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Prevalence Of Metabolic Syndrome In Association With Socio Demographic Burden Among Pakistani Population

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Abstract

Metabolic syndrome (Met S) is one of the most common disorder which gives rise to various complications mainly, diabetes and cardiovascular diseases. The aim of this study to investigate the prevalence of metabolic syndrome and its associated determinants among the adults of Pakistan. Demographical data and determination of lifestyle was evaluated by questionnaire developed by WHO, and interview. Informed consent was taken from all the participants. Analysis showed that females are more prone to Met S as compared to males. Analysis of age group showed that above the age of 60 years, risk of affected from Met S is increased, (36%, P: 0.0001) according to IDF criteria and (17.56%, P: 0.0001) according to ATP. It was concluded that females are more prone to MetS as compared to males, age above 60 is also a risk factor as well as lack of physical activity and adoption of sedentary lifestyle.

Keywords: Diabetes, metabolic syndrome, prevalence of metabolic syndrome.

Introduction

In the past years, metabolic syndrome is becoming a worldwide challenge which is also affiliated with several other types of disorders including CVD and diabetes (Alberti et al., 2005; Alberti et al., 2006). Development of cardiovascular disease and prone to diabetes is a characteristic feature of metabolic syndrome (Stern, et al., 2004). It is reported that 20-25% of the global population is affected with metabolic syndrome and is the leading cause of various other common diseases including obesity individuals who develop metabolic syndrome are at two times more risk to develop type 2 diabetes mellitus (Zimmetet al., 2001). In this context, the need to explore the various causative factors leading to metabolic syndrome are of great importance and of high demand. As this syndrome is highly associated with life style and sedentary habits, early diagnosis of metabolic syndrome may prevent to develop further complications like cardiovascular diseases

and diabetes (Zimmetet al., 2005; Steinberger & Daniels, 2003; Chandaliaet al., 1999; Mohan &Deepa, 2006). This study was developed to evaluate the prevalence of metabolic syndrome related to life style, socio-demographic status and physical activity by the help of different diagnostic approaches. In this study, IDF and ATP approaches are used to evaluate the effect of this syndrome among a specific population of Pakistan

Literature Review

Metabolic syndrome is associated with various risk factors which involves several health hazardous diseases including diabetes mellitus, cardiovascular diseases and stroke. Generally, it is characterized by the evaluation of some risk factors which are obesity, increased blood glucose, elevated levels of triglycerides, increased blood pressure and decreased HDL cholesterol (Zimmet et al., 2005; Mohan &Deepa, 2006).

South Asian population is originated from India, Srilanka, Bangladesh, Maldives, Nepal and Pakistan (Jafar et al., 2004; King et al.,1998). South Asian population is the population with a common incidence of diabetes, hypertension and obesity (Misra & Vikram, 2002). The life style and sedentary habits of South Asian population makes them more prone to metabolic syndrome (Reaven, 2004; Snehalatha et al., 1999; Ramachandran et al., 1998). A critical analysis shows that the high incidence of diabetes in South Asian population demonstrates that there is an abundance of muscles to fat ratio and stomach bloating (Chandaliaet al., 1999). In this aspect, obesity is found to be the most common and essential factor that leads to insulin opposition (Laws et al., 1994). Weight is also another factor which is highly associated with metabolic syndrome in South Asian population as reported also in Indian population (Dhawanet al., 1994;Misra&Khurana, 2009; Lopez, 2006). The most critical aspect regarding South Asian population is that the occurrence of three common and traditional hazards for developing cardiovascular diseases including smoking, hypertension and hypercholesterolemia due to the intake of high fat and unhealthy diet (Mc Keigueet al., 1989; Mc Keigueet al., 1988). This evaluation showed according to the age and BMI record, South Asian population has higher insulin levels due to increased glucose intake, high cholesterol levels and hypertension which eventually leads to obesity and diabetes. It may be suggested that in general, CHD factors re highly associated with metabolic syndrome and it depends on the life style (Mc Keigueet al., 1991; Cleland &Sattar, 2005).

Methodology

Study design

It is a cross-sectional study and also includes a survey study conducted in 2017-2018 in Pakistan. This survey was based on the epidemiological data related to metabolic syndrome.

Population data and size

Adults were selected randomly from the population of Pakistan. 541 adults were selected from the age of 18 up to 70 years. All the participants selected randomly and the interviews were conducted.

