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RESEARCH PAPER

Gender differences and clustering pattern of behavioural risk factors for chronic non-communicable diseases: community-based study from a developing country

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Objectives: This study estimates the burden of behavioural risk factors for chronic non-communicable diseases (CNDs) to evaluate the degree of clustering and the differential of these factors by gender in adults.
Methods: In a community-based survey, information was obtained about behavioural risk factors for CNDs among 534 adults in Karachi, Pakistan. Chi-square test and odds ratio (OR) with 95% confidence interval (CI) were calculated to evaluate the differences of these factors by gender.
Results: Overall, 22.5% of adults had anxiety/depression, 47.8% did not have adequate intake of fruits and vegetables, 60.1% were physically inactive while 49.8% were overweight/obese. More women had anxiety/depression (OR = 2.1; 95% CI = 1.4–3.1), were physically inactive (OR = 2.1; 95% CI = 1.5–3.1) and overweight/obese (OR = 6.2; 95% CI = 4.3–9.1). On the contrary, greater number of men were found to have inadequate fruit and vegetable consumption (OR = 1.8; 95% CI = 1.3–2.5). Only 1.1% of study subjects had none of the studied risk factors, 16.9% had one while 82% had ≥2 factors. The clustering of these risk factors was significantly higher in women ($p < 0.001$).
Discussion: This study shows that almost all of the adults in the study had behavioural risk factors for CNDs and clustering of these factors is very common and significantly higher in women. The tendency of clustering risk factors in individuals provides opportunities to address factors with integrated approaches to prevent/delay the onset of CNDs.

Keywords: Behavioural risk factors, Clustering pattern, Chronic non-communicable diseases, Developing country, Gender difference

INTRODUCTION

Chronic non-communicable diseases (CNDs) and their associated risk factors are emerging rapidly in an epidemic proportion and are becoming a major public health challenge particularly for developing countries[1–4] including Pakistan.[5] For the developing countries, it is estimated that by the year 2020, seven out of every ten deaths will be attributed to CNDs.[6] According to a surveillance report,[7] about 60% of deaths were reported due to CNDs in Karachi, the largest city of Pakistan and these figures are expected to rise. About one-fourth of Pakistani adult population is reported to have elevated blood pressure and over 35% are overweight and obese.[8] One in four middle-aged adults in Pakistan has prevalent coronary artery disease.[9] The burden of oral cavity and breast cancers in Pakistan is amongst the highest in the world.[10] Additionally, the future projections of CNDs' burden for Pakistan are also frightening. For instance, it is estimated that by the year 2030, the number of persons with diabetes in Pakistan will rise to 14 million as compared 5.2 million in the year 2000,[11] if no active intervention is taken.

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There is unequivocal evidence that all these CNDs are instigated by unhealthy behaviours such as inadequate intake of fruits and vegetables, physical inactivity, obesity, active and passive smoking, anxiety and depression.[2,12–14] Prevention and modification of these unhealthy behaviours have positive effects in reducing CNDs and all-cause mortality.[1,15] It is reported that at least 80% of heart disease and type 2 diabetes, and one-third of cancers could potentially be avoided by adopting healthy behaviours.[15,16]

It is well established that clustering of two or more risk factors is usually associated with an increased risk of developing CNDs than can be expected on the basis of the sum of the separate effects.[17,18] Insight into clustering of behavioural risk factors is important because this can be used in designing integrated preventive strategies. With some exceptions, majority of previously reported work investigated either the clustering of biological/clinical risk factors.[19–21] reported on children and adolescents[17] or studied on a specific group of diseased population[22]. Khuwaja and colleagues[22] in Karachi, Pakistan, documented some of behavioural risk factors like smoking status and physical inactivity[22] but this work was done only among persons with type 2 diabetes. A study from India[19] reported the clustering of cardiovascular risk factors in Indian population; however, their focus was mainly on biological risk factors such as glucose intolerance, hyperinsulinaemia and dyslipidaemia. In Pakistan, the prevalence of the coexistence of risk factors for cardiovascular disease was reported[20,21] but the data of this report were collected well over a decade ago,[20] representing only one selected religious sub-group community and the definitions used to define risk factors were quite old.[21] Furthermore, these studies focused mainly on biological and clinical factors like hypertension, diabetes, proteinuria and hyperlipidaemia, and hence missed some major behavioural risk factors for CNDs (anxiety, depression, unhealthy dietary habits and exposure to passive smoking), which have higher relevance and applications on primary- and secondary-level prevention.

