference individuals and who were at risk (34.52±3.93 mg/dl). Mean LDL of normal (85.50±10.38 mg/dl) waist circumference subjects were significantly higher (P<0.05) than individuals who were at risk (104.21±24.96 mg/dl). No significant difference (P>0.05) was found between the mean VLDL of normal (29.17±5.27 mg/dl) waist circumference subjects and those who were at risk (33.39±9.76 mg/dl). A significantly higher difference (P<0.05) was observed between mean TC of normal (151.30±20.07 mg/dl) waist circumference individuals and women whose waist circumference were at risk (171.41±33.51 mg/dl).

Table 7. Lipid profile in relation with waist circumference

Variables	Mean ±SD Waist circumference		P-value
	Normal (<80 cm)	At risk (≥80 cm)	
TG (mg/dl)	145.85±26.39	169.13±48.49	0.041
HDL (mg/dl)	37.00±3.21	34.52±3.93	0.011
LDL(mg/dl)	85.50±10.38	104.21±24.96	0.001
VLDL (mg/dl)	29.17±5.27	33.39±9.76	0.066
TC (mg/dl)	151.30±20.07	171.41±33.51	0.012

P= probability, SD= standard deviation, WC= Waist circumference, TG= Triglycerides, VLDL= Very low density lipoproteins, HDL= High density lipoproteins, LDL= Low density lipoproteins, TC= Total cholesterol.

4.8. Correlation of macronutrients intake with lipid profile

Table 8 shows correlation between macronutrients intake and lipid profile of studied subjects. A negatively non-significant relationship was observed between fats and triglycerides and a non-significantly positive relation with calories, carbohydrates and protein. HDL was found negatively non-significantly correlated with fats and carbohydrates while positively but non-significantly with calories and proteins. LDL was positively correlated with fats and proteins while a significant (P<0.05) positively correlation was observed among LDL, calories and carbohydrates. VLDL was found non-significantly (P>0.05) positively related with calories, carbohydrates and proteins. A non-significantly negative correlation was observed between VLDL and fats. Total cholesterol was found significantly positive correlated with calories and was non-significantly positive correlated with carbohydrates, protein and fats.

Table 8. Correlation of macronutrients intake with lipid profile

Variables	TG	HDL	LDL	VLDL	TC	Calories	CHO	Proteins	Fats
TG	1	0.07	0.63**	0.97**	0.78**	0.17	0.08	0.10	-0.10
HDL	0.07	1	-0.24*	0.08	0.00	0.06	-0.07	0.06	-0.02
LDL	0.63**	-0.24*	1	0.59**	0.64**	0.28**	0.29**	0.00	0.04
VLDL	0.97**	0.08	0.59**	1	0.761**	0.16	0.02	0.05	-0.09
TC	0.78**	0.00	0.64**	0.76**	1	0.26**	0.16	0.11	0.01
Calories	0.17	0.01	0.28**	0.16	0.26**	1	0.68**	0.41**	0.48**
CHO	0.08	-0.07	0.29**	0.02	0.16	0.68**	1	0.40**	0.36**
Proteins	0.10	0.06	0.00	0.05	0.11	0.41**	0.40**	1	0.25**
Fats	-0.10	-0.02	0.04	-0.09	0.01	0.48**	0.36*	0.25**	1

*Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed).

4.9. Lipid profile in relation with of macronutrient intake of subjects

Table 9 shows the mean intake of nutrients and their relationship with lipid profile of studied subjects. Mean caloric intakes of subjects with

normal triglycerides were 1653.31±389.88 kcal/day and those at risk were 1730.30±407.27 kcal/day. Further, the mean CHO intake of at risk subjects for triglycerides was higher than normal subjects. No significant (P<0.05) difference among the mean intake of calories, protein, fats and carbohydrates of normal and at risk subjects was recorded.

Moreover, a non-significant difference (P>0.05) in the mean intakes of calories, carbohydrates, proteins and fats was observed for HDL, LDL and VLDL.