They were asked about their social determinants which includes gender, Age, medical status, educational status, residence, employment, personal and family clinical history, and use of tobacco, sleeping routine, dietary habits, water intake, psychological issues, and financial status and about their physical fitness. They were also examined in terms of anthropometric parameters such as BMI, blood pressure and other determinants.

For BMI, height and weight were measured by using stadiometer and weighing scale, respectively. For waist measurement, measuring tape was used. For the measurement of blood pressure, sphygmomanometer was used. Information regarding unhygienic habits i.e., smoking, were also taken.

Inclusion and Exclusion criteria

All the participants included were healthy adults from age 18-70 year with no history of any medical disability or disease. All the participants must be the residence of the Pakistan for 5 years at least before the study was conducted.

Adults who are physically handicapped, with any known psychological disorder, without taking consent, who were the residents for less than 5 years, pregnant ladies, who are on hormonal therapy, those who are unable to communicate verbally, having any allergy or prone to cancer and below the age of 18, were excluded from the study.

Questionnaire

The questionnaire was consisted of four sections which are further divided in the sub-sections. 1st section includes the socio-demographic details, 2nd section contains the family details and medical history, 3rdpart consisted of detailed information of their life style and 4th part contains the anthropometric parameters of the sample population. This questionnaire is the part of interview based section of this study which was conducted by the key investigator.

Statistical Analysis

Data determined by this study was further analyzed by using SPSS software. For the analysis of quantitative variables, student's t-test was used. For qualitative analysis, chi square was applied. P-value <0.05 was considered as significant and <0.01 as highly significant.

Results

Socio-demographic Analysis

Current study was conducted over 541 individuals. Among them, 315 (58.2%) were male subjects and 226(41.8%) were female subjects. Mean age of the subjects was 38.30 (12.82) years. Mean age of the male subjects was 39.38 (13.68) years whereas the mean age of female subjects was 36.81 (12.20) years. Furthermore, subjects were divided into five different age groups as per the global standards. Group 1 consists of adults from 18-30 years and comprises of 157 adults (29%), group 2 ranges from 31-40 years and included 138 individuals (25%), group 3 consists of 41-50

years and included 141 individuals (26.1%), group 4 consists of individuals ranges from 51-60 years includes 79 individuals (14.6%) and last group consists of adults from 60 and above, included 26 adults (4.8%) of this group. Most of these individuals belonged to the rural areas which were 353 adults (62.2%) while 188 adults were belong to urban localities (34.8%). The studies subjects were also divided into economic classes according to Pakistani criteria as per lower (42), middle (444) and upper (25) classes.

According to the literacy skills, population was divided as illiterate (160), primary level(99), secondary level or matriculation(40), higher secondary or intermediate(54), bachelors or graduation (45) and post-graduation (39). While interview, information regarding their marital status was also taken. Among them, 394 were married while 120 of them were single. 27 of them were widow or separated adults. As per in terms of employment, 161 of them were government employee while 106 were unemployed, rest of the individuals were belong to other professions as shown in table. Participants have no medical history of any disease. However, information about unhygienic habits showed that 193(35.7%) adults were involved in smoking while 348 (63.3%) were non-smokers.

Table 1: Regression analysis of the socio- demographic analysis of variables in relation with frequency and percentage

Variables	Frequency (n)	Percentage (%)
Gender		
Male	315	58.2
Female	226	41.8
Total	541	100
Age (in years)		
18-30	157	29.0
31-40	138	25.0
41-50	141	26.1
51-60	79	14.6
60	26	4.8
Total	541	100
Socioeconomic status		
LSES	42	13.3
MESE	444	82.1
USES	25	4.6
Locality of patients		
Rural	353	62.2
Urban	188	34.8
Marital Status	Married	394 72.8
	Unmarried/single	120 22.2
	Widow/Divorced	27 5.0
	Total	541 100
Familymedicalhistory	NO	458 84.7
	YES	83 15.3
	Total	541 100.0
Smoking	YES	193 35.7
	NO	348 64.3
	Total	541 100.0

Prevalence of Met S among adults

Prevalence of metabolic syndrome in the current study was evaluated by the modified method of ATP-III (Adult Treatment Panel three) and IDF (International Diabetic Federation) criteria shown in table. According to the criteria of ATP-III, total 155 (28.7%) adults were Met S +ve whereas 386 (71.3%) were Met S -ve out of 541 sample population. According to IDF criteria, total 264 (48.8%) adults were Met S +ve.