The impact of CNDs on the lives of people and the health system of the country is devastating when measured in terms of premature morbidity and mortality, disability, family hardships and economic loss. Pakistan, like many other developing countries, has poor health and economic indicators,[23] and thus is unable to bear the management costs of these overwhelming diseases. Hence, the best strategy to combat such conditions is to identify and modify the behavioural risk factors that have been proven to be responsible for the development of CNDs. It is also imperative to investigate the combined prevalence of these risk factors, which could help in developing and implementing integrated preventive strategies in resource-poor settings like Pakistan. For this reason, we conducted a study to assess the burden of behavioural risk factors for CNDs to evaluate the degree of clustering of these factors and to determine the differential of factors by gender in an adult population of Karachi.

METHODS

This community-based cross-sectional survey was conducted in an urban community of Karachi, the largest city and economic hub of Pakistan with a population of over 14 million, representing all the ethnic and socio-economically diverse population of the country. By systematic random sampling, information was obtained from 604 adults of 25–64 years of age from 680 household visits. One adult from each household was interviewed. As the objectives of this study were to focus on the behavioural risk factors of CNDs, we excluded those adults who already had been diagnosed with any of the CNDs (diabetes, hypertension, coronary artery disease and any type of malignancy). Twenty-one households had no eligible study subject, 13 houses were

locked, while 42 households refused to participate in the study. Final analysis was done on 534 study subjects about whom we procured the complete required information.

After obtaining consent to participate in the study, about 20 minute face-to-face interviews were conducted by voluntary community health workers who had at least 12 years of schooling. Due to cultural and social considerations, we recruited only female data collectors. To ensure the consistency of data collection, all the interviewers were trained for this task before conducting interviews. Study participants were assured about the confidentiality and anonymity and all efforts were made to ensure the privacy of information. A pre-tested structured questionnaire was used to obtain information about socio-demographic (sex, age, marital status, education level and monthly household income) and behavioural risk factors. Anxiety and depression were assessed by using validated Urdu language (local language) version of Aga Khan University Anxiety and Depression Scale (AKUADS).[24] At a score of ≥ 19, AKUADS has a specificity of 79%, sensitivity of 66%, positive predictive value of 83% and negative predictive value of 60%.[24] Physical activity was assessed using International Physical Activity Questionnaire (IPAQ).[25] Study participants who were not doing moderate to vigorous activity for 30 minutes or more for most of the days (≥ 4 days) in a week were categorised as 'physically inactive'. Height was measured to the nearest 0.1 cm, and weight was measured to the nearest 0.1 kg, wearing minimum clothing and without shoes. Body mass index (BMI) was calculated as weight in kilograms divided by height in meter squares. The cut-offs of BMI were used as recommended jointly by World Health Organization and the International Obesity Task Force for Asian population.[26]

For this study, modifiable behavioural risk factors were defined as follows:

- Inadequate intake of fruits and vegetables: <10 servings of fruits/vegetable in last 7 days,
- Physical inactivity: <30 minutes of moderate to vigorous activity most of the days (at least 4) in last 7 days,
- Anxiety and depression: ≥ 19 score on AKUADS,
- Overweight/obesity: BMI ≥ 23 kg/m^2,
- Passive smoking: at least 30 minutes of regular exposure to second-hand smoking most (at least 5) days of the week either at home or/and at workplace for at least last 6 months,
- Current smoking: currently smoking any number of cigarettes either regularly or occasionally.