There was significant (P>0.05) difference between the mean caloric intake of normal and those with high cholesterol (1667.49±402.56 kcal/day vs. 1882.02±348.82 kcal/day). While no significant (P>0.05) differences were seen among mean intake of CHO, protein and fats of studied subjects with high total cholesterol.

Table 9. Lipid profile in relation with macronutrient intake of the subjects

Variables		Calories	P-value	CHO	P-value	Protein	P-value	Fats	P-value
TG	Normal	1653.31±389.88	0.356	213.62±89.29	0.776	64.13±24.09	0.577	77.54±21.43	0.299
	At risk	1730.30 ± 407.27		217.93±61.06		61.54±21.22		73.50±16.93	
HDL	Normal	1713.84 ± 410.74	0.478	219.86±75.35	0.248	62.31±20.35	0.841	74.51±19.52	0.541
	At risk	1633.65±293.37		196.35±49.73		63.57±31.84		77.74±13.54	
LDL	Normal	1689.16±425.39	0.252	212.95±72.27	0.088	62.34±22.50	0.802	74.54±18.82	0.380
	At risk	1869.98±335.01		261.35±61.75		64.54±19.83		81.02 ±17.48	
VLDL	Normal	1661.88±388.18	0.433	217.68±91.55	0.770	65.72±25.71	0.275	77.37±21.17	0.324
	At risk	1728.01±416.06		213.30 ±56.08		60.62±20.04		73.48 ±17.35	
TC	Normal	1667.49±402.56	**0.049 ***	212.92±75.64	0.282	61.00±21.88	0.613	75.03±18.52	0.962
	At risk	1882.02±348.82		234.24±50.12		65.09±24.65		74.79±20.36	

*= significant, P= probability, TG= Triglycerides, VLDL= Very low density lipoproteins, HDL= High density lipoproteins, LDL= Low density lipoproteins, TC= Total cholesterol, CHO= carbohydrates

Table 10. Relationship between lipid profile and dietary intake of the subjects by food groups

Table 10 shows the frequency of intake of food groups of the studied subjects and their association with lipid indicators. The frequency of intake from milk group (1-3 days/week) by the risk group was 38.1%, 31.8%, 57.1%, 40% and 56.2% for TG, HDL, VLDL and TC respectively. The consumption frequency of meat group (1-3 days/week) recorded was 29.7%,40%, 14.3%,38.3% and 37.5% for at risk group for TG, HDL, VLDL and TC respectively. Further, maximum consumption frequency of eggs, starchy vegetables, cereals, beverages and sweets were observed for at risk groups for all the lipid parameters. Moreover, the study subjects in the normal group were found to have maximum intake of fruits, vegetables, nuts, fish and salads.

Table 10. Relationship between lipid profile and dietary intake of the subjects by food groups

