OPEN ACCESS

ORIGINAL ARTICLE

Frequency of Metabolic Syndrome Among Patients With Type 2 Diabetes Mellitus

Muhammad Ayaz[1], Syed Jalal Shah[2], Humaira Achakzai[3], Mohsin Shabir[4], Muhammad Shabbir khan[5], Rabia Latif[6]

[1]Assistant Professor Medicine Muhammad College of Medicine & Muhammad Teaching Hospital Peshawar, Pakistan
[2]Trainee Registrar Medicine Muhammad Teaching Hospital Peshawar, Pakistan
[3]Associate Professor Medicine Rehman Medical Institute Peshawar, Pakistan
4Senior Registrar Cardiology Rehman Medical Institute Peshawar, Pakistan
[5]Assistant Professor Biochemistry Northwest School of Medicine Peshawar, Pakistan
[6]Research Assistant Khyber Medical University Peshawar, Pakistan

Correspondence:
Muhammad Ayaz
Email: drayaz80@yahoo.com

Abstract

Background: The most common risk factors of diabetes mellitus, include ethnicity, family history, obesity, metabolic syndrome, behavioral factors, such as physical inactivity, a diet containing higher amounts of saturated fat and carbohydrates, and a relatively lower number of fruits and vegetables, smoking, alcohol consumption and sleep duration. Out of these, obesity is directly related to metabolic syndrome and insulin resistance.

Objective: To determine the frequency of metabolic syndrome among patients with type 2 diabetes mellitus.

Material and Methods A total of 260 patients were examined. The sample size was calculated with a WHO sample size calculator using a reference study with 58% metabolic syndrome type 2 diabetes patients (confidence level= 95%, and margin of error=6%).

Results: The results were analyzed as: Distribution of age among 260 patients was observed as n= 30-40 Years 48(18.5%), 41-50 Years 86(33.1%) 51-60 Years 64(24.6%) 61-70 Years 62 (23.8%). The mean age was 49.12 years with a standard deviation ±2.142 Gender-wise distribution of 260 participants was analyzed as n=260 Gender Distribution Male 182(70.0%) Female 78(30.0%). Distribution Metabolic syndrome among type II diabetic patients was 201(77.3%).

Conclusion: This study indicates that metabolic syndrome poses a serious health risk to Pakistani diabetes patients, who are more likely to have problems like cardiovascular disease and early death. The predictor's female gender, age in the 50–60 age range, residency in an urban area, and single status are all changeable. Therefore, health authorities should offer these most at-risk diabetes patients subpopulations specific interventions including lifestyle changes.

Keywords: Frequency, Metabolic Syndrome, Type 2 Diabetes Mellitus

Cite this article: Ayaz M, Shah Jalal S, Achakzai H, Shabir M, khan Shabbir M, Latif R. Frequency of Metabolic Syndrome Among Patients With Type 2 Diabetes Mellitus. BMC J Med Sci. 2024; 5(2): 102-108.

Introduction

The most common endocrine condition, diabetes mellitus, is characterized by elevated blood sugar levels brought on by decreased insulin secretion, action, or both. It is the biggest health issue of the 21st century. An estimated 425 million individuals worldwide suffer from diabetes[1]. Type 2 diabetes mellitus comprises about 90% of cases of diabetes.

Type 2 diabetes mellitus risk factors include ethnicity, family history, obesity, metabolic syndrome, behavioral factors, such as physical inactivity, diet containing higher amounts of saturated fat and carbohydrates and a relatively lower number of fruits and vegetables, smoking,

Authorship Contribution: [1,6]Substantial contributions to the conception or design of the work; or the acquisition, Data analysis, Literature review, [2]Drafting the work or revising it critically for important intellectual content, [3,4,6]Final approval of the version to be published, Topic Selection & Supervision
Funding Source: none
Conflict of Interest: none

Received: July 12, 2024
Accepted: Dec,26, 2024
Published: Dec 30, 2024

alcohol consumption, and sleep duration[2]. Obesity is directly related to metabolic syndrome and insulin resistance though it is also the major modifiable factor[3].