The data was analysed using the Statistical Package for Social Sciences (SPSS) version 16. Frequencies and proportions for personal characteristics and behavioural risk factors were calculated separately. The chi-square test and odds ratio along with their 95% confidence interval were calculated using logistic regression to see the difference of risk factors and clustering by gender. Clustering of behavioural risk factors was studied as none, one, two, three and four or more. We did not include smoking status in clustering of risk factors because all smokers in this study were men.

RESULTS

The socio-demographic characteristics of the study population are summarised in Table 1. Of the total, 54.7% were men and 86.7% were married. In all, 37.5% were between 45 and 64 years of age and 46.7% had either no or only primary level schooling. Overall, 25.3% of the study subjects reported their monthly household income to be more than 10,000 Pakistan rupees (US$ 1 = 80.00 Pakistan rupees, approximately).

Proportion of individual behavioural risk factors for CNDs and its differential by gender among the study population are given in Table 2. Anxiety and depression were prevalent in 22.5% of the study subjects: more in women (29.3%) compared to

men (16.8%) (OR = 2.1; 95% CI: 1.4–3.1; $p < 0.001$). Inadequate intake of fruits and vegetables was common (47.8%) among the study population: more in men as compared to women (men: 54.1% *v.* women: 40.1%; OR = 1.8; 95% CI: 1.3–2.5; $p < 0.001$). Sixty percent of study subjects were physically inactive and majority of them were women (69.8%) compared to men (52.1%) and this difference was also significant (OR = 2.1; 95% CI: 1.5–3.1; $p < 0.001$). In all, 49.8% of study population was overweight/obese, more women compared to men (73.1% *v.* 30.5%; OR = 6.2; 95% CI: 4.3–9.1; $p < 0.001$). Overall, 40.1% of the respondents were exposed to passive smoking and this exposure was slightly higher among men; however, the difference was not significant statistically (men: 41.8% *v.* women: 38.0%; OR = 1.2; 95% CI: 0.8–1.7; $p = 0.377$). Only 10% of the respondents in this study reported as being current smokers and all those were men.

TABLE 1. *Socio-economic characteristics of study subjects (n = 534)*

Characteristics	Number (%)
Sex	
Men	292 (54.7)
Women	242 (45.3)
Age in years	
25–34	178 (33.3)
35–44	156 (29.2)
45–64	200 (37.5)
Marital status	
Currently married	463 (86.7)
Others[a]	71 (13.3)
Educational status	
No formal schooling	175 (32.8)
Up to 5 years of schooling	74 (13.9)
6–12 years of schooling	182 (34.0)
More than 12 years of schooling	103 (19.3)
Monthly income (in Pak. Rupees)[b]	
Less than 5000	105 (19.7)
5000–10,000	179 (33.5)
More than 10,000	135 (25.3)
Not mentioned	115 (21.5)

[a]Others: Unmarried, separated, divorced, widowed.
[b]US$ 1 = 80.0 rupees (Pak) (approximately).

Clustering pattern of behavioural risk factors for CNDs among study participants is given in Table 3. In all, only 1.1% of study subjects were without any risk factor for CNDs and 16.9% of the respondents had any one of the studied risk factors. In all, the clustering of behavioural factors was present as: two among 48.9% of the respondents, three among 27.9% of the respondents, and four or more among 5.2% of the respondents. The overall distribution of number of clustering for these risk factors for CNDs was more among women compared to men ($p < 0.001$).