		TG		HDL		LDL		VLDL		TC	
		Normal	At risk	Normal	At risk	Normal	At risk	Normal	At risk	Normal	At risk
Milk*	Never/rarely	27 (73.0)	36 (51.7)	6 (40.0)	57 (67.1)	60 (64.5)	3 (42.9)	28 (73.70)	33 (55.0)	56 (66.7)	7 (43.8)
	1-3 days/week	9 (24.3)	24 (38.1)	6 (40.0)	27 (31.8)	29 (31.2)	4 (57.1)	9 (23.7)	24 (40.0)	24 (28.6)	9 (56.2)
	4-6 days/week	1 (2.7)	3 (4.8)	3 (20.0)	1 (1.2)	4 (4.3)	0 (0.0)	1 (2.6)	3 (5.0)	4 (4.8)	0 (0.0)
Meat[A]	Never/rarely	20 (54.1)	38 (60.3)	7 (46.7)	51 (60.0)	52 (55.9)	41 (44.1)	21 (55.3)	37 (61.7)	48 (57.1)	10 (62.5)
	1-3 days/week	17 (45.9)	35 (29.7)	8 (53.3)	34 (40.0)	6 (85.7)	1 (14.3)	17 (44.7)	23 (38.3)	36 (42.9)	6 (37.5)
Fish	Never/rarely	33 (89.2)	48 (76.2)	12 (80.0)	69 (81.2)	75 (80.6)	6 (85.7)	34 (89.5)	47 (78.3)	69 (82.1)	12 (75.0)
	1-3 days/week	4 (10.8)	14 (22.2)	3 (20.0)	15 (17.6)	17 (18.3)	1 (14.3)	4 (10.5)	12 (20.0)	14 (16.7)	4 (25.0)
	4-6 days/week	0 (0.0)	1 (1.6)	0 (0.0)	1 (1.2)	1 (1.1)	0 (0.0)	0 (0.0)	1 (1.7)	1 (1.2)	0 (0.0)
Eggs	Never/rarely	11 (29.7)	13 (20.6)	4 (26.7)	20 (23.5)	22 (23.7)	2 (28.6)	11 (28.9)	13 (21.7)	21 (25.0)	3 (18.8)
	1-3 days/week	14 (37.9)	27 (42.9)	8 (53.3)	33 (38.8)	37 (39.8)	4 (57.1)	14 (36.8)	26 (43.3)	35 (41.7)	6 (37.5)
	4-6 days/week	8(21.6)	10 (15.9)	1 (6.7)	17 (20.0)	18 (19.4)	0 (0.0)	9 (23.7)	8 (13.3)	14 (16.7)	4 (25.0)
	Daily	4 (10.8)	13 (20.6)	2 (13.3)	15 (17.6)	16 (17.2)	1 (14.3)	4 (10.5)	13 (21.7)	14 (16.7)	3 (18.8)
Meat[B]	Never/rarely	36 (97.3)	59 (93.7)	14 (93.3)	81 (95.3)	89 (95.7)	6 (85.7)	37 (97.4)	57 (95.0)	79 (94.0)	16 (100.0)
	1-3 days/week	0 (0.0)	4 (6.3)	1 (6.7)	3 (3.5)	3 (3.2)	1 (14.3)	0 (0.0)	3 (5.0)	4 (4.8)	0 (0.0)

	4-6 days/week	1 (2.7)	0 (0.0)	0 (0.0)	1 (1.2)	1 (1.1)	0 (0.0)	1 (2.6)	0 (0.0)	1 (1.2)	0 (0.0)
Legumes	Never/rarely	33 (89.2)	60 (95.2)	14 (93.3)	79 (92.9)	87 (93.5)	6 (85.7)	34 (89.5)	57 (95.0)	77 (91.7)	16 (100.0)
	1-3 days/week	4 (10.8)	3 (4.8)	1(6.7)	6 (7.1)	6 (6.5)	1 (14.3)	4 (10.5)	3 (5.0)	7 (8.3)	0 (0.0)
Colored vegetables	Never/rarely	3 (8.1)	9 (14.3)	3 (20.0)	9 (10.6)	12 (12.9)	0 (0.0)	3 (7.9)	9 (15.0)	8 (9.5)	4 (25.0)
	1-3 days/week	34 (91.9)	54 (85.7)	12 (80.0)	76 (89.4)	0 (0.0)	7(100.0)	35 (92.1)	51 (85.0)	76 (90.5)	12 (75.0)
Salads	Never/rarely	13(35.1)	32(50.8)	2 (13.3)	43 (50.6)	41(44.1)	4 (57.1)	13 (34.2)	32 (53.3)	37 (44.0)	8 (50.0)
	1-3 days/week	24(64.9)	29(46.0)	13 (86.7)	40 (47.1)	50 (53.8)	3 (42.9)	25 (65.8)	26 (43.3)	45 (53.6)	8 (50.0)
	4-6 days/week	0(0.0)	1(1.6)	0 (0.0)	1 (1.2)	1 (1.1)	0 (0.0)	0 (0.0)	1 (1.7)	1 (1.2)	0 (0.0)
Starchy vegetable	Never/rarely	12(32.4)	23(36.5)	5(33.3)	30 (35.3)	33 (35.5)	2(28.6)	12 (31.6)	23 (38.3)	28 (33.3)	7 (43.8)
	1-3 days/week	25 (67.6)	40(63.5)	10 (66.7)	55 (64.7)	60 (64.5)	5(71.4)	26 (68.4)	37 (61.7)	56 (66.7)	9 (56.2)
Fruits	Never/rarely	35 (94.6)	59(93.7)	14 (93.3)	80 (94.1)	87 (93.5)	7 (100.0)	36 (94.7)	56 (93.3)	79 (94.0)	15 (93.8)
	1-3 days/week	2 (5.4)	4 (6.3)	1 (6.7)	5 (5.9)	6 (6.5)	0(0.0)	2 (5.3)	4 (6.7)	5 (6.0)	1 (6.2)
Cereals	1-3 days/week	33 (87.7)	4(32.3)	0 (0.0)	85 (97.7)	80 (86.1)	7 (100.0)	34 (33.3)	4 (32.3)	72 (80.5)	12 (92.3)
	4-6 days/week	5 (12.3)	9(67.8)	13 (100.0)	2 (2.3)	13 (13.9)	0 (0.0)	51 (66.7)	9 (67.8)	15 (19.5)	1 (7.7)
Nuts	Never/rarely	36(97.3)	61(96.8)	15 (100.0)	82 (96.5)	91 (97.8)	6 (85.7)	37 (97.4)	59 (98.3)	81 (96.4)	16(100.0)
	1-3 days/week	1(2.7)	2(3.2)	0 (0.0)	3 (3.5)	2(2.2)	1 (14.3)	1(2.6)	1 (1.7)	3 (3.6)	0(0.0)

