ORIGINAL ARTICLE

Most Prevalent Diseases with Relation of Body Mass Index and Waist Circumference in Karachi, Pakistan

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ABSTRACT

Objectives: To relate the body mass index (BMI) and waist circumference (WC) with diseases commonly found in Karachi.
Subjects and Methods: One hundred sixty one subjects of age group of 35 to 74 years were studied through cross-sectional questionnaire based survey from different areas of Karachi from February 2010 to January 2011. Height and WC were measured while BMI was calculated by standard formula. Data was analyzed by using GraphPad Software and mean ± SD were used to interpret the findings.
Results: The findings describe the percentages of different diseases commonly found in study population like 32.91% have diabetes with BMI 26.69 ± 4.4 kg/m^2 and WC 35.92 ± 4.3 inch, 30.43% have hypertension with BMI 26.79 ± 4.42 kg/m^2 and WC 36.31 ± 4.72 inch, 14.28% have cardiovascular diseases BMI 25.38 ± 4.10 kg/m^2 and WC 36.17 ± 3.91 inch, 10.55% have bone related problems with BMI 26.51 ± 4.52 kg/m^2 and WC 38.11 ± 6.4 inch, 6.83% have asthma, 6.21% have migraine, 4.96% have arthritis and 1.86% was found anemic with collective BMI 25 - 29 kg/m^2 and WC 34 - 39 inch. Whereas 30.43% of population have no disease (control) with BMI 24.03 ± 3.68 kg/m^2 and WC 34.11 ± 3.86 inch.
Conclusion: The results concluded that diabetes mellitus ranked first and the most commonly found disease followed by hypertension, cardiovascular and bone related problems, asthma, migraine, arthritis and anemia. Over all the highest rate of most of the commonly found diseases in Karachi was observed in participants of 45-54 years with BMI > 25 kg/m^2 and WC >35 inch.

Key words: BMI, waist circumference, percentage, Karachi.

INTRODUCTION

An abnormal fat deposition in adipose tissue on both subcutaneous and visceral body region is the basic characteristic of obesity[1] to the level that weakens the health and considered as an independent risk factor for most of the acute and chronic diseases in the world such as diabetes mellitus,[2-3] cardiovascular diseases,[4] stroke,[5-6] dyslipidemia,[7] osteoarthritis,[8] cancer of several sites like endometrial, breast and colon,[9-10] hypertension[11] and other metabolic health risk.[12] The frequency of overweight and obesity is increasing with high rate and estimated to be the second leading cause of preventable death after cigarette smoking in both developed and developing countries by affecting all segments of the population, including men, women and children.[13-16] It is also now becoming an alarming cause of disability and death in many developing countries.[17-20] A prospective study conducted in 2007 specifies overweight and obesity are potential risk sources for psoriasis in women.[21] According to World Health Organization (WHO), globally almost 1.5 billion adults above the age of 20 years were found overweight in 2008 with high prevalence in female gender and nearly 43 million children less than the age of 5 years were overweighed in 2010.[22] This figure is expected to increase up to 65 % by the year 2015 in adult population.[22]

In clinical setting obesity or adiposity is conveniently measured by body mass index (BMI)[23] and proved that high BMI is associated with increased health risk because of its association with adiposity.[24-25] Indeed within a given population BMI is positively associated with adiposity however this relation can be altered by numerous factors such as age, gender, race and physical activity patterns. The WHO guidelines classify individuals as underweight with BMI <18 kg/m^2 reflects the malnutrition state that may lead to clinical problems, normal weight having BMI 18.50 - 24.99 kg/m^2 reflects

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good health with long life expectancy, overweight or pre-obese with BMI 25-29.99 kg/m^2 with increasing risk of co-morbidities and obese further categories into class I with BMI 30 - 34.99 kg/m^2, II with BMI 35-39.99 kg/m^2 and III with BMI > 40 kg/m^2 with moderate, severe and very high risk of co-morbidities respectively.[5] It has been reported that the middle-aged adults with BMI ranging from 35-40 kg/m^2 are at high risk of hypertension, diabetes, etc worldwide and associated with twice an increase in healthcare expenditure than normal weight and persons of same age group with BMI > 40 kg/m^2 doubles the healthcare costs.[26]

