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Original research article

RISK FACTORS AND FREQUENCY OF METABOLIC SYNDROME AMONG ADULTS

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Abstract: *Non-communicable diseases (NCDs) pose a significant public health challenge in developing nations, accounting for the most critical mortality rates and illness burden globally. Approximately 74% of annual worldwide deaths are attributed to non-communicable diseases (NCDs), with 77% of these fatalities happening in nations with low or middle incomes. The global prevalence of metabolic syndrome is recognized as a significant public health concern due to its correlation with an increased risk of developing diabetes and cardiovascular issues in individuals of all age groups, including adults, teens, and children.* ***Objective:*** *To determine the risk factors and frequency of metabolic syndrome among adults.* ***Methods:*** *The current study was a sectional study at HMC Hayatabad Peshawar. This study lasted one year, from April 2023 to April 2024. The total sample size was 1000, determined using the WHO sample size calculator. Experts collected anthropometric measurements, including weight and height. A standardized sphygmomanometer was employed to assess blood pressure. Blood samples were obtained from each subject. The data was analyzed using the SPSS version 23 program.* ***Results:*** *This research had a total of 1000 participants. In our study, there were 550 (55%) male participants, and 450 individuals (35%) identified as female. The average (standard deviation) age was 43.05 (11.2) years. Metabolic syndrome was found to be present in 350 (35%) of the participants. In our research, we found that obese individuals had an odds ratio (OR) of 15.01, individuals aged 51 years or older had an OR of 5.91, and overweight participants had an OR of 5.91. These findings indicate that these groups are at a much higher risk of developing metabolic syndrome.* ***Conclusion:*** *Our research findings suggest that metabolic syndrome is quite frequent in our community, with a higher occurrence among females. According to our research, the primary characteristics that significantly impact participation include hyperglycemia, hypertension, abdominal obesity, high levels of triglycerides, and low levels of high-density lipoprotein (HDL).*

Keywords: Metabolic syndrome; Risk factors; Frequency; Adults.

Introduction

Non-communicable diseases (NCDs) pose a significant public health challenge in developing nations and account for the most critical mortality rates and illness burden globally. Approximately 74% of annual worldwide deaths are attributed to non-communicable diseases (NCDs), with 77% of these fatalities happening in nations with low or middle incomes. The global prevalence of metabolic syndrome is recognized as a significant public health concern due to its correlation with an increased risk of developing diabetes and cardiovascular issues in individuals of all age groups, including adults, teens, and children (1). Multiple risk factors are considered to diagnose metabolic syndrome (2, 3). An individual who has abdominal obesity, elevated blood pressure, and increased fasting plasma glucose levels is at a greater risk for developing cardiovascular disease due to the combination of these risk factors (3, 4). Based on the results of a prospective cohort investigation involving 6255 participants, those who exhibited one or more risk factors for metabolic syndrome were found to have an increased susceptibility to cardiovascular illnesses. Furthermore, metabolic syndrome is a strong indicator of cardiovascular disease (CVD), coronary heart disease (CHD), and the total mortality rate relative to its components (4). According to statistical analysis from the National Health and Nutrition Examination Survey (NHANES III), metabolic syndrome is more common among children and adolescents, particularly among overweight and obese children (5). Around 155 million children, or 10% of the world's school-aged population, are overweight or obese, based on the report of the International Obesity Task Force (IOTF) (6). In a thorough analysis of 463 studies on metabolic syndrome epidemiology in children, the average prevalence was 3.3%. Among groups with overweight, the prevalence was 11.9%, while in communities with obesity, it was 29.2% (7). Metabolic syndrome has emerged as a prominent and complex condition in the early 21st century, with many researchers considering it a global pandemic (8, 9). The prevalence of metabolic syndrome in Latin America is around 24.9% (10). A comprehensive research conducted in Brazil revealed that the occurrence of metabolic syndrome among adults is similar to that seen in developed countries, with a mean frequency of 29.6%. (11).

