Original Article

Ethnic differences in metabolic syndrome among South Asians of Pakistan

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ABSTRACT

Objective: To determine the prevalence of metabolic syndrome in different ethnic subgroups of urban population of Karachi, Pakistan.

Methodology: This cross sectional study was conducted in Lyari Town. Data of 856 adults >25 years old was available in terms of ethnic subgroups for analysis; 363 of these subjects gave blood samples. Their anthropometric, demographic and biochemical data was collected. Distinct ethnic subgroups- Muhajir, Punjabi, Sindhi, Baluchi and Pushtun were defined on the basis of mother tongue.

Results: Out of 856 subjects, 73% were females. Mean age of the subjects was 40.7±14.1 years. Metabolic syndrome was found in 34.8% subjects according to the IDF criteria. In terms of ethnic groups the highest prevalence of metabolic syndrome was seen in Pushtuns (41.3%) and the lowest in Muhajirs (32.5%). Statistically significant differences were seen in the age adjusted waist circumference, waist-hip ratio, fasting triglycerides, insulin and HOMA levels among ethnic subgroups.

Conclusion: Prevalence of metabolic syndrome in the studied population was found to be significantly high but there was no statistical difference seen among various ethnic subgroups. Further large scale studies are needed to confirm these findings.

KEY WORDS: Metabolic syndrome, Ethnic subgroups, South Asians.

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INTRODUCTION

The term "metabolic syndrome" refers to the clustering of a number of cardiovascular risk factors (obesity, hypertension, dyslipidemia and hyperglycemia) in an individual which predisposes the person to a greater risk of developing cardiovascular diseases (CVD) and type 2 diabetes mellitus.[1,2] Patients with metabolic syndrome are at twice the risk of developing CVD over the next 5 to10 years compared to individuals without the syndrome. Moreover, metabolic syndrome also confers a 5-fold increased risk for type 2 diabetes mellitus.[3]

In recent times, a global transition in disease pattern has been observed, with the relative impact of infectious diseases decreasing while chronic diseases like cardiovascular diseases, cancer and diabetes increasing.[1] It is largely attributed to a combination of urbanization, lifestyle changes, unhealthy food rich in fats and lack of physical activity.[1]

It is estimated that by 2025, three out of four people with diabetes will be living in third world countries, and similar trends are likely to be seen for other components of the metabolic syndrome. Likewise it is also expected that four out of five deaths due to chronic diseases will occur in low and middle income countries.[1] This has led to increased clinical and re-

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search focus in the metabolic syndrome these days. Ethnic subgroups are principally defined on the basis of religion or language, but are also distinguished by different dietary practices and different genetic factors.[4]

There are clear ethnic differences in the prevalence of metabolic syndrome within the same geographical location. In a study in US, the age-adjusted prevalence of the metabolic syndrome among US adults was found to be 23.7%.[5] Mexican Americans had the highest prevalence rates of metabolic syndrome (31.9%) followed by White Americans (23.8%). There was a disproportionately higher prevalence of hypertension among African Americans (46%), whereas Mexican Americans had the highest prevalence of low HDL cholesterol, high TG, fasting glucose, medication use and abdominal obesity.[5] Similarly the prevalence of metabolic syndrome among Asian Indians in the US was 32%, which did not vary by gender but increased with age.[6]

Pakistan is a multi ethnic country and the population comprises of five major ethnic groups, originating from various parts of Central and South Asia. These are Muhajirs, Sindhis, Punjabis, Baluchis and Pushtuns. The groups have distinct differences in terms of language, place of origin, cultural practices and values, dietary habits, health beliefs and behaviors.[7]

Most studies regarding the prevalence of metabolic syndrome have been done in the Western World. The data regarding the prevalence of metabolic syndrome in terms of ethnic differences is scarce from South Asia. To our knowledge, this is the first study of its kind in the urban Pakistani population which has looked at the ethnic subgroups.

The objective of this study was to determine the prevalence of metabolic syndrome in different ethnic subgroups. It will provide key etiological clues and would be of value in targeting interventions.

METHODOLOGY

This cross sectional study was based on a survey conducted from July to December 2004, by generating a computerized random sample of households in Lyari Town, Karachi using a geographical imaging system (GIS). The details of sampling, design and anthropometric measurements have been reported previously.[8] To describe briefly, out of the 85,520 households, 532 households were randomly selected and 867 adults >25 years old consented to take part in the survey.

The rationale for choosing Lyari Town in Karachi, Pakistan for this study was that its residents comprise a multiethnic community that includes the five major ethnic groups found in Pakistan. The ethical approval for this survey was taken from Institutional Review Board (IRB) of Baqai Institute of Diabetology and Endocrinology. All adults 25 years and older were invited to participate in the survey after giving signed informed consent. In the case of illiterate participants, the consent form was read out to them and a thumbprint was procured in the presence of a household member or neighbor as a witness.