Gender wise Prevalence of Met S

Total 63 male subjects were Met S +ve (20%) and 251 male subjects were –ve out of 315 whereas 92 female subjects were +ve (40.7%) and 134 were –ve (55.8%) out of 226 as per the ATP-III guidelines. According to IDF criteria, total 109 male subjects were MetS +ve (34.6%) and 160 were –ve (50.8%) whereas 155 female subjects were Met S+ve (68.6%) and 117 were Met S –ve (51.8%) out of 226 female population.

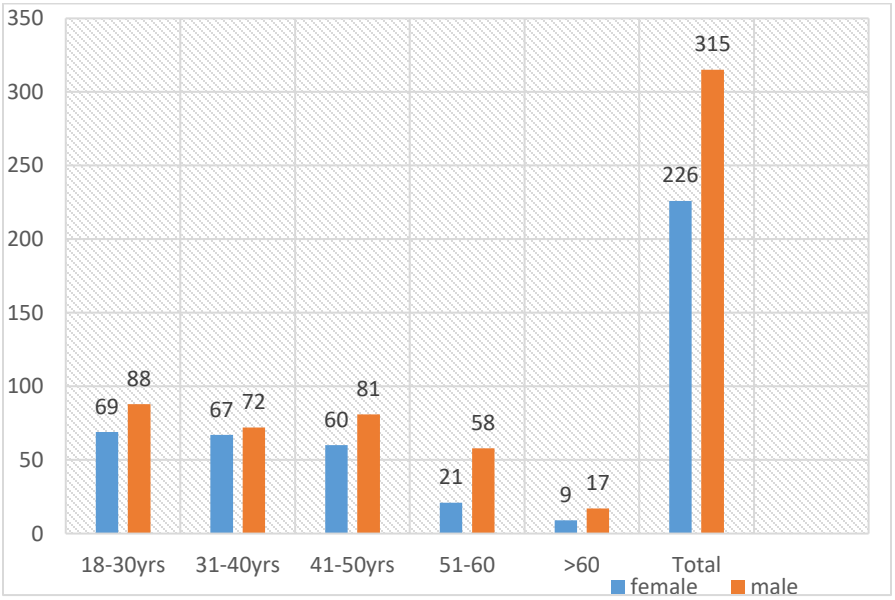

Figure 1. Gender wise prevalence in metabolic syndrome

Table 2: Prevalence of metabolic syndrome with respect to determinants

Variables	IDF			ATP-III			
	Mets +ve n (%)	Mets-ve n (%)	ODD P valueratio	Mets –ve n (%)	Mets +ve n (%)	ODD ratio	P value

Male	**315**	**155(49.0)**	**160(51.0)**	**4.120 <0.0001**	**63(20)**	**252(80)**	**2.74<0.0001**
Female	**226**	**109(48.2)**	**171(51.8)**		**92(41.0)**	**134(59.0)**	
Total	**541**	**264(49.0)**	**277(51.0)**		**155(29.0)**		**386(71.0)**

Prevalence of Me S according to determinants

This section represents the determinants analysis involved in the study and their relativity with the Met S. It includes age of the subjects, their socio-economic status, marital status, their locality and physical activity.

According to IDF criteria, age specific groups consisted of 20 individuals who were MetS +ve in the age group of 18-30 year out of total of 157 individuals (12.7%). Total 63 individuals were affected from Met S in the age group of 31-40 years (35.7%) out of 138. Among the participants of age group 41-50 years, total 101 subjects were affected out of 141 (71.6%). Among the population of age group 50-60 years, total 58 subjects wer affected out of 79 subjects of this group (73.4%). While in the age group of 60 and above, 22 out of 26 subjects were affected (84.65). Prevalence of age specific groups of metabolic syndrome as per the ATP-III criteria were 8(5.1%), 37(26.9%), 73(51.8%), 19(24.0%), 6(23.0%) in all the age groups from 18-30, 31-40, 41-50, 51-60 and 60 above respectively, in the sample population.

