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DIABETES MELLITUS;
PREVALENCE OF HIGH BLOOD CHOLESTEROL, OBESITY, SMOKING AND PHYSICAL ACTIVITY IN URBAN POPULATION OF FAISALABAD.

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ABSTRACT. **Objective:** To estimate the prevalence of diabetes, high total cholesterol, obesity, smoking and physical activity in urban population of Faisalabad. **Research design and methods:** The project was limited to population based screening for above mentioned variables using WHO criteria. Study was conducted by holding numerous screening camps in different urban areas over the course of two years. People age 20 years or above were included in the study. Total 5349 people, 58% males (3102) and 42% females (2247) were screened for diabetes and high blood cholesterol. Body mass index was calculated by measuring height in meter square and weight in kilograms. People were interviewed for smoking and physical activity and relevant data was entered in the designed proforma. **Results:** Within the chosen age range, total prevalence of diabetes was 16% and among them 11% were previously diagnosed and 5% were unaware of their diabetes (newly diagnosed). Cholesterol was high ($\geq$200 mg/dl) in 48 % males and 34% females. 9.2 % of the males were found to be obese (BMI>30) in comparison to 14.3 % of females whereas 36.26% of males and 36.84 % of females were overweight (BMI $\geq$ 25 to 29.9 kg/m²). The prevalence of smoking was 38.8% in males and 1.2 % in females respectively. In daily routines only 6.8 % of the males were doing the physical exercise (30 minutes exercise five days a week or equivalent) whereas among females it was 1.9 %. **Conclusion:** Diabetes and metabolic syndrome in adults is now a global health problem, and the population of developing countries like Pakistan are facing this menace especially in the urban areas where it is on the rise with each passing day.

INTRODUCTION

In many regions of the world, one of the most dreadful enemies of health is combination of poverty with illness which imposes a double burden of disease, disability and

premature death in millions of people.[1] This is what is happening in South Asia, which has one quarter of the global population and about half of this population lives below the poverty line and has limited access to health care[1]. Although infectious diseases remain a formidable enemy, the population is ageing and non-communicable diseases are rising[2-3]. Compared with the population in industrialized countries, those in the developing world appear to be at greater risk of the diseases associated with being overweight, and cardiovascular disease has become the leading cause of disability and death in many developing countries[6,7]. The prevalence of diabetes and its adverse health effects has risen more rapidly in South Asia than in any other large region of the world[8]. India has a higher number of people with diabetes than any other country, with estimates ranging from 19.4 million in 1995[8] to 32.7 million in 2000[9] and 40 million in 2007.[23] In 2003, with a diabetic population of 23.8 million, China was second in the world to India (35.5 million) and by 2007 it still remained second to India with a diabetic population of 39.8 million[10,4]. In 1995, Pakistan was 8th in the list of top ten countries with high prevalence of diabetes and had 4.3 million people with diabetes mellitus.[11] However, it is estimated that in the year 2025, Pakistan will be 4th in the list with 14.5 million diabetic people[11]

Developing countries are increasingly exposed to the pandemic of obesity, which affects all segments of the population, including men, women and even children[4,5].

Particularly abdominal obesity, has been implicated as a risk factor for coronary heart disease in Western population[14], and in Asians it has been linked with the major components of the metabolic-syndrome as well as ischemic heart disease[13,14].

According to one of the studies in China, it was found that among the Chinese population ranging from 35 to 74 years of age, 23.8% (112,500,000 persons) had borderline high total cholesterol (200 to 239 mg/dL), and 9.0% (42,540,000 persons) had high total cholesterol ($\geq$ 240 mg/dL)[16]. Indian population is found to have a fairly high prevalence of elevated blood cholesterol as data by 2004 suggests that total cholesterol $\geq$ 5.2 mmol/l (200

mg/dl) is prevalent in 33.2% males and 28% females[17].