A total of 871 persons >25 years were approached; out of which 867 persons participated in the survey (response rate was 99.5%). Data of 856 participants was available in terms of ethnic subgroups. Anthropometric and demographic information was collected during interview. Weight, height, waist, and hip circumference were measured with the participants in standing position wearing light clothes and no shoes.

At the end of the household visit, all adults 25 years and older were asked to undertake an 8-hour fast for blood tests (fasting blood glucose, insulin and lipid profile) that were collected at home on weekends. Out of 867 persons, 363 gave blood, giving a response rate of 42% for blood collection. Within one hour of blood collection, the samples were centrifuged and separated. All selected parameters of blood lipids (total cholesterol, triglycerides, high density lipoprotein cholesterol (HDL-C) and low-density lipoprotein cholesterol (LDL-C)) and blood glucose estimation were performed using a Vita lab Selectra auto analyzer. Fasting blood glucose and lipid profiles were done by the glucose oxidase GOD PAP method and cholesterol CHOD PAP methods, respectively. Fasting insulin was done by using enzyme linked immunosorbent assay (ELISA) based on the sandwich principle. HOMA-R was calculated using the formula below:

HOMA-R = Insulin (μIU/ml) × glucose (mmol/l)/ 22.5

Statistical analysis: Analysis was done on SPSS version 13. Results are presented in the form of Mean ± SD, 95% Confidence Interval (C.I) and percentages. Univariate general linear model was applied to get Mean and 95% CI for each ethnic group after adjusting for age. Chi-square test was used to determine significance of percentages. $P<0.05$ was considered statistically significant.

RESULTS

Table-I shows the baseline characteristics of the studied population. Out of 856 subjects, 625(73%) and

231(27%) were females and males respectively. Mean age of females was 39.4±13.6 years whereas males were older with mean age of 44.3 ±14.9 years (p<0.000).

When age adjusted means of the ethnic groups were compared, Pushtuns had the highest waist circumference compared to all the other groups (p<0.001). This trend was also seen in Pushtun females (p<0.000).

Waist to hip ratio was statistically different (p<0.000) amongst the ethnic subgroups. The difference between Pushtuns with Muhajirs (p=0.043) and with Sindhis (p=0.002) was statistically significant. Differences were seen in female (p=0.011) and male (p=0.014) ethnic groups. No difference was seen in systolic and diastolic blood pressures in the ethnic subgroups.

Table-II shows the age adjusted biochemical profile of the subjects. Statistical difference was seen in the serum cholesterol levels in males. On further analysis differences were seen between Pushtun and Baluchi males (p=0.037).

On analysis of the triglyceride levels differences were seen among Baluchis with Muhajirs (p=0.008) and with Punjabis (p=0.029). Females had higher mean HDL cholesterol (43.2 mg/dl) than males (37.4 mg/dl). Females also had a higher mean LDL than males (p=0.032). However no significant difference was seen among male and female ethnic groups individually in HDL and LDL levels. No significant difference of fasting blood glucose was seen in various ethnic groups among males and females.

Taking Pushtuns as a reference population significant difference was seen between Pushtuns and Muhajirs (p<0.000) in insulin levels overall. Pushtun and Muhajir females (p<0.000) and Pushtun and Sindhi females (p=0.032) were found to be significantly different.

Analysis of HOMA showed significant differences between Pushtuns with Muhajirs (p=0.002) and with Sindhis (p=0.048) overall. On further analysis difference was seen between Muhajir and Pushtun females (p=0.002) while males had no significant difference in the ethnic subgroups.

Table-I: Baseline characteristics of the studied subjects (n = 856).