The term "metabolic syndrome" describes a combination of risk factors for both cardiovascular disease and diabetes mellitus. These risk factors include obesity, hyperglycemic state, dyslipidemia, as well as hypertension. This syndrome is sometimes referred to as the insulin resistance syndrome, deadly quartet, and syndrome-X. The metabolic syndrome is becoming increasingly common with the increase in urbanization, excess caloric dietary habits, obesity, and sedentary lifestyle, and has grown to be a significant global public health and clinical challenge. The metabolic syndrome thus leads to the development of type 2 diabetes and cardiovascular diseases. Numerous studies have demonstrated a direct link between metabolic syndrome and the future risk of type-2 diabetes and cardiovascular disease due to insulin resistance and hyperinsulinemia4. A person is five times more prone to have type 2 diabetes mellitus and two times to suffer from cardiovascular disease if he is having metabolic syndrome.

Clinicians should evaluate patients who have metabolic concerns during normal clinic visits. According to Endocrine Society clinical guidelines, people who have metabolic syndrome risk factors either one or more should be assessed every three years. The evaluation includes measurements of blood pressure, circumference around the waist, fast blood glucose, and lipid profile. People with metabolic syndrome are advised to adopt aggressive lifestyle measures, such as increasing physical activity with weight loss, to reduce their risk of developing any complications such as cardiovascular and/or type-2 diabetes. S. Ashraf et al. in their study had reported that 45% of individuals with diabetes had metabolic syndrome[5] while another study by Nsiah et al., reported a 58% prevalence of metabolic syndrome in such patients[6].

The purpose of the current study is to establish the metabolic syndrome prevalence in individuals with type-2 diabetes. The metabolic syndrome is an established risk factor for cardiovascular illnesses, which have been responsible for an increase in fatalities over time. While a great number of studies had already been done in other groups of the population on this subject, none have been conducted in our setting in the previous two years. Consequently, this research will furnish us with the latest information regarding the occurrence of metabolic syndrome in those diagnosed with diabetes mellitus type 2, specifically in those whose disease is under control or not. Finding out which metabolic syndrome risk factors are most prevalent and how they raise the risk of cardiovascular disease in the general population was the aim of this investigation. The results of our study can be used to create preventative strategies against the community's most common manifestations of metabolic syndrome, improving the prognosis for these people.

Material and Method:

We carried out this research work from November 1, 2022, to April 30, 2023, in Muhammad Teaching Hospital's Medical Department in Peshawar. 260 patients in total were observed as part of a descriptive (cross-sectional) study designed to assess the metabolic syndrome prevalence among individuals with diabetes type 2. WHO software was used to calculate the 58%6 metabolic syndrome frequency in those having diabetes mellitus type 2, the confidence level of 95%, and a margin of error of 6%.

Inclusion Criteria:

The study included only those patients having diabetes mellitus type 2, both controlled and uncontrolled, who had had the disease for more than two years, who were between the ages of thirty and seventy, and who were either male or female.

Exclusion Criteria:

- Patients having diabetes mellitus type 1,
- Patients younger than 30 years and those older than 70 years,
- Female patients with pregnancy,
- Patients with a positive history of coronary artery disease,
- Patients with a positive history of valvular heart diseases,
- Patients with a positive history of atrial fibrillation,
- Patients using Multivitamins supplements.

The above conditions were excluded from the study as they are effect modifiers and will create bias in study results if included.

Data Collection Procedure:

The hospital's ethics and research committees gave their approval before the current study could be conducted. The study included all patients who satisfied the inclusion criteria, having type-2 diabetes mellitus (both controlled and uncontrolled), having diabetes for more than two years, being between the ages of thirty and seventy, and being either male or female. Every patient who was part of the trial gave written informed consent.