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Furthermore, there is much controversy about the actual existence of metabolic syndrome (12, 13). Irrespective of the nature or actual existence of the syndrome, all of its component problems have been scientifically shown to independently and regularly increase the likelihood of developing heart disease and diabetes (14). Over the years, Pakistani food and lifestyle patterns have changed with global political, social, and economic transformations. The extensive promotion and easy availability of fast food and carbonated drinks have a notably adverse effect on youngsters. Peshawar, Khyber Pakhtunkhwa, has also seen a similar transformation, where physicians now face the challenge of maintaining a perfect equilibrium between the needs of individual patients and the broader aspects of public health in their approach to treatment. This study aimed to evaluate the prevalence of metabolic syndrome and its related risk factors amongst individuals in Peshawar, Khyber Pakhtunkhwa, Pakistan.

Methodology

The current study was a cross-sectional study done at HMC Hayatabad Peshawar. This study lasted one year, from April 2023 to April 2024. Before sampling, the hospital research and ethics committee approved this project. All participants provided written informed consent. The total sample size was 1000, determined using the WHO sample size calculator. The inclusion criteria included individuals of both genders who were >18 years of age and agreed to participate in our research. Conversely, the exclusion criteria consisted of individuals with cancer, HIV, eating disorders, hepatitis B and hepatitis C, allergies, etc. Additionally, women who were pregnant were omitted. A Performa that had been predesigned was used to gather all the data, comprising anthropometric and socio-demographic data. The classification of physical activity was based on four groups: low (walking for up to 1 hour/day), moderate (walking for more than one hour/day), high (engaging in intense exercise for up to half an hour per day), and very high (engaging in severe exercise for more than half an hour per day). Experts collected anthropometric measurements, including weight and height. A standardized sphygmomanometer was employed to assess blood pressure. Blood samples were obtained from each subject. The data was analyzed using the SPSS version 23 program. Standard deviation and mean were recorded for continuous data, whereas categorical variables were computed as percentages and proportions. The categorical variables were analyzed using a chi-square test. The study used logistic regression to establish the correlation between the metabolic syndrome and several risk variables. A p-value of less than 0.05 was taken as statistically significant.

Results

This research had a total of 1000 participants. In our study, 550 (55%) male participants and 450 individuals (35%) identified as female. The average (standard deviation) age was 43.05 (11.2) years, ranging from a minimum age of 18 to a maximum age of 72. The age-wise distribution reveals that 450 (45%) of the subjects were in the age range of 18-30. Additionally, 25% of the participants were in the age group of 31-40. Furthermore, 18% of the participants were in the age group of 41-50. Lastly, 12% of the participants were aged 51 years or older. Based on the participants' educational level, 180 individuals (18%) had no formal education, 250 individuals (25%) had completed primary school, 380 individuals (38%) had completed secondary education, and 190 individuals (19%) had completed university-level education. Based on smoking status, 20 individuals (2%) were classified as current smokers, 50 individuals (5%) were classified as past smokers, and 930 individuals (93%) reported as never smoking. The mean (standard deviation) body mass index (BMI) in our research was 27.99 (9.42) kg/m2. In terms of obesity, 50 (5%) individuals were classified as underweight, 350 (35%) participants were classified as average weight, 280 (28%) participants were classified as overweight, and 320 (32%) participants were classified as obese. Based on the level of physical activity, 720 (72%) individuals were classified as having a low level of activity, 200 individuals (20%) participants had a moderate level, 50 (5%) participants had a high level, and 30 (3%) participants had a very high level. The average (standard deviation) waist circumference was 82 (4.99) cm. 450 (45%) individuals had abdominal obesity. In our research, diabetes was present in 50 people, accounting for 5% of the participants. Hypertension, on the other hand, was found in 450 patients, making up 45% of the total participants. (Figure 1) The average systolic blood pressure was 123 (6.47) mmHg, and diastolic blood pressure was 82 (5.01) mmHg, respectively. The average (standard deviation) levels of glycemia, cholesterol, HDL, LDL, and triglycerides were 112 (5.13), 161 (42.21), 32.23 (6.05), 82 (23.05), and 166 (23.85) mg/dl, correspondingly. (Table 1) Metabolic syndrome was found to be present in 350 (35%) of the subjects. (Figure 1) Our research observed 204 (58.29%) female subjects and 146 (41.71%) male participants with metabolic syndrome. The average (standard deviation) age of individuals with metabolic syndrome was 47.05 (8.11) years (p=0.002). The incidence of metabolic syndrome varied according to the degree of education, with rates of 2.86% among the uneducated, 40% among those with elementary education, 49.71% among those with secondary education, and 7.43% among those with university education (p=0.001). The incidence of metabolic syndrome was 1.71% among current smokers, 7.43% among past smokers, and 90.86% among those who had never smoked (p=0.07). The mean (standard deviation) body mass index (BMI) among individuals diagnosed with Metabolic syndrome was 33.31 (2.9) kg/m2 (p=0.002). The prevalence of metabolic syndrome based on different weight categories was as follows: 26 individuals (7.43%) with average weight, 140 individuals (40%) who were overweight, and 184 individuals (52.57%) who were obese. No underweight participants were reported to have metabolic syndrome in our research (p=0.001). The prevalence of metabolic syndrome was 70.86% for those with little physical activity, 22.28% for those with moderate physical activity, 4.57% for those with high physical activity, and 2.29% for those with very high physical activity (p=0.002). The average (standard deviation) waist circumference was 93 (12.75) cm in individuals diagnosed with Metabolic syndrome (p=0.001). A total of 326 patients (93.14%) with abdominal obesity were found to have metabolic syndrome (p=0.002). The prevalence of Metabolic syndrome was 40% among patients with diabetes and 52.57% among those with hypertension (p=0.003). Table 2 The average systolic blood pressure amongst