	Baluchis	*Muhajir*	*Punjabi*	*Pushtun*	*Sindhi*	*Total*	*p-value*
No. of subjects	171	236	106	106	237	856	
Female	130	175	76	78	166	625	
Male	41	61	30	28	71	231	
Age (yrs)	39.1±14.0	40.9±14.1	40.5±13.1	41.2±14.2	41.7±14.7	40.7±14.1	NS
Female	38.3±13.2	39.8±13.4	38.1±12.8	40.1±13.1	40.2±14.6	39.4±13.6	NS
Male	41.6±16.2	44.0±15.4	46.5±12.2	44.4±16.9	45.2±14.4	44.3±14.9	N
Age Adjusted							
Waist Circumference (cm)	86.7	85.7	85.9	91.2	83.8	85.5	0.001
	84.4-88.9	83.7-87.6	83.1-88.8	88.3-94.1	81.8-85.7	84.3-86.7	
Female	85.6	85.9	87.9	93.7	83.8	86.8	0.000
	83.1-88.0	83.8-87.9	84.7-91.1	90.6-96.8	81.6-85.9	85.5-87.9	
Male	90.1	84.9	81.4	84.3	83.9	84.3	NS
	84.7-95.5	80.5-89.4	75.1-87.6	77.8-90.8	79.9-88.0	82.3-86.3	
WHR	0.92	0.89	0.93	0.92	0.88	0.90	0.000
	0.90-0.94	0.88-0.91	0.91-0.96	0.90-0.95	0.86-0.89	0.90-0.92	
Female	0.91	0.88	0.93	0.91	0.88	0.903	0.011
	0.89-0.93	0.86-0.90	0.90-0.96	0.89-0.94	0.86-0.89	0.893-0.91	
Male	0.94	0.92	0.95	0.95	0.88	0.91	0.014
	0.89-0.93	0.86-0.90	0.90-0.99	0.90-0.99	0.86-0.91	0.89-0.93	
SBP * (mmHg)	127.4	125.2	121.3	127.4	123.8	126.2	NS
	122.9-131.8	121.9-128.5	116.7-125.9	122.4-132.4	120.7-126.9	124.7-127.7	
Female	125.6	125.5	120.9	126.3	123.4	126.3	NS
	121.1-130.1	122.0-128.96	115.9-125.9	121.1-131.5	119.9-126.9	124.8-127.8	
Male	134.2	124.4	123.3	130.5	124.9	126.12	NS
	121.8-146.5	116.7-13	112.7-133.8	117.3-143.7	118.2-131.7	123.4-128.7	

*No statistical difference was seen in Diastolic Blood Pressure in the ethnic groups
Data presented in the form of mean, 95% CI.

Table-III shows the prevalence of metabolic syndrome and its associated risk factors in different ethnic groups. The overall prevalence of metabolic syndrome was found to be 34.8% according to IDF definition. Highest prevalence was seen in Pushtuns (41.3%) and lowest in Muhajirs (32.5%). When Sindhis were compared with other ethnic groups statistical difference was seen in the central obesity between Sindhis and Baluchis (p=0.0198) and in hypertension between Sindhis and Pushtuns (p=0.046). Other risk factors like smoking, family history of diabetes, stroke and hypertension were also analyzed in MS positive and MS negative subjects. Smokers and those with a family history of stroke were found to have almost twice the risk of having metabolic syndrome.

DISCUSSION

Prevalence of metabolic syndrome in Pakistan has been reported as 34.8% according to IDF criteria.[8] In our study we noticed that mean waist circumference of all the women in ethnic groups was above normal, with Pushtun women having the highest age adjusted waist circumference which translated into highest prevalence of metabolic syndrome (41.3%). Epidemiological studies from different parts of the world suggest that the prevalence of metabolic syndrome varies according to ethnicity. Data from the Third National Health and Nutrition Examination Survey (NHANES III) done in U.S. adults shows that metabolic syndrome was present in 23.8, 21.6, and 31.9% of whites, blacks, and Hispanics, respectively.[5] Other studies from the US suggest that metabolic syndrome is more common among Mexican Americans compared to non-Hispanic whites and blacks.[9]

Among the major ethnic groups of Pakistan, Punjabis share their ancestry with both Aryans and Semitic Arabs. Aryans invaded the region over 4000 years ago and the Semitic Arabs arrived in the area which now constitutes the province of Punjab about 1000 years ago.[10] Pushtuns are socially and culturally identical to the Pushtuns of Afghanistan and have been living here for more than 6000 years.[7] Sindhis on the other hand, have been present in the Indus valley (now in the province of Sindh) for over 5000 years. Baluchis migrated from Syria to the region that now constitutes the province of Baluchistan over 2000 years ago.[7] Muhajirs are the Muslim refugees who migrated in 1947 from various parts of undivided India to the areas that now constitute Pakistan. All the ethnic groups have distinct historical and cultural backgrounds.

Studies have proven that South Asians have a pronounced tendency for central obesity[11] for which they are believed to have a genetic and metabolic susceptibility.[12] Furthermore central rather than generalized obesity has been shown to be related to diabetes and cardiovascular diseases in South Asians.[11] Reason being, metabolic activity of the intra-abdominal fat differs from the subcutaneous fat.[13]

Table-II: Age adjusted biochemical profile of the subjects (n = 363).