Table 3: Metabolic Syndrome Analysis with respect to IDF and ATP- III

Criteria		**IDF**				**ATP-III**			
variable		**MetS positive**				**MetS positive**			
Age group	**n**	**Male**	**female**	**Total n (%)**	**Odd ratio (chia square)P**	**Male**	**Female**	**Total n (%)**	**% Odd ratio(chia square)P**
18-30	**157**	**11**	**9**	**20(12.7)**	**Reference group**	**3**	**5**	**8(5.1)**	**Reference group**
31-40	**138**	**28**	**35**	**63(45.7)**	**5.57(39.35) <0,0001**	**8**	**29**	**37(26.9)**	**6.8(26.79) <0,0001**
41-50	**141**	**58**	**43**	**101(71.6)**	**17.2(106.8) <0,0001**	**25**	**42**	**67(47.5)**	**19.9(81.77) <0,0001**
51-60	**79**	**43**	**15**	**58(73.4)**	**18.9(87.45)<0,0001**	**21**	**12**	**33(42.7)**	**13.3(49.25) <0,0001**
≥60	**26**	**15**	**7**	**22(84.6)**	**37.67(65.17)<0,0001**	**6**	**4**	**10(38.4)**	**11.64**

									<0,00001
Total	**541**	**155**	**109**	**264**	**49.0**	**63**	**92**	**155**	**29.5**

For socio-economic status, the highest prevalence was found in study samples belongs to upper class (USES), in which 17 adults were affected from MetS out of 25 (68.0%). Among the subjects involved in middle class (MSES), a total of 217 out 444 were found to be affected by MetS (49%). In the lower middle class (LSES), 30 individuals were MetS positive (41.7%) as per the IDF criteria. As per the ATP-III criteria, prevalence of MetS in upper class (USES) was 11 out of 25 individuals (44.0%), total 128 out 444 subjects belongs to middle class (29.0%)and 16 subjects in the lower class(22.2%), were affected from MetS.

For the evaluation of marital status, observations according to the IDF criteria, among married subjects 227 out of 394 individuals were MetS +ve (72.8%). Among unmarried subjects, 15 subjects out of 120 were MetS +ve (22.2%).

Table 4: Metabolic Syndrome Analysis in Marital Status

Criteria		**IDF MetS positive**				**ATP-III MetS positive**			
Variable	**n(%)**	**Male n(%)**	**Female n(%)**	**Total n**	**(%)**	**Male n(%)**	**Femalen (%)**	**Total**	**(%)**
Married	**394(72.8)**	**135(34.2)**	**92(23.3)**	**227**	**57.6**	**55(14.5)**	**80(20.3)**	**135**	**34.2**
Unmarried/ single	**120(22.2)**	**7(5.8)**	**8(6.6)**	**15**	**12.5**	**3(2.5)**	**5(4.1)**	**8**	**6.6**
Widow	**25(4.6)**	**13(52)**	**7(28)**	**20**	**80**	**5(20)**	**5(20)**	**10**	**40**
Divorced/ Separated	**2(.4)**	**0**	**2(100)**	**2**	**100**	**0**	**2(100)**	**2**	**100**

As per the IDF criteria, out of 353 subjects belongs to rural areas 172 subjects were found to be affected (49.2%). In the urban population, 92 subjects out of 188 subjects were found to be affected by MetS (49.3%). According to the ATP criteria, total 98 individuals belongs to the rural area were found to be positive (44%) while 57 subjects from urban area were affected (30.3%).

Table 5: Metabolic Syndrome Analysis with respect to Socio- economic Status

Criteria		**IDF**	**ATP-III**
Over all prevalence of Mets		**264(49.0)**	**155(29.0)**
Variable	**No. of samples**	**MetS positive**	**MetS positive**

Socio-economic status	N	Male n (%)	Female n(%)	Total N	%	Male n(%)	Female n(%)	Total n	%
LSES	72	17(24.1)	13(18.0)	30	41.7	6(8.3)	10(13.8)	16	22.2
MSES	444	128(29.2)	89(20.0)	217	49.0	53(12.3)	75(18.1)	128	29.0
USES	25	10(40)	7(28)	17	68.0	4(16.0)	7(28.0)	11	44.0
TOTAL	541	155	109	264	49.0	63	92	155	29.0

Prevalence of MetS associated with obesity, smoking and physical activity

Current study was based on four BMI groups according to the American Diabetes Association in Asian population. They were underweight group < 18 kg/m² 18- 22.9 kg/m² normal, 23-25kg/m² overweight and greater than 25 were obese. Among the underweight subjects, no individual was found to be MetS affected according to the both diagnostic criteria. Whereas 51/99 (51.5%), 7/99 (7.07%) among normal BMI group, 57/113 (50.4%), 15/113 (13.2%) among over weight BMI group, 161/321 (50.1%), 133/321 (41.4%) among obese BMI group according IDF and ATP criteria respectively were affected.