	Never/rarely	19(51.4)	25(39.7)	4 (26.7)	40 (47.1)	41 (44.1)	3 (42.9)	19 (50.0)	25 (41.7)	38 (45.2)	6 (37.5)
Beverages	1-3 days/week	17(45.9)	37(58.7)	10 (66.7)	44 (51.8)	50 (53.8)	4 (57.1)	18 (47.4)	34 (56.7)	46 (54.8)	8 (50.0)
	4-6 days/week	1(2.7)	1(1.6)	1(6.7)	1 (1.2)	2 (2.2)	0 (0.0)	1 (2.6)	1 (1.2)	0 (0.0)	2 (12.5)
	Never/rarely	3(8.1)	2(3.2)	0 (0.0)	5 (5.9)	5 (5.4)	0 (0.0)	3 (7.9)	2 (3.3)	5 (6.0)	0(0.0)
	1-3 days/week	29 (78.4)	54(85.7)	12 (80.0)	71(83.5)	76 (81.7)	7 (100.0)	30 (78.9)	51 (85.0)	67 (79.8)	16(100.0)
Sweets	4-6 days/week	5 (13.3)	6 (9.5)	3 (20.0)	8 (9.4)	11 (11.8)	0 (0.0)	5 (13.2)	6 (10.0)	11 (13.1)	0(0.0)
	Daily	0(0.0)	1 (1.6)	0 (0.0)	1 (1.2)	1 (1.1)	0 (0.0)	0 (0.0)	1 (1.7)	1 (1.2)	0(0.0)
	Never/rarely	6 (16.2)	4 (6.3)	0 (0.0)	10 (11.8)	9(9.7)	1 (14.3)	6 (15.8)	4 (6.7)	10 (11.9)	0(0.0)
Fats	1-3 days/week	25 (67.6)	46(73.0)	0 (0.0)	71 (83.5)	65 (69.9)	6 (85.7)	26 (68.4)	43 (71.7)	57 (57.9)	14 (87.5)
	4-6 days/week	3(8.1)	10(15.9)	9 (60.0)	4 (4.7)	13(14.0)	0(0.0)	3 (7.9)	10 (16.7)	11 (13.1)	2 (12.5)
	Daily	3(8.1)	3(4.8)	6 (40.0)	0 (0.0)	6(6.5)	0(0.0)	3 (7.9)	3 (5.0)	6 (7.1)	0(0.0)

Milk*=fresh milk, yogurt, lassi, raita,cream, ice-cream, kheer, custard, Meat[A]=chicken, mutton, beef, qeema, Meat[B]=koftay, shamikabab, chaplikabab

DISCUSSION

Globally the prevalence of chronic diseases is increasing most commonly CVD, obesity, hypertension and other respiratory diseases. The most common chronic disease in South Asian developing countries are cardiac heart diseases (CHD). Well-known risks for CHD are obesity and poor diet. Cardiovascular diseases can be easily determined by abdominal fats and waist circumference; considered as an important indicator in the anthropometric assessment of obesity. Most simple technique used for determination of obesity is BMI. According to WHO classification of BMI, the present study demonstrated that almost 37% of women were overweight and 22% were obese. Waist circumference of 80% of the subjects was at risk and 20% were normal. TC of 63% of women was at risk. HDL of the 85% participants was at risk while 93% and 60% of subjects had disturbed LDL and VLDL levels.