Research has indicated that central adiposity is associated with increased health risk[27] and waist circumference (WC) is considered as one of its measurements beside waist-to-hip and waist to height ratios.[4] It is established that WC is linked with morbidity and mortality independent of BMI.[25] Recent attention has been paid to the applicability of anthropometric markers to measure abdominal obesity and the association of WC with health risk like cardiovascular diseases (CVD).[1] WC is also recognized as a key component of the metabolic syndrome in both children and adults.[28] Similarly, a retrospective study reported that WC is a good predictor of insulin resistance.[29] The guidelines of National Institute of Health (NIH) clearly describes that the adult women and men having WC greater than 35 and 40 inches respectively are considered at higher risk of obesity related disorders.[30]

Since BMI does not independently provides a complete estimate of body fat distribution and WC is another effective clinical tool to assess the risk associated with obesity and more importantly linked to measure CVD as compare with BMI.[12] The WHO also recommends that WC should be used as an additional measure to identify those at increased risk of obesity-associated illness due to excess abdominal fat.[31-32] Interestingly, WC criteria for the diagnosis of abdominal obesity are not applicable uniformly to all population and ethnic groups.[33] Therefore this study was conducted to relate the body mass index (BMI) and waist circumference (WC) with diseases commonly found in Karachi in 2010 and in future a countrywide survey will help to assess the overall performance.

MATERIALS & METHODS:

STUDY DESIGN

The present study design was cross-sectional questioner-based survey and data were collected from different areas of Karachi.

STUDY PROTOCOL

Verbal consent was taken from study subjects before handing over the questionnaire with an assurance for confidentiality of information and their professional acquaintance. Questioner contain different variables related to life-style, mood and dietary patterns, state of health / name of disease (if any diagnosed), parameters to calculate body mass index (BMI) and waist circumference (WC). Initially questioners were given to randomly selected physically observed normal to obese subjects (n=210) of age 35 year and above. Finally total study population (n=161) consisted of both genders including male (n=82) and female (n=79) age ranging from 35 to 74 years with low to medium socioeconomic status of which some people were doing government jobs while majority were engaged with private jobs, some were retired persons and most of the females were house wives was selected as 20 participants had regretted their availability and 29 were not reported their response in defined manner hence they were excluded from the study. The return rate of questionnaire was approximately 77%. The expected commonly prevalent diseases in Karachi that included in questioner were anemia, arthritis, asthma, diabetes mellitus, heart diseases, hypertension and migraine.

Whereas different medical terms that have been written by participants like osteoporosis, backache, shoulder pain, knee swelling, vitamin D and calcium deficiencies, etc, were collectively included as bone related problems in the present survey. The study population was divided in patients with defined diseases and compared with the same age group population with no disease (control).

The population younger than 35 year and elder than 74 year of age was excluded from the study. Data was collected through convenient sampling method from different areas of Karachi including Federal B area, Gulistan-e-Johar, Gulshan-e-Hadeed, Kemari, Millat Town, Malir, North Karachi, North Nazimabad, Qasba colony and Shah Faisal Colony from February 2010 to January 2011 in Karachi.

WC AND BMI ASSESSMENTS

Inch tape (Butterfly brand) was used to measure waist circumference, height and weight machine (CAMRY) to measure weight of individuals of study population. Whereas the formula used to measure their BMI was adopted from topic entitled “Effect of obesity on the incidence of type 2 diabetes mellitus varies with age”[2]

$$\text{BMI} = \frac{\text{WEIGHT (KILOGRAM)}}{\text{SQUARE OF HEIGHT (METERS)}}$$

STATISTICAL ANALYSIS

The results were recorded and expressed as mean ± SD and finally percentage of each commonly found diseases in study population was calculated by using GraphPad Software, Quick Calcs Online calculators for scientists.[34]

RESULTS

I. Percentage of different diseases in study population of Karachi and their association with BMI (kg/m^2) and WC (inch).