□	*Baluchis*	*Muhajir*	*Punjabi*	*Pushtun*	*Sindhi*	*Total*	*p-value*
Cholesterol (mg/dl)	173.38 163.1-183.66	186.96 177.22-196.7	181.29 169.48-193.11	179.03 165.2-192.85	176.6 165.78-186.42	177.74 172.5-182.92	NS
TG (mg/dl)	122.43 102.53-142.34	159.07 140.62-177.53	155.99 133.38-178.6	148.81 123.14-174.48	131.7 113.47-149.94	146.05 136.05-156.05	0.042
HDL (mg/dl)	43.42 40.58-46.26	40.76 38.05-43.47	39.91 36.65-43.18	40.71 36.89-44.53	41.71 39-44.43	40.3 38.87-41.72	NS
LDL (mg/dl)	113.6 106.12-121.08	118.59 111.49-125.68	112.01 103.41-120.62	114.53 104.46-124.59	113.48 106.34-120.63	112.99 109.2-116.79	NS
Glucose (mg/dl)	87.39 81.19-93.6	85.03 79.49-90.58	86.04 79.46-92.61	90.34 82.24-98.44	85.65 80.4-90.89	86.31 83.37-89.25	NS
Insulin(μIU/ml)	7.58 6.67-8.49	9.56 8.62-10.51	8.04 6.98-9.09	6.7 5.54-7.86	8.12 7.25-8.99	7.96 7.49-8.43	0.003
HOMA	1.56 1.32-1.79	1.89 1.67-2.11	1.64 1.39-1.89	1.3 0.99-1.6	1.67 1.47-1.87	1.63 1.5-1.74	0.035

Data presented in the form of mean, 95% CI.

Table-III: Prevalence of Metabolic Syndrome and its associated risk factors in the ethnic subgroups (n=363).

	Baluchis	*Muhajirs*	*Punjabis*	*Pushtuns*	*Sindhis*	*Total*	*p-value*
MS (IDF)	35.53	32.53	34.48	41.30	32.93	34.78	0.879
Female	34.48	32	33.33	50	35.71	36.13	0.517
Male	38.89	33.33	37.50	21.43	26.92	31.78	0.796
Central Obesity (>80 cm female; >90 cm male)	68.60	63.85	60.34	68.75	52.27	62.26	0.148
Hypertension (>130/85 mmHg)	43.02	43.37	51.72	66.67	48.86	49.03	0.076
FPG (>100 mg/dl)	17.30	12.12	15.56	22.58	12.33	11.01	0.651
HDL (<50 mg/dl female;<40 mg/dl male)	62.85	74.67	73.07	76.92	63.15	59.50	0.274
TG (>150 mg/dl)	27.69	32.87	32.65	30.77	28.94	25.34	0.96

Data presented in the form of percentages.

The reason for above normal waist circumference in our study is that men are normally the bread earners in our urban society and women are culturally more house oriented and family caring housewives.[14] This sedentary life style contributes to central obesity. Moreover Pushtuns had the highest percentage of hypertensives, elevated blood glucose levels and low HDL as compared to the other ethnic groups (Table-III).

Baluchis had the second highest prevalence of metabolic syndrome and its components like central obesity and elevated fasting blood glucose. Punjabis had second highest percentage in the prevalence of being hypertensive and having elevated triglycerides. Muhajirs had the highest prevalence of elevated triglyceride levels among all the ethnic groups although they had the lowest prevalence of metabolic syndrome.

It is interesting to note that Muhajirs and Sindhis had the lowest prevalence of metabolic syndrome among all the ethnic groups. Although Muhajirs and Sindhis have distinct ancestries and are genetically different but have been living in the same geographical location for the last six decades. Environmental factors may have a role in their low prevalence of metabolic syndrome as compared to other groups.[15] These findings need to be explored through further studies.

No statistical differences in blood pressures were seen in the ethnic groups unlike seen in NHSP.[4] Age adjusted HDL cholesterol levels were found to be below normal range similar to the findings of other local studies.[16,17]

Although statistically significant ethnic differences in fasting serum insulin and HOMA levels were seen overall and in females but this trend was not reflected in males (Table-II).These findings need to be validated further by larger scale studies.

Subjects with family history of stroke and smokers were at more risk of having metabolic syndrome compared to those without family history and non smokers in our study; similar findings were observed in other studies.[18,19]

However there were some limitations to this study. Inspite of using computerized random selection of households by GIS to minimize the selection bias, the sample size was small. Hence the findings cannot be generalized for the Pakistani population as a whole. Thus the results have to be interpreted with caution. Further large scale studies are needed to validate these findings.

CONCLUSION

The prevalence of metabolic syndrome in studied population was found to be significantly high but there was no statistical difference seen among various ethnic subgroups. Further large scale studies are needed to confirm these findings.

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1. Conception and design or acquisition of data or analysis and interpretation of data.
   S. Faraz Danish Alvi, M. Zafar Iqbal Hydrie, Abdul Basit, A Samad Shera.
2. Drafting the article or revising it critically for important intellectual content.
   S. Faraz Danish Alvi, M. Zafar Iqbal Hydrie, Asher Fawwad, Abdul Basit, Mussarat Riaz.
3. Final approval of the version to be published.
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