DISCUSSION

To the best of our knowledge, this is the first attempt from Pakistan to document the

TABLE 2. *Proportion of behavioural risk factors for CNDs among study subjects and their differences by gender*

Behavioural risk factor	Total (n = 534)	Men (n = 292)	Women (n = 242)	Odds ratio (95% CI)	p-value
	Number (%)	Number (%)	Number (%)		
Anxiety and depression	120 (22.5)[b]	49 (16.8)	71 (29.3)	2.1 (1.4–3.1)	0.001
Inadequate intake of fruits and vegetables	255 (47.8)[a]	158 (54.1)	97 (40.1)	1.8 (1.3–2.5)	0.001
Physical inactivity	321 (60.1)[b]	152 (52.1)	169 (69.8)	2.1 (1.5–3.1)	0.001
Overweight/obesity	266 (49.8)[b]	89 (30.5)	177 (73.1)	6.2 (4.3–9.1)	0.001
Passive smoking	214 (40.1)	122 (41.8)	92 (38.0)	1.2 (0.8–1.7)	0.377
Current smokers	51 (9.6)	51 (17.5)	00 (0.0)	–	–

[a]Significantly higher in men (p-value < 0.001);
[b]Significantly higher in women (p-value < 0.001).

burden and clustering of behavioural risk factors for CNDs among adult population in a community-based survey. This work also assessed the difference of proportion of these risk factors for CNDs among men and women.

Literature revealed that depression and psychological stress are significantly associated with chronic CNDs like diabetes, hypertension and coronary artery disease.[14,27] Women generally have higher prevalence rates of depression and anxiety disorders as well as other psychological disorders compared to men.[27,28] In a community-based survey from Pakistan,[27] which had used the same instrument (AKUADS), 30% of women were found to have anxiety and depression. In our study, about a quarter of subjects had anxiety and depression and again this was more prevalent in women.

Inadequate intake of fruits and vegetables is considered to be a very important determinant of CNDs. The shift of the traditional reliance from the plant foods (vegetables and fruits) to meat and other animal products has significantly increased the incidence of CNDs like obesity, diabetes, stroke, heart disease and certain types of cancers.[5,12] In a survey conducted in USA, a very small percentage of Asians consumed appropriate servings of fruits and vegetables in their diet.[29] Also, in this study, a large number of study subjects particularly men did not consume adequate servings of fruits and vegetables. These results are also consistent with the study from Karachi, Pakistan,[30] where men were more frequently found eating out, mainly animal-origin products. Probably because men spend more time outside their home as compared to women due to the nature of their jobs and work requirements, they have more access to fast-food restaurants and snacks.

Regular physical activity has consistent benefits in preventing and delaying the onset of various CNDs, as well as serving as a cornerstone in the management of these diseases.[1,16] According to a community-based survey,[29] less than one-third of the Chinese adults were reported to be engaged in regular physical activity. Ghazala and Khuwaja,[30] in a study from Pakistan, reported that only a quarter of the adults were engaged in any physical activity on regular basis. In the present study, majority of the individuals were not physically active and women were more inactive physically than men. There are a couple of explanations for this. For example, it is observed that instead of outdoor leisure and recreation activities, interest to watch television and movies and play computer games and video has risen considerably. Lack of safe outdoor playgrounds and walking tracks in many areas of the city is an added factor for the large number of physically inactive persons. Limited awareness about benefits of physical activity and not giving it priority may be an additional reason. Another important reason for the high percentage of physically inactive women may be that in our society, due to

TABLE 3. *Clustering of behavioural risk factors for CNDs among study subjects and their difference by gender*

Clustering of risk factors	Total ($n = 534$)	Men ($n = 292$)	Women ($n = 242$)
	Number (%)	Number (%)	Number (%)
None	6 (1.1)	6 (2.1)	0 (0.0)
One	90 (16.9)	75 (25.7)	15 (6.2)
Two	261 (48.9)	140 (47.9)	121 (50.0)
Three	149 (27.9)	69 (23.6)	80 (33.1)
Four and above	28 (5.2)	2 (0.7)	26 (10.7)

$\chi^2 = 73.898$; df = 4; p-value < 0.001.

cultural reasons, females are generally not permitted to go outside the home and perform regular exercise/walking.