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individuals with Metabolic syndrome was 133 (2.45) mmHg, and diastolic blood pressure was 84 (5.05) mmHg, accordingly ($p<0.001$). Additionally, the average levels of glycemia, cholesterol, HDL, LDL, and triglycerides among participants with Metabolic syndrome were 112 (6.45), 172 (54.11), 32.05 (2.99), 113 (39.41), and 182 (21.99) mg/dl, accordingly ($p<0.02$).

In our research, we found that obese individuals had an odds ratio (OR) of 15.01, individuals aged 51 years or older had an OR of 5.91, and overweight participants had an OR of 5.91. These findings indicate that these groups are at a much higher risk of developing metabolic syndrome. The information is shown in Table 3. According to our research, the variables that had the most significant impact on participants were hyperglycemia (odds ratio: 5.15), high blood pressure (odds ratio: 4.61), abdominal obesity (odds ratio: 351.12), high triglyceride levels (odds ratio: 4.61), and low high-density lipoprotein levels (odds ratio: 11.9). (Table 4)

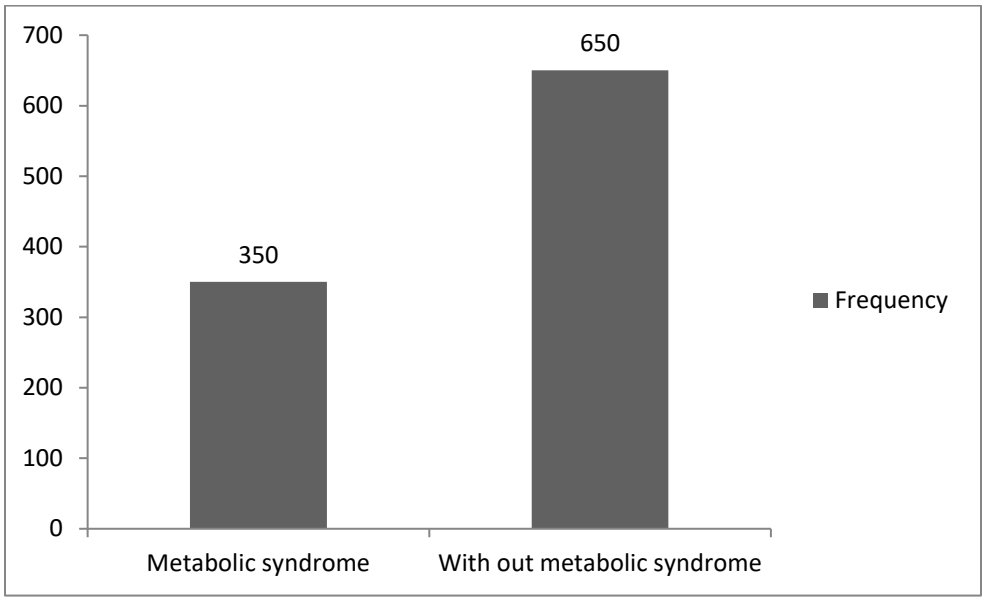

Figure 1: Overall frequency of metabolic syndrome

Table 1: Socio-demographic characteristics of the enrolled patients

Parameter	Category	Frequency (%)
Gender	Male	550 (55%)
	Female	350 (35%)
Age	18-30	450(45%)
	31-40	250 (25%)
	41-50	180 (18%)
	≥51	120 (12%)
Education	Uneducated	180 (18%)
	Primary	250 (25%)
	Secondary	380 (38%)
	University level	190 (19%)
Obesity	Underweight	50 (5%)
	Normal weight	350 (35%)
	overweight	280 (28%)
	Obese	320 (32%)
Physical activity	Low	720 (72%)
	Moderate	200 (20%)
	High	50 (5%)
	Very high	30 (3%)
Smoking	Current smoker	20 (2%),
	Former smoker	50 (5%)

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	Never smoke	930 (93%)
Abdominal obesity	Yes	450 (45%)
	NO	550 (55%)
Diabetes	Yes	50 (5%)
	NO	180 (90%)
Hypertnsion	Yes	450 (45%)
	NO	550 (55%)

Table 2: Metabolic syndrome frequency w.r.t different categorical variable