The percentage of different diseases and their association with BMI and WC described that out of 161 people, 32.91 % have diabetes mellitus with BMI 26.69 ± 4.4 kg/m^2 and WC 35.92 ± 4.3 inch. Forty nine (30.43 %) people have hypertension with BMI 26.79 ± 4.42 kg/m^2 and WC 36.31 ± 4.72 inch. Twenty three (14.28 %) people have CVDs with BMI 25.38 ± 4.10 kg/m^2 and WC 36.17 ±3.91 inch. Seventeen (10.55 %) have bone related problems with BMI 26.51 ± 4.52 kg/m^2 and WC 38.11 ± 6.4 inch. Eleven (6.83%) persons have asthma with BMI 27.27 ± 4.57 kg/m^2 and WC 37.18 ± 4.21 inch. Ten (6.21 %) persons have migraine with BMI 25.29 ± 4.47 kg/m^2 and WC 35.6 ± 2.59 inch. Eight (4.96%) persons arthritis with BMI 29.13 ± 3.15 kg/m^2 and WC 38.5 ± 3.4 inch. Only three persons (1.86 %) have anemia with BMI 27.73 ± 7.33 kg/m^2 and WC 34 ± 3.46 inch. Whereas out of 161 people, 30.43 % persons were found normal not suffering from any of the above disease with BMI 24.03 ± 3.68 kg/m^2 and WC 34.11 ± 3.86 inch (Table 1 & Figure 1).

II. Percentage of diseases in different age groups of both gender of study population.

Asthma was found in all age groups but its presence was high (3.10%) in participants of age 45-54 years followed by 1.86%, 1.24% and 0.62% in other participants of 65-74, 35-44 and 55-64 years respectively. Mostly females were affected from the same allergy. Only females of 35-44 years of age were found anemic. Arthritis was found in all age groups but it was high in age group of 55-64 years (1.86 %) with 1.24 % females and 0.62 % males. Whereas 1.24% participants in each age group of 45-54 and 65-74 years were suffering from the same problem. In age group of 35-44 years only 0.62 % was suffering from arthritis and that was female, no male was found. Bone related problems have an effect on all age groups. It severely affects participants of 45-54 years (5.59 %), of which 4.34 % females and 1.24 % males. Similarly diabetes had affected all age groups like 13.04 % was found in participants of 55-64 years, followed by 9.93%, 6.10%, 3.72% in age groups of 45-54, 65-74 and 35-44 years respectively. Hypertension was found in all age groups, of which its highest percentage 14.90 % was found in people of 45-54 years. Participants with migraine were found as 3.10 %, 2.48%, 0.62% in age groups of 45-54, 35-44, 55-64 years respectively and it was not found in age group of 65-74 years (Table 2).

III. Distribution of study population according to WC.

Out of total study population 41.61% people were found having WC ranging from 31-35 inch with 21.11% males and 20.49% females. WC from 36-40 inch assessed in 34.16% people with 18.01% males and 16.14% females. WC > 40 inch showed by 12.42% people with 7.45% males and 4.96% females. Only 11.80% people were found having waist circumference < 30 inch with 7.45% males and 4.34% females (Figure 2).

IV. Distribution of study population according to BMI

Out of total study population 46.58% people were found having BMI from 18.5-24.9 kg/m^2 with 29.81% males and 16.77% females. 37.26% participants with BMI 25- 29.9 kg/m^2 were found with 19.25% females and 18.01% males. The percentage of people having BMI > 30 kg/m^2 was found as 16.77% with 14.28% females and 2.48% males. Whereas 3.72% participants were found having BMI < 18.5 kg/m^2 with 3.10% females and 0.62% males (Figure 3).

Figure 1: Different disease (%) in study population

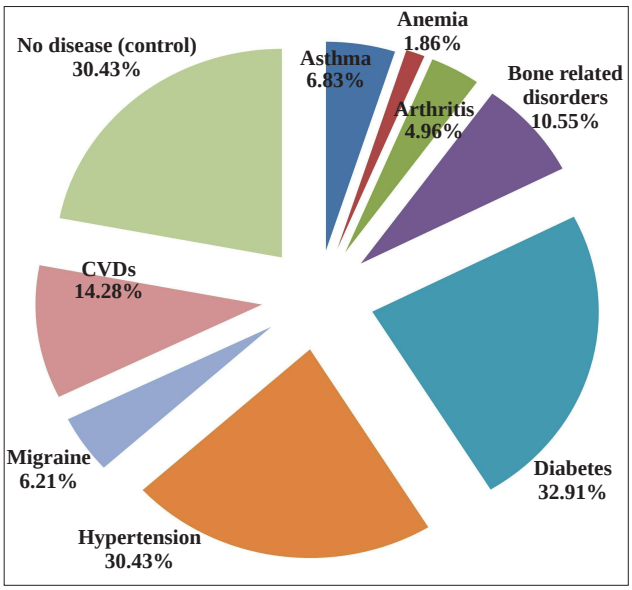


Table 1: Study of BMI (kg/m^2) and waist circumference (inch) with different disease in study population