Excessive body weight is a well-established risk factor for a large number of CNDs[2,31] and is rising rapidly as a public health problem in many developing countries with Pakistan being no exception.[5,32] Using BMI cut-offs recommended for Asians, the overall prevalence of overweight and obesity in Pakistani adults was reported significantly higher in women (28%) when compared to men (22%).[32] We have also used the same cut-offs which are recommended for the Asian population.[26] In our study, the overall prevalence of overweight and obesity was found to be 50% and significantly more prevalent among women when compared to men. We found a much higher prevalence of overweight and obesity compared to the data of National Health Survey of Pakistan (NHS, P) reported earlier.[32] There are two possible explanations for this difference. Our data are representative of urban Pakistan and it is well observed that urban residents eat more dense caloric diets and perform less physical activity compared to rural residents thereby risking a greater probability of being obese. Second, there has been an ongoing rise in the prevalence of obesity in South Asian countries including Pakistan since the NHS (Pakistan)was conducted well over a decade ago in 1990–1994.

It is well proven that smoking and exposure to passive smoking increases the risk of developing CNDs.[13,33,34] Khuwaja and Kadir, from Pakistan,[34] documented 34% adults who smoked cigarettes and among them 48% also smoked in their homes. In the present study, only 10% of subjects reported as being current smokers and all of them were male. The prevalence of smoking in our study was lower than reported previously.[34] It is possible that many study participants did not admit that they smoke, as smoking is a socially unacceptable habit in our part of world. Second, previous study was conducted only on men[34] and it is well reported that smoking is more prevalent among men in Pakistan.[8] Similar results were recently reported[35] among Asian adults living in USA where, compared to women, men were more likely to be current smokers (1.0% *v.* 23.6%). However, over 40% of individuals in this study were exposed to passive smoking on a regular basis and this exposure is almost equally prevalent among both genders.

The tendency for preventable and modifiable behavioural risk factors to cluster has important implications for health-promotion and disease-prevention efforts. Higher prevalence of the coexistence of the risk factors for cardiovascular disease among Pakistani women as compared to Pakistani men was reported.[20] However, other than central obesity, all other reported risk factors were biological (hypertension, diabetes, proteinuria, hyperlipidaemia), and the data used were quite old. Our study showed that a large number of adults had clustering of behavioural risk factors and well over 80% of studied population had two or more of these factors coexisting. This study also revealed that clustering of these risk factors was more prevalent among women.

Some of the limitations in this study need to be addressed. Though the study conducted was a community-based one and study participants were represented well in each group of socio-demographic variable, the results cannot be generalized to all the adult population of Pakistan as this work was done in a defined population of urban Pakistan. Limited funding did not allow laboratory investigations to be carried out (particularly blood sugar and lipids) and hence their association with behavioural risk factors could not be assessed. We were not able to measure some variables like blood pressure and waist circumference, which have important association with cardiovascular diseases. As the interview was house-based and smoking is not an acceptable social habit, underreporting of smoking status may have happened. Nonetheless, our study has a number of methodological strengths, including use of validated tools and questionnaires and use

of obesity cut-offs recommended for the Asian population.

In conclusion, almost all in the study population in this community-based survey had at least one of these risk factors and the clustering phenomenon is very common; over 80% subjects (more women than men) had coexistence of two or more risk factors. Individually, men were less likely to have adequate fruits and vegetables while women were more physically inactive, obese and had anxiety and depression. In addition, considerable proportion of both men and women were exposed to passive smoking.

This work will help to build effective primary prevention strategies with an integrated approach for intervention programmes focusing and promoting healthy behaviours which should include improved accessibility to healthy food, safe playing courts and grounds, promotion of mental health and prohibition of smoking at work and public places. These steps will provide positive cost-benefit results in comparison with treatment and management of chronic and crippling CNDs after they have developed. This study will also pave the ground for further research involving community-based representative samples at a larger scale to identify the magnitude of preventable and modifiable behavioural risk factors for the development of CNDs, particularly to understand the social and cultural determinants for these gender disparities.

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