Parameter	Category	Individuals with Metabolic syndrome N (%)	*P*- Value
Gender	Male	146 (41.71%)	0.002
	Female	204 (58.29%)	
Age	Mean (SD)	47.05 (8.11) years	0.002
Education	Uneducated	10 (2.86%),	0.001
	Primary	140 (40%),	
	Secondary	174 (49.71%)	
	University level	26 (7.43%)	
Obesity	Underweight	00 (00%)	0.002
	Normal weight	26 (7.43%),	
	overweight	140 (40%),	
	Obese	184(52.57%)	
Physical activity	Low	248 (70.86%),	0.002
	Moderate	78 (22.28%),	
	High	16(4.57%)	
	Very high	8 (2.29%)	
Smoking	Current smoker	6 (1.71%),	0.07
	Former smoker	26 (7.43%)	
	Never smoke	318 (90.86%)	
Abdominal obesity	Yes	326 (93.14%)	0.002
	NO	24 (6.86%)	
Diabetes	Yes	140 (40%)	0.002
	NO	210 (60%)	
Hypertension	Yes	184 (52.57%)	0.002
	NO	166 (47.43%)	

Table 3: Correlation of metabolic syndrome with socio-demographic variables

Parameter	Sub-category	OD	CI (95%)	*P*- Value
Age	18-30	3.11	1.93-7.01	0.001
	31-40	4.32	2.07-8.01	0.007
	41-50	4.33	3.41-8.26	0.002
	≥51	5.91	3.81-12.51	0.005
Education	Uneducated	0.39	0.12-1.99	0.09
	Primary level	0.59	0.14-2.11	0.08
	Secondary level	0.69	0.15-1.99	0.21
	University level	0.13	0.09-0.51	0.002
Obesity	Underweight	0.00	00 to 00	0.73
	Normal weight	0.00	00 to 00	0.79
	overweight	5.91	5.01- 12.11	0.004
	Obese	15.01	7.99-23.11	0.003
Physical activity	Low activity	0.59	0.29-1.12	0.03
	Moderate Activity	0.71	0.28-1.11	0.004
	High activity	0.31	0.12-0.92	0.71
	Very high activity	0.39	0.08-0.81	0.09
Smoking	Current smoker	3.01	0.4-7.13	0.09
	Former smoker	2.07	0.59-6.31	0.07
	Never smoke	2.09	0.2-7.77	0.06
Abdominal obesity		351.12	129.22- 980.33	0.004

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Table 4: Correlation of metabolic syndrome concerning laboratory and anthropometric measure

Variable	Odd ratio	CI (95%)	*P*- Value
High Blood pressure	4.61	3.21-9.61	0.002
Hyper-glycemia	5.15	3.01-9.89	0.001
cholesterol (High)	2.37	1.33-6.22	0.01
HDL	11.9	5.01-33.21	0.005
triglycerides (High)	4.61	3.01-14.21	0.002