In Pakistan a study on lower middle class revealed that the prevalence of high cholesterol >200 mg/dL is 16% and 24% in men and women respectively[15].

Worldwide about 4 million people die annually from tobacco related causes, and by the late 2020s the estimated toll will be about 10 million[18]. South Asia, with about a quarter of the world's population, contributes substantially to these figures[18]. Cigarette consumption is high in some countries, with average annual use of 1440 cigarettes for every inhabitant in the Maldives, 620 in Nepal, and 560 in Pakistan[18].

A study in Britain showed that South Asians have significantly lower levels of habitual physical activity than Europeans[21]. Surveys from 2001, 2002, and 2003 for the Asian and Native Hawaiian or Other Pacific Islander (NHOPI) populations from all 50 states and the District of Columbia indicated that 38.6% of Asians and NHOPIs met recommended levels of lifestyle physical activity, compared with 45.8% of the total U.S. population, and approximately 24% were inactive during their leisure time[30]. With increasing rates of urbanization in India, major changes in lifestyle patterns have occurred for a large proportion of individuals[19]. This has led to a trend towards decreasing physical activity due to improved transportation and availability of energy saving devices[19]. Change in life style, higher density energy food, reduced physical activity, inventions of remote control gadgets and less exercise have all led to increased incidence of obesity and other associated disorders[20].

As the diabetes, high total cholesterol, obesity, smoking and physical activity is increasing like a pandemic this study was conducted to observe there prevalence in a highly industrialized urban area like Faisalabad, to set future planes to handle the challenge.

MATERIAL AND METHODS
This study was a population based prevalence survey. The fieldwork was completed within a period of 24 months, starting in January 2006. The first 3 months were taken for the training of physicians and paramedics

various field techniques (e.g. accurate blood pressure measurement and anthropometric measures) and preparation of standard questionnaire. Seventeen medical camps were held in various urban areas of Faisalabad and a total 7500 people, 2500 in 2006 and 5000 in 2007 were screened randomly. All the subjects were fully informed about the purpose of the study. Those detected as having any disease were provided with complete medical investigation and management in the referral hospital free of cost.

A detailed questionnaire incorporating demographic profile, socio-economic data, relevant symptoms, tobacco consumption, physical activity pattern, dietary habits, health history, serum total cholesterol, blood glucose was prepared in English and was translated into Urdu. A third party retranslation of questionnaire was done to make sure that the information is conveyed accurately. A complete physical examination was performed on all the subjects. Blood pressure was recorded in sitting position after 5 min rest with a mercury sphygmomanometer according to the standard guidelines. If one abnormal reading was observed, a second reading was recorded after 10 min of rest.

Incompletely filled proforma were excluded from the study and total of 5349 people were included and among them were 58%males (3102) and 42% females (2247).

ANTHROPOMETRIC MEASUREMENTS
Height was measured without shoes with the participant standing erect and looking straight ahead with his/her head in the Frankfort horizontal plane. Height was recorded to the nearest 0.1 cm. Weight was measured on a spring balance with the participant wearing light clothing. Weight was measured to the nearest 0.1 kg. The body mass index (BMI) was calculated as weight (kg) /height^2 (m^2).

BIOCHEMICAL SAMPLES
Random blood glucose of 6000 people was tested with Optium Xceed (Abbot) and test strips and 1500 were tested with Accucheck Active (Roche).Blood cholesterol was tested with cholesterol meter Accutrend GCT and Accutrend Cholesterol testing strips.

OPERATIONAL DEFINITIONS
Diabetes Mellitus: Diabetes mellitus was diagnosed according to the diagnostic criteria of the American Diabetic Association i.e, random blood sugar level ≥ 200 mg/dL along with symptomatology (newly diagnosed) or there is previous history of diabetes (previously diagnosed).

Blood Cholesterol: ≥ 200 mg/dL was labeled high cholesterol.