Disease	N (%)	Height (m)	Weight (kg)	BMI (kg/m^2)	Waist (inch)
Asthma	11 (6.83)	1.62 ± 0.08	71.57 ± 11.42	27.27 ± 4.57	37.18 ± 4.21
Anemia	3 (1.86)	1.56 ± 0.03	68.33 ± 18.92	27.73 ± 7.33	34 ± 3.46
Arthritis	8 (4.96)	1.64 ± 0.08	78.23 ± 6.07	29.13 ± 3.15	38.5 ± 3.4
Bone related problems	17 (10.55)	1.66 ± 0.10	75.71 ± 14.71	26.51 ± 4.52	38.11 ± 6.4
Diabetes mellitus	53 (32.91)	1.60 ± 1.38	68.15 ± 11.52	26.69 ± 4.4	35.92 ± 4.3
Hypertension	49 (30.43)	1.64 ± 0.12	73.04 ± 13.03	26.79 ± 4.42	36.31 ± 4.72
Migraine	10 (6.21)	1.68 ± 0.10	71.31 ± 8.82	25.29 ± 4.7	35.6 ± 2.59
Cardiovascular diseases	23 (14.28)	1.63 ± 0.13	69.13 ± 12.42	25.38 ± 4.10	36.17 ± 3.91
No disease (Control)	49 (30.43)	1.65 ± 0.11	65.93 ± 11.86	24.03 ± 3.68	34.11 ± 3.86

Table 2: Diseases in different age groups of both genders in study population

Age (years)	Asthma (%)	Anemia (%)	Arthritis (%)	Bone related problems (%)	Diabetes mellitus (%)	Hypertension (%)	Migraine (%)	CVDs (%)
35-44 year								
N	2 (1.24)	3 (1.86)	1 (0.62)	5 (3.10)	6 (3.72)	8 (4.96)	4 (2.48)	3 (1.86)
Male	1 (0.62)	0	0	1 (0.62)	2 (1.24)	3 (1.86)	1 (0.62)	2 (1.24)
Female	1 (0.62)	3 (1.86)	1 (0.62)	4 (2.48)	4 (2.48)	5 (3.10)	3 (1.86)	1 (0.62)
45-54 year								
N	5 (3.10)	0	2 (1.24)	9 (5.59)	16 (9.93)	24 (14.90)	5 (3.10)	5 (3.10)
Male	1 (0.62)	0	0	2 (1.24)	8 (4.96)	10 (6.21)	2 (1.24)	1 (0.62)
Female	4 (2.48)	0	2 (1.24)	7 (4.34)	8 (4.96)	14 (8.69)	3 (1.86)	4 (2.48)
55-64 year								
N	1 (0.62)	0	3 (1.86)	1 (0.62)	21(13.04)	13 (8.07)	1 (0.62)	10(6.21)
Male	0	0	1 (0.62)	1 (0.62)	11 (6.83)	7 (4.34)	1 (0.62)	6 (3.72)
Female	1 (0.62)	0	2 (1.24)	0	10 (6.21)	6 (3.72)	0	4 (2.48)
65-74 year								
N	3 (1.86)	0	2 (1.24)	2 (1.24)	10 (6.10)	4 (2.48)	0	5 (3.10)
Male	3 (1.86)	0	2 (1.24)	2 (1.24)	6 (3.72)	2 (1.24)	0	3 (1.86)
Female	0	0	0	0	4 (2.48)	2 (1.24)	0	2 (1.24)

Figure 2: Distribution of total study population according to WC (inch)