Discussion

This study aimed to examine metabolic syndrome and its risk variables in the Peshawar region of KPK. Thirty-five percent of the patients had metabolic syndrome overall. Previous research indicates that the incidence of metabolic syndrome in Pakistan ranges from 18-46% (15-19). Based on our research, a prior study found that the overall frequency of metabolic syndrome in adults was 38.98% (20). Other researchers also reported similar results to our findings, with 30.52% in South Korea, 35.73% in Morocco, and 35.1% in Northwestern Nigeria (21) (22) (23). However, our observed incidence of metabolic syndrome is higher than the prevalence observed by Owolabi et al. in South Africa, which was 21.8% (24). The high prevalence of metabolic syndrome in adults in Peshawar, Khyber Pakhtunkhwa, may be explained by the area's high rates of obesity, diabetes, and hypertension in this population. Genetics and way of life may also contribute to these phenomena. In our research, metabolic syndrome was found in 204 (58.29%) of the female individuals and 146 (41.71%) of the male participants. These results are consistent with prior research that found that 18.56% of participants in the male group and 40.12% of individuals in the female group had metabolic syndrome (22). Another previous study also reported females with high frequency (25). Contrasting to our research, a survey carried out by Santos et al. revealed that males were more likely than women to have metabolic syndrome (26). The several cut-off points utilized as metabolic syndrome standards, like low HDL cholesterol, hypertriglyceridemia, and abdominal obesity, may be correlated to these results. In females going through menopause, the quantity of circulating estrogen dropped. Elevated risk of cardiovascular problems in women can result from estrogen lack due to its effects on lipid metabolism, obesity, and prothrombotic conditions (27). There may be a correlation between the higher frequency of obesity among female participants in the study and the greater prevalence of metabolic syndrome in females across all age groups. One possible explanation might be the rapid deterioration of endothelial function after menopause in females. Numerous studies indicate that the prevalence of metabolic syndrome is rising in less developed nations (28, 29). The variables contributing to this issue include rapid growth, lifestyle modification (such as unhealthy eating habits and lack of physical activity), and a lack of knowledge. Individuals with metabolic syndrome had higher total cholesterol levels, diastolic blood pressure, and glycemia. They were more prone to developing hypertension, diabetes, and abdominal obesity in comparison to those without the condition. Previous research has linked metabolic dysfunctions, like hypertension, obesity, and hyperglycemia, to an increased chance of developing the metabolic syndrome (30, 31).

In our research, we found that obese individuals had an odds ratio (OR) of 15.01, individuals aged 51 years or older had an OR of 5.91, and overweight participants had an OR of 5.91. These findings indicate that these groups are at a much higher risk of developing metabolic syndrome. According to our research, the variables that had the greatest impact on participants were hyperglycemia (odds ratio: 5.15), high blood pressure (odds ratio: 4.61), abdominal obesity (odds ratio: 351.12), high triglyceride levels (odds ratio: 4.61), and low high-density lipoprotein levels (odds ratio: 11.9). Obesity is the primary risk factor for metabolic syndrome, and our research aligns with prior studies on this issue (22, 32).

An essential strength of this research is that it is among the limited number of studies conducted on metabolic syndrome in Pakistan and has a large sample size. The results of this study will unquestionably contribute to raising awareness and preventing metabolic syndrome in Peshawar, Khyber Pakhtunkhwa. However, there are certain disadvantages to take into account. The cross-sectional design of the research limits the ability to examine causal relationships between risk factors and metabolic syndrome in the study population. Furthermore, there was a single analysis of a blood sample to assess the occurrence of metabolic syndrome, which could lead to minor errors.

Conclusion

Our research findings indicate that metabolic syndrome is quite frequent in our community, with a higher occurrence among females. According to our research, the primary characteristics that significantly impact participation include hyperglycemia, hypertension, abdominal obesity, high levels of triglycerides, and low levels of high-density lipoprotein (HDL). Our research suggests that abdominal obesity is the most effective indicator of metabolic syndrome. The findings of our study highlight the significance of using evidence-based methods to prevent, diagnose, and treat metabolic syndrome and its associated factors in individuals residing in Peshawar, Khyber Pakhtunkhwa, Pakistan.

Declarations

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate.

It is approved by the department concerned. (IRB-HMC-P2937/22)

Consent for publication

Approved

Funding

Not applicable

Conflict of interest

The authors declared an absence of conflict of interest.

Authors Contribution

TAHIR ZAMAN KHAN (Medical Officer)
Data Analysis
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AMIR KHAN & KIRAN GHAFOOR
Concept & Design of Study

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