Smoking: WHO criteria was used for smoking, according to which, a smoker is a person who, at the time of the survey, smoked any tobacco product either daily or occasionally. A daily smoker is a person, who smoked any tobacco product at least once a day (people who smoked every day, but not on days of religious fasting, were still classified as daily smokers). An occasional smoker is a person, who smoked but not every day). A non-smoker is a person who either had never smoked at all or had never been a daily smoker and had smoked less than 100 cigarettes (or the equivalent amount of tobacco) in his/her lifetime. Passive smokers, who were never-smokers but exposed to cigarette smoke to more than 30 minutes/day. The exposure to tobacco smoke was determined in persons who were exposed either in home/workplace or both keeping in mind the fact that the iniquitousness of tobacco smoke in homes, workplaces, public areas and private establishments makes exposure to environmental tobacco smoke unavoidable.

Overweight and Obesity: Over weight and obesity were defined both by WHO cutoff i.e, BMI $\geq$ 25 to 29.9 kg/m^2 and BMI $\geq$ 30 kg/m^2 and above respectively and by current recommendations for the Asia-Pacific region define adult overweight at BMI ≥ 23 and obesity at BMI ≥ 25.

Physical Activity: Physical activity was defined by any moderate-to-vigorous-intensity aerobic activity for at least 30 minutes on most days of the week as part of a regular routine.

STATISTICAL METHODS
Data were entered into an Excel spreadsheet. Population

was segregated into male and female groups. Discrete variables such as diabetes, BMI classes, Smoking, Physical Activity etc were presented in percentages and Chi square test was used to find out the significance between male & female among these variables. Continuous variables such as age, weight, height, BMI, total cholesterol were presented in mean ± SD and Independent t-test was used to analyze the significant difference between male & female among these variables. P<0.05 was considered as statistically significant value. SPSS v13 was used to analyze the data.

RESULTS
Within the chosen age range, total prevalence of diabetes was 16%(858) (568 male & 290 female) and among them 11% (589, 391 male & 198 female) were

previously diagnosed and 5% (269, 177 male & 92 female) were unaware of their diabetes (newly diagnosed). Cholesterol was high (≥ 200 mg/dl) in 48 % males (1489) and 34% females (764).

9.2%(285) of the males were found to be obese (BMI>30) in comparison to 14.3 %(321) of females whereas 36.26% (1125) of males and 36.84 % (828) of females were overweight (BMI $\geq$ 25 to 29.9 kg/m²). The prevalence of smoking was 38.8% (1204) in males and 1.2 %(27) in females respectively (Passive smoking was not included).

In daily routines only 6.8 %(211) of the males were doing the physical exercise (30 minutes exercise five days a week or equivalent) whereas among females it was 1.9 %(43). (Table-I).

Table-I. Prevalence of diabetes and other risk factors. (Total 5349 people, 58%males (3102) and 42% females (2247)						
	% among 5349 people	No. among 5349 people	% among 3102 males	No. among 3102 people	% among 2247 males	No. among 2247 people
Total Prevalence of DM (Known+ Unknown)	16.04%	858	18.31%	568	12.91%	290
Known Diabetics	11.0%	589	12.60%	391	8.81%	198
Unknown diabetics (RBC $\geq$200)	5.03%	269	5.71%	177	4.09%	92
High Total Cholesterol $\geq$ 200 mg/dl	42.12%	2253	48.00%	1489	34.00%	764
Obesity BMI $\geq$30 (WHO Criteria)	11.3%	606	9.19%	285	14.29%	321
Overweight BMI $\geq$25 to 29.9 (WHO Criteria)	36.51%	1953	36.27%	1125	36.85%	828
Obesity BMI $\geq$25 (Asia Pacific Criteria)	47.84%	2559	45.45%	1410	51.13%	1149
Overweight BMI $\geq$2 to 24.9 (Asia Pacific Criteria)	31.84%	1703	30.27%	939	34.00%	764
Smoking	23.01%	1231	38.81%	1204	1.20%	27
Physical Activity i.e. 30-60 min Exercise for 5 or More Days of the Week	4.75%	254	6.80%	211	1.91%	43

Male population was affected more in all the risks studied in population under observation as compared to the female. Prevalence of diabetes, high total cholesterol, obesity, smoking were high in male population (p-value

<0.008, <0.001, <0.001, <0.001, <0.004 and <0.001 respectively). Physical activity was more in male population (p-value <0.001) as compared to female. (Table-II).