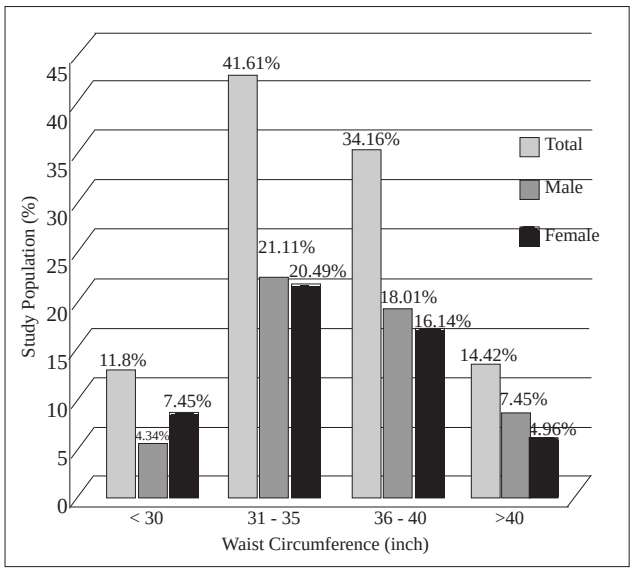
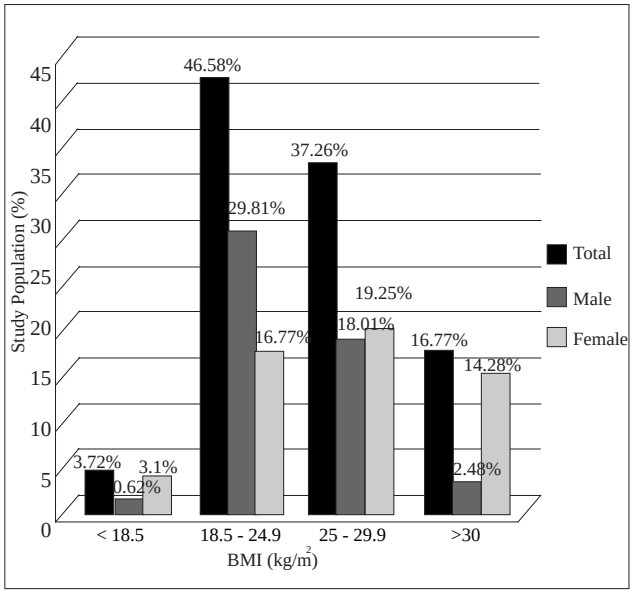


Figure 3: Distribution of total study population according to BMI (kg/m^2)



DISCUSSION

Due to the sedentary life-style and change in dietary pattern, the number of overweight people increases day by day which in turn increases the risk of obesity worldwide.[3] Obesity doesn't represent health but it may become an independent risk factor for most of the acute and chronic diseases such as cardiovascular diseases, diabetes mellitus, osteoarthritis, cancer, hypertension etc. Obesity occurs when energy intake exceeds then energy expenditure.[15] There are number of factors that contribute obesity including age, sex (females are prone to obesity as compared to male), genetic makeup, over eating, different emotional conditions (depression, hopelessness, anger, boredom, etc), sedentary lifestyle, medication, etc.[4] Beside these, change in diet pattern like high-fat diet and culture of junk food/ fast food which has been prevailing all over the world now-a-days strongly affect both genders by enhancing the lipid deposition.[14] The life-style including both professional and domestic also contributes the risk of obesity such as females from high-income families as compared to low-income families are normally dependent on maids or servants for raising their children and other house-hold works that also become one of the factors which minimizes the exercise that body really needs. No doubt they used to of passing certain period of time in a day in different sliming centers or gyms but it effects gradually and slowly or produced no physically apparent effect. Adapting sedentary life style is the beginning of different conditions such as diabetes, hypertension, dislipidemia, coronary heart diseases, arthritis and others.[35] It has been reported that even normal activities such as standing or walking around at home for house hold works and brisk walking are associated with significantly low risk of obesity and its related problems.[36] On the other hand females from low-income families are often tangled in different financial and other domestic problems like multiple pregnancies, inadequate medical status, insufficiency of healthy food especially in Asian countries like Pakistan, India, Bangladesh, etc induced mental and physical exhaustion or depression in them that in turn enhanced the risk of non-communicable diseases such as diabetes, hypertension, etc, which again developed the risk of obesity.[37] Globally, male gender from both high- and low-income classes are also showing high incidence rate of obesity because of different factors, the most important of which is job-oriented stress including giving more time to job to earn more money and adapting negative habits to energize themselves and minimize job stress such as smoking, alcohol intake or any other so called energy drinks etc[38] that also enhanced the hazard of hypertension, hyperlipidemia, cardiovascular diseases, etc, which may leads to the increase chances of physical disability and hospitalization.[7,11,26]