Detailed histories were taken from patients and relevant clinical examinations were performed. To reduce confounders in the study outcomes, strict exclusion criteria were adhered to. After an overnight fast, approximately 5 milliliters of venous blood were drawn and sent to the main hospital laboratory to measure triglycerides, HDL-cholesterol, and fasting blood glucose (FBG). Blood pressures were measured using a sphygmomanometer in the sitting position in both arms after 15 minutes of rest. The

highest value was taken as the patient's blood pressure. Using a measuring tape, waist circumferences were taken halfway between the supra-iliac crest and the inferior angle of the ribs. Patients' demographics and clinical data were recorded on the approved pro-forma.

Data Analysis Procedure:

SPSS-24 was used for all the statistical analysis. Age, length of diabetes, weight, height, and BMI were examples of continuous data that were displayed as mean ± standard deviation (SD). Frequencies as well as percentages represent qualitative characteristics such as gender, place of residence, socioeconomic position, and diabetes status. Other variables included a family history of diabetes mellitus, hypertension, smoking status, and metabolic syndrome. The following effect modifiers were used to stratify people with metabolic syndrome: age, gender, length of diabetes, BMI, residence address, socioeconomic status, diabetes status, family history, hypertension, and smoking history. Using the post-stratification chi-square test, a P-value less than 0.05 was considered significant statistically. Tables and graphs display the analyses.

Results:

The results were analyzed as: Gender distribution among 260 patients was analyzed as n=260 Gender Wise Distribution Male 182(70.0%) Female 78(30.0%) as shown in figure- 1.

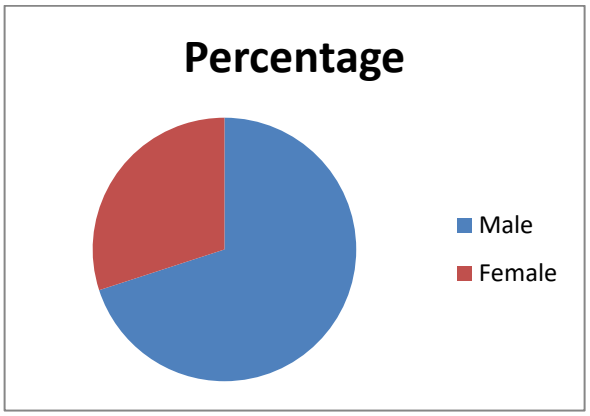

Figure No. 1: Gender-Based Distribution Of Patients (SAMPLE SIZE, N=260)

Analysis was done on the age distribution of 260 patients as n 30-40 Years 48(18.5%), 41-50 Years 86(33.1%)51-60Years 64(24.6%)61-70 Years 62 (23.8%). The mean age was 49.12 years with a standard deviation of ±2.142. (Table No. 1).

Table NO. 1: AGE GROUP DISTRIBUTION OF PATIENTS (SAMPLE SIZE, n =260)

				Valid	Cumulative
		Frequency	Percent	Percent	Percent
Age Groups	Valid 30-40 Years	48	18.5	18.5	18.5
	41-50 Years	86	33.1	33.1	51.5
	51-60 Years	64	24.6	24.6	76.2
	61-70 Years	62	23.8	23.8	100.0
Total		260	100.0	100.0	

Distribution among type II diabetic patients based on controlled and uncontrolled status was 176(67.7%) and 84(32.3%) respectively. (Table No. 2).

TABLE NO.2: DISTRIBUTION BASED ON STATUS OF DIABETES (SAMPLE SIZE, n =260)

			Valid	Cumulative
	Frequency.	Percentage	Percentage	Percentage
Valid Controlled	176.0	67.70	67.70	67.70
Uncontrolled	84.0	32.30	32.30	100.00
Total	260.0	100.00	100.00	

Distribution of Metabolic syndrome among type II diabetic patients was 201(77.3%) (Table No. 3)

TABLE NO. 3: DISTRIBUTION BASED ON PRESENCE OF METABOLIC SYNDROME (SAMPLE SIZE, n =260)