Table-II. Male Population is more at risk in term of various risk factors except physical activity			
	Male (n=3102) n (n %)	Female (n = 2247) n (n %)	*P-Value*
Total Prevalence (Known+ Unknown)	568 (18.3%)	290 (12.9 %)	< 0.001*
Known Diabetics	391(12.6%)	198 (8.8%)	< 0.001*
Unknown diabetics (RBC ≥200)	177 (5.7%)	92(4.1%)	0.008*
High Total Cholesterol ≥ 200 mg/dl	1489 (48%)	764 (34%)	< 0.001*
Obesity BMI ≥30 (WHO Criteria)	285 (9.2%)	321 (14.3%)	< 0.001*
Overweight BMI ≥25 to 29.9 (WHO Criteria)	1125 (36.3%)	828 (36.9%)	0.662
Obesity BMI ≥25 (Asia Pacific Criteria)	1410 (45.5%)	1149 (51.1%)	< 0.001*
Overweight BMI ≥2 to 24.9 (Asia Pacific Criteria)	939 (30.3%)	764 (34%)	0.004*
Smoking	1204 (38.8%)	27 (1.2%)	<0.001*
Physical Activity i.e. 30-60 min Exercise for 5 or More Days of the Week	211 (6.8%)	43 (1.9%)	<0.001*

Prevalence of diabetes was related to the BMI >30 both in male and female (p-vale <0.001). Table III.

Table-III. Diabetes have relation with BMI				
WHO Criteria		MALE (N=391) n= (n %)	Female (n= 198) n (n %)	P -value
Known Diabetes	< 25 BMI	210 (53.7 %)	120 (60.6 %)	0.114
	25 - 29.9 BMI	142 (36.3%)	74 (37.4%)	0.856
	30 BMI	39 (10%)	4 (2%)	0.001*

DISCUSSION

Diabetes currently affects246 million people worldwide and is expected to affect 380 million by 2025 with largest increase in the developing countries[23]. According to Pakistan National Diabetes Survey (PNDS), the crude prevalence of diabetes in the Urban areas was 11.52 % and in Urban Punjab it was 13.68%[24].

According to a recent study (Shera et al), the prevalence of diabetes in the urban areas, all four Provinces of Pakistan was 6.0% in men and 3.5% in women[12]. Newly diagnosed diabetes was 5.1% in men and 6.8% in women and overall glucose intolerance (DM+IGT) was 22.04% in urban areas[12].

The results of our study showed that the crude prevalence of diabetes in urban areas of Faisalabad was 15% (858) with 11 % known and 5% unknown diabetics (newly diagnosed). When population was standardized for sex, among 3102 males 18.3 %(568) were diabetic, 12.6 %(391) were known and 5.7 %(177) were newly diagnosed, where as among 2247 females, the prevalence was 12.9(290) with 8.8 %(198) known diabetics and 4.1% (92) were newly diagnosed. This prevalence is higher than reported by Shera et al. Reason for this could be that the total number of subjects examined in study by Shera et al were 5433 which included 1893 males (1208 in rural and 685 in urban areas) and 3540 females (2243 in rural and 1297 in urban areas), so the total sample size representing the

urban population was 1982. More over, these 1982 people were representing all the four provinces of Pakistan where as in our study 5349 people were representing the urban population of Faisalabad. Another reason is that Faisalabad is one of the most heavily industrialized cities of Pakistan. Moreover the prevalence is variable in different areas as in Pakistan, different small studies have shown a range from 8%-16% but overall consensus is that the prevalence of type-2 diabetes is about 12% in people age 25 and above[25].