Table 6: Metabolic Syndrome Analysis associated with Obesity, Smoking and Physical Activity

Criteria		IDF			ATP-III		
Variable		MetS positive			MetS positive		
BMI group	n (%)	Male	female	Total n (%)	Male	Female	Total n (%)
<18 (underweight)	07(1.3)	0	0	0	0	0	0
18-22.9(Normal)	99(18.5)	47	4	51(51.5)	5	2	7(7.07)
23-25(overweight)	113(20.9)	52	5	57(50.4)	10	5	15(13.2)
≤25(obese)	321(59.3)	61	100	161(50.1)	48	85	133(41.4)
Total	541	155	109	264	63	92	155

Among the 193 smokers, 111 subjects were affected from MetS (57%) and out of 348 nonsmokers, 153 were affected from MetS (43%) according to the IDF criteria. According to the ATP-III criteria, total 98 smoker were found to be MetS +ve (49%) whereas 57 non-smokers were affected from MetS (16.3%).

Table 7: Metabolic Syndrome Analysis between Smokers and Non Smokers

Criteria		IDFMetS positive				ATP-III MetS positive			
Variable	N (%)	Male n(%)	Female n(%)	Total (%)	OR(x2, risk ratio) P value ,	Male n(%)	Female n(%)	Total (%)	OR(x2, risk ratio) P value
Smoker	193(35.7)	109 (56.4)	2(1.0)	111(56.1)	1.72(9.21,1.3)00.3	41(21.2)	57 (29.5)	98(44.)	5.26(71.8, 3.1)<0.0001
None smoker	348(64.3)	46 (13.2)	107(30.7)	153(43.9)		22 (38.5)	35(61.4)	57(16.3)	
Total	541(100)	155	109	264	49.0	63	92	155	29.0

In terms of physical activity, total 244 were found to be physically active, among them 32 were found to be MetS +ve (13.1%) whereas out of 297, 232 subjects showed no activity according to the IDF criteria. As per the ATP-III criteria, total 20 subjects were found to be MetS +ve (8.19%) whereas 135 individuals showed no activity were also +ve for MetS (45.4%).

Table 8: Metabolic Syndrome Analysis with respect to Physical Activity

Criteria		IDF MetS positive				ATP-III MetS positive			
Variable	N (%)	Male n(%)	Female n(%)	Total n(%)	OR(x2) p-value. RR(.95 confidence interval)	Male n(%)	Female n(%)	Total n(%)	OR(x2) p-value. RR(.95 confidence interval)
Activity	244	6(2.4)	26(10.6)	32(13.1)	23.64(226.51) <0.0001 5.9(4.2-8.2	5(8.8)	15(25.6)	20(8.9)	9.33(90.96) <0.0001 5.5(3.57-8.5)
NO Activity	297	149(50.1)	83(28.4)	232(78.1)		77(13.3)	58(11.8)	135(45.4)	
Total	541	155	109	264	49.0%	63	92	155	29.0%

Discussion

This study is mainly based on the risks and factors associated with the prevalence of metabolic syndrome. Metabolic syndrome is the leading cause of various cardiovascular disorders and diabetes. This issue is not only related to the health, but is also interconnected with various social and economic aspects which may lead to CVD and diabetes (Zimmet et al., 2001; Zimmet et al., 2005).

Overall prevalence of metabolic syndrome is found to be 28.6%-48.8% according to both criteria used in the study. Similar studies were conducted in several areas of Karachi also which showed that in urban areas, prevalence of MetS was 7.4-49% according to different definitions of WHO, NCEP, IDF and many others (Majeed, 2018). Another study revealed the prevalence about 34-49% (Ahmed et al., 2020; Wierzbicki et al., 2005). Another study was conducted in Brazil showed higher prevalence of MetS in females (33.6%) as compared to males (7.75%) by considering National Education Cholestrol Program criteria (Finco et al., 2017). Most of other studies showed higher prevalence according to the IDF criteria, which also suggests that is depends on the diagnostic criteria as well. IDF method mainly depends on the waist circumference and central obesity. Similar studies were conducted in Qatar, China, Nepal, Srilanka, Bangladesh and Portugal(Shera et al.,1995; Harikrishnan et al., 2018; Zhu et al., 2020; Okube et al., 2020; Jiang et al., 2018; Warnakulasuriya et al., 2021).