The present survey described the percentage of different diseases commonly found in study population belong to metropolitan city, Karachi, like 32.91% have diabetes, 30.43% have hypertension, 14.28% have cardiovascular diseases, 10.55% have bone related problems, 6.83% have asthma, 6.21% have migraine, 4.96% have arthritis and 1.86% was found anemic. However, 30.43% of population have no disease and serve as control (disease free subjects). Therefore, the most commonly found non-communicable disease in study population of Karachi was diabetes that equally affects both genders of all age groups and its highest rate (13.04 %) was found in people of 55-64 years. However its incidence was start observing from people of 35 years goes up to people of 74 years of age. The second commonly found disease was hypertension that also affects both genders of study population by observing its highest rate (14.90%) in persons of 45-54 years. Cardiovascular diseases ranked third in this survey and its high rate was observed in persons of 55-64 years. This observation was also strengthens the concept that diabetes and hypertension together increases the risk of cardiovascular diseases.[39] Fourth ranked bone related problems was found in age group of 45-54 years that include most of the females and it must be due to post-menopausal effect or low intake of vitamins and minerals.[40] However few males were also found affecting from the same bone related problems in 65-74 years of age. Again people of 45-54 years of age were found affecting by the fifth and sixth ranked diseases including asthma and migraine. Asthma is a type of allergic reaction or inflammation of respiratory tract caused by number of allergens such as dust, pollen, certain chemicals, etc.[41] Whereas migraine is a type of headache that normally felt in one side of the head. Its main cause is still unclear but may be due to abnormal brain activity and triggered by different factors such as physical and emotional stress, certain odor, bright light, etc and it has been reported that it first happens in 10-45 years of age and may begin later in life.[42] The seventh and eight ranks go to arthritis and anemia. The incidence rate of arthritis was starting from 35 years in female while observed in males of 64-74 years. Arthritis is an inflammation of joints and it is due to the breakdown of cartilage because of number of reasons including general wear and tear of joints, autoimmune disease, broken bones, etc.[8] Anemia is characterized by insufficient amount of hemoglobin and most of the females are anemic worldwide and it has been reported earlier that obesity is associated with low serum iron concentration.[43]

According to the classification of WHO, the BMI and WC of overweight persons are in the range of 25-34 kg/m^2 and greater than 34 inch respectively.[5] Interestingly all the participants of the present survey who were suffering from different commonly found diseases in Karachi also showed their BMI and WC in the same range. Only anemic females showed BMI equivalent to overweight people but WC equivalent to normal people (34 inch). However participants with no diseases (control group) demonstrated BMI 24.03 kg/m^2 and WC 34.11 inch which are good and described by different studies for healthy people.[5] Over all, the present survey reveals that females are more susceptible to obesity than males and are at greater risk of different diseases by showing 14.28% females with BMI > 30 kg/m^2. The same range was also demonstrated by only 2.48% males. On the basis of WC there are almost equal number of males and females found at risk of diseases due to obesity by showing WC > 35 inch (The WC range for male is > 40 inch and for female is > 34 inch). The observations of BMI and WC strongly support the incidence rates of first three commonly found diseases in present survey as fat deposition not only enhanced the risk of insulin resistance in body but also disrupt the vasculature of blood capillaries (including the coronary arteries) thus increased the risk of type II diabetes, hypertension and cardiovascular diseases in population.[2,28,31]

Therefore, it has been suggested that people > 40 year should take few important precautions to reduce overweight and to prevent the risk of obesity including eat healthy or low-fat diet with equal proportion of vegetable and meat, adapt appropriate physical activity (jogging/ exercise/routine house-hold work) with mental relaxation and good cultural values. All these good habits will help them to maintain their BMI and waist circumferences within normal ranges (which are not influenced by genetic make-up of an individual) and may decrease the risk of chronic diseases that normally induced by overweight or obesity.

CONCLUSION

The results concluded that diabetes mellitus ranked first and the most commonly found disease in study population of Karachi, followed by hypertension, cardiovascular and bone related problems, asthma, migraine, arthritis and anemia. Over all the highest rate of most of the commonly found diseases in Karachi was observed in participants of 45-54 years with BMI > 25 kg/m^2 and WC >35 inch.

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