Women with central obesity and increased BMI are at risk of chronic diseases. Our results are in agreement with Dodani et al. (2004) who carried out a study on frequency and awareness of risk factors associated with CHD. According to the results, 18.5% of the subjects were obese and more than half of the subjects were overweight. Several investigations reported that obesity were more prevalent in females compared to males. A study on lipid indicators and hazards of obesity in adults concluded that overweight and increased waist

circumference was the main reasons for the development of chronic diseases as they caused disturbances in the lipid markers and lead to CVD (Sharma and Sharma, 2015). Hu et al. (2000) studied the effect of obesity and fats scattering on lipids in American adults established negative relationship between high density lipoprotein and BMI in women. Waist circumference was negatively associated with HDL and positively correlated with triglycerides.

BMI is one of main factor in the development of CHD, causing imbalance in lipid parameters of the person. The present results are supported by previous studies which reported a statistically significant ($p<0.05$) difference among the low density lipoprotein and total cholesterol of obese individuals and other BMI groups (Tomasik et al. 2011; Chehrei et al., 2007; Pajak et al.,2005). Another study reported that mean TC was significantly different among obese and other BMI groups ($P<0.05$) and mean HDL was higher in underweight individuals. Previous study concluded that mean TG and LDL were not significantly ($P>0.05$) different among groups while in present study they are significantly ($P<0.05$) different. This contradiction in the results of both studies may due to the difference in age limits (Ajlan, 2011). Because with increasing age the risk for CVD also increases due to inactivity and other factors like dietary and life style changes.

The present study highlighted irregular dietary intakes of the female subjects. Our results are in agreement with the findings of a previous study that observed non significant statistical difference ($p>0.05$) in the mean intakes of macronutrients; carbohydrates, fats, protein and calories among normal lipid profile subjects and those with irregular lipid profile (Zeb et al., 2015).

Difference in food consumption was observed in different areas of district Peshawar because of culture and availability of specific food. According to WHO (2002) consumption of vegetables and fruits are different within the countries and across the borders due to their agriculture, economic and culture differences. Our findings shows that cereals, eggs, milk group, meat, sweets and beverages were consumed mostly as compared to fruits, nuts and vegetables and legumes in those subjects whose lipid profile was disturbed. Baig et al., (2015) reported that individuals who consumed meat and meat products 1-3 days/week had HDL level at risk and those who consumed it on daily basis had higher LDL and TG. Consumption of fruits and vegetables should be the main components of the healthy diet in order to avoid risks for heart diseases, digestive problems and some types of cancers. Esmaillzadeh et al. (2006) concluded that high intake of fruits and vegetables lowers the risk of chronic diseases like CHD and also effective in weight reduction as they are rich sources of antioxidant, phytochemicals and other micronutrients.

CONCLUSION

The present concluded that obesity is associated with the lipid disturbance and waist circumference plays an important role in the development of the chronic diseases. Diversity in the dietary habits of normal and obese individuals was observed. Irregular dietary intakes were observed in the subjects. Consumption of fruits, vegetables and nuts were slightly lower. Frequent consumption of milk and milk products, fats, cereals, eggs, sweets, beverages, meat and meat products were observed while fruits, vegetables, nuts and fish were consumed less frequently. Our finding provides the baseline information about the nutritional status and dietary habits of the studied population. Our baseline data can be a primary source for policy makers to initiate health and nutritional programs in the community. Moreover, due to unavailability of resources, small sample size was taken from Peshawar city. Future studies with larger sample size are recommended to get more appropriate and representative results.

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