According to the selected criteria, both of these methods showed a higher prevalence of MetS in females. Females were found to be 68.6% +ve according to IDF and 40.7% according to ATP-III criteria which suggests that female subjects are at double risk (4.12, <P 0.0001) as per IDF and (2.74, <P 0.0001) as per ATP-III criteria. Many other studies also showed similar studies with about 57- 95% prevalence in females according to ATP-III criteria (Ahmed et al., 2020;Shera et al., 1995; Khan & Jackson, 2018; Jbet al., 2018). Similar type of studies were conducted in China, Bangladesh and India which also showed higher prevalence of MetSin females as compared to male (Steinberger & Daniels, 2003; Ramachandran et al.,1998; Chandalia et al., 1999; Laws et al., 1994; McKeigue et al.,1988; Finco, et al., 2017).

Characteristics which play a key role in the development of MetS. Lack of the physical activities and sedentary life style may also lead to various disorders and MetS including diabetes. (48, 104). In the socio-economic status groups, highest prevalence of MetS was found in upper class according to both IDF and ATP-III criteria which was 68% (n=17/25) and 44.2% (n=11/25) respectively. Similar studies also showed higher prevalence of MetSin upper class due to the use of fast food, lack of physical activity and increased use of beverages, especially in the developed countries(Stern et al.,2004;Zimmet et al., 2005; Steinberger & Daniels, 2003; Reaven, 2004;Okube et al., 2020).

According to this study, highest prevalence of MetS was found in the ages of 60 or above i.e., 69.4% according to IDF criteria whereas 48.6% according to ATP-III criteria. 183. Several studies showed that prevalence of MetS is highly age dependent and is about seven fold increase in the

population of ages 20-80 years with a varying degree (Sooriyaarachchiet al., 2021; Iqbal et al., 2011; Jeong& Yu, 2018; Yusuf et al.,2001; De Silva et al.,2019).

According to this study, 59% (n=321/541) of the studied population were obese whereas 20.8% (n=113/541) were overweight individuals. Another survey conducted in rural areas of Pakistan also showed the higher prevalence of obesity in the population (Jafar et al., 2004; Majeed, 2018; Ahmed et al.,2020; Wierzbicki et al., 2005; Shera et al., 1995; Iqbal et al., 2014). This study reported that prevalence of MetS is higher in females as compared to males. It makes the obesity epidemic which affects many nations and is the leading cause of CVD and diabetes (Snehalathaet al., 1999; Wang et al., 2020; Saklayen, 2018; Di Marzo&Silvestri, 2019).Accumulation of accessive body fats may also lead to insulin resistance and is associated with obesity (Jafaret al., 2004; Yusuf et al.,2001; Das et al., 2010).

It is a well-known fact and that smoking is the leading cause of cardiovascular disorders (Di Marzo&Silvestri, 2019;Khan & Jackson, 2018; Rippe, 2019). According to this study, prevalence of MetS was found to be higher smokers as compared to non-smokers according to both selected criteria. ATP criteria showed three times more risk of obesity in smokers as compared to non-smokers. This study can also be compared with several other studies conducted in China, Taiwan and Korea which also showed that risk of obesity is strongly associated with smoking and they are at increased risk to get affectd by MetS (Sun et al., 2012; Chen et al., 2008; Oh et al., 2005).

As we discussed earlier, sedentary and unhealthy life style is the leading cause of the disorders associated with MetS. Findings from various studies showed that lack of physical activity and sedentary behaviors play a vital role in the development of obesity and other factors associated with MetS. This study revealed that the individuals who were physically active showed reduced prevalence of MetS as compared to physically inactive individuals and showed statistically significant results.

Conclusions

Recent study shows the prevalence of metabolic syndromes by using two different approaches and is found to be between 29%-49%, previously documented in other Asian countries also. Prevalence was observed highest in the IDF criteria and lowest as per the ATP criteria. Findings showed the increased tendency of developing MetS in the individuals >60 years. It was concluded that MetS is affected from different factors including age factor, obesity, diabetes and gender also. Most of the population involved in this study were physically inactive and this is also a major cause of developing metabolic syndrome.

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