Prevalence of hypercholesterolemia in our study was high (Cholesterol $\geq$ 200 mg/dl) in 48 % males (1489) and 34% females (764). This figure is higher than other studies. In Metroville Health Study in Karachi, high cholesterol was 16% and 24% in men and women of lower middle class community respectively (Dennis et al)[15].

In a WHO study it was shown that 44.6% had a BMI 25-26.9 (overweight) and 17% were obese with a BMI of > 27[28].

However in 2004 it was reported that the prevalence of over weight and obesity were 52.2% (Dodani et al)29.Where as in Metroville study over-weight/obesity were 34% and 49% for men and women respectively, compared to 16% and 25% for Pakistan National Survey[15].

Results of our study revealed that 9.2 %(285) of the males were obese (BMI>30) in comparison to 14.3 %(321) of females whereas 36.26% (1125) of males and 36.84% (828) of females were overweight (BMI $\geq$ 25 to 29.9 kg/m²).It can be observed from above that although figures vary among different areas but one thing is in common that they are alarmingly high.

Smoking increased substantially between 1990 and 1999 in Bangladesh, India, the Maldives, and Pakistan, reflecting a shift in the focus of the tobacco multinationals towards poorer countries, which have less effective regulation[18]. According to National Health Survey of Pakistan (NHSP) 1990-1994,Overall prevalence of smoking was 15.2%, whereas it was 28.6% (27.3-29.9%) among men and 3.4% (2.9-3.9%) among women.[27] In our study prevalence of smoking was 38.8% (1204) in males and 1.2%(27) in females respectively (Passive smoking was not included).A harmful consequence of smoking, not emphasized in other regions, has been well researched in Bangladesh.[18] This is the damage done to poor families when tobacco gets priority over food and other essentials[18]. A recent study in India shows that those with the lowest standard of living smoke the most[18].More over the problem is not only to the active smoker him/herself, but with each puff of smoke, the smoker is seriously affecting the health of the people in his/her company who get the "blessing" of passive smoking. These passive smokers could be spouse, siblings, offspring and people at workplace etc. In 1983, Surgeon General's Report stated that cigarette smoking is one of the three major independent heart disease risk factors with the other two major heart disease risk factors, hypertension and hypercholesterolemia. But because of its wide spread prevalence, smoking is the largest preventable cause of heart disease in the United States[26].

Change in life style, higher density energy food, reduced physical activity, inventions of remote control gadgets and less exercise have all led to increased incidence of obesity and other associated disorders[20].This is not only in Pakistan but a study done in the UK showed that based upon physical activity index (PAI), 88 % of Pakistanis, 87 % of Bangladeshis and 71 % of Indians did not meet the guidelines as compared to 52% Europeans[22].In our study, only 6.8 %(211) of the males were doing the physical exercise (30 minutes exercise five days a week or equivalent) whereas among females it was 1.9 %(43).

Diabetes Mellitus and metabolic syndrome are emerging in our country as a non-infectious epidemic disease. In the face of our meager resources, this challenge is more than overwhelming. Despite these horrific statistics, the good news is that if we realize, the solution to the problem is within our own hands. They should give up sedentary life style and perform regular physical activities. Healthy life style can never be overemphasized than today. They should be encouraged to stop smoking

and take a healthy diet containing low saturated and trans-fatty acids, and low in dietary cholesterol. Use of olive oil should be encouraged. They should take much more fiber and refrain from refined diets. It should be controlled and propagated by media like newspapers, television, radio, as also by doctors and paramedical staffs and should encourage them to control diabetes mellitus. Diabetic patients have to continue treatment for the rest of their life and compliance should be stressed.

CONCLUSION
Diabetes and metabolic syndrome in adults particularly in developing countries, it is on rise. There is a dire need of concerted efforts to curb this challenge.
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