			Valid	Cumulative
	Frequency.	Percentage	Percentage	Percentage
Valid Yes	201	77.30	77.30	77.30
No	59	22.70	22.70	100.00
Total.	260	100.00	100.00	

Stratification of metabolic syndrome based on gender and respective chi-square is shown in Table No. 4

TABLE NO. 4: STRATIFICATION OF METABOLIC SYNDROME* GENDER WISE DISTRIBUTION

			Gender Wise Distribution		
			Male	Female	Total
Metabolic Syndrome	Yes	Count	182	19	201
		Expected Count	140.7	60.3	201.0
		% within Metabolic syndrome	90.5%	9.5%	100.0%
		% within Gender Wise Distribution	100.0%	24.4%	77.3%
	No	Count	0	59	59
		Expected Count	41.3	17.7	59.0
		% within Metabolic syndrome	.0%	100.0%	100.0%
		% within Gender Wise Distribution	.0%	75.6%	22.7%
Total		Count	182	78	260
		Expected Count	182.0	78.0	260.0
		% within Metabolic syndrome	70.0%	30.0%	100.0%
		% within Gender Wise Distribution	100.00%	100.0%	100.0%

χ^2 Test for Association		
	Value	P-value
Pearson χ_1^2	178.10	0.00
Continuity-Correction	173.79	0.00
Likelihood-Ratio Fisher's Exact Test	191.87	0.00
Linear by Linear Association	177.39	0.00
N of Valid Casesb	260	

Stratification of Metabolic syndrome based on age and respective chi-square is shown in Table No. 5

TABLE NO. 5: STRATIFICATION OF METABOLIC SYNDROME* AGE WISE DISTRIBUTION

			Age Wise Distribution				
			30-40 years	41-50 years	51-60 years	61-70 years	Total
Metabolic Syndrome	Yes	Count	45	61	34	61	201
		Expected Count	37.1	66.5	49.5	47.9	201.0
		% within Metabolic syndrome	22.4%	30.3%	16.9%	30.3%	100.0%
		% within Age Wise Distribution	93.8%	70.9%	53.1%	98.4%	77.3%
	No	Count	3	25	30	1	59
		Expected Count	10.9	19.5	14.5	14.1	59.0
		% within Metabolic syndrome	5.1%	42.4%	50.8%	1.7%	100.0%
		% within Age Wise Distribution	6.2%	29.1%	46.9%	1.6%	22.7%
Total		Count	48	86	64	62	260
		Expected Count	48.0	86.0	64.0	62.0	260.0
		% within Metabolic syndrome	18.5%	33.1%	24.6%	23.8%	100.0%
		% within Age Wise Distribution	100.0%	100.0%	100.0%	100.0%	100.0%

χ^2 Test for Association

	Value	P-value
χ^2_3	46.43	0.00
Likelihood-Ratio	53.64	0.00
Linear by Linear Association	0.153	0.69
N of Valid Casesb	260	

Stratification of metabolic syndrome based on the status of diabetes is shown in Table No. 6

TABLE NO. 6: STRATIFICATION OF METABOLIC SYNDROME* STATUS OF DIABETES

			Status of Diabetes		
			Controlled	Uncontrolled	Total
Metabolic Syndrome	Yes	Count	176	25	201
		Expected Count	136.1	64.9	201.0
		% within Metabolic syndrome	87.6	12.4	100.0%
		% within the status of diabetes	100	29.8	77.3%
	No	Count	0	59	59
		Expected Count	39.9	19.1	59.0
		% within Metabolic syndrome	0	100	100.0%
		% within the status of diabetes	0	22.7	22.7%

Total		Count	176	84	260
		Expected Count	176.0	84.0	260.0
		% within Metabolic syndrome	67.7%	32.3%	100.0%
		% within the status of diabetes	100.0%	100.0%	100.0%

χ^2 Test for Association		
	Value	P-value
χ_1^2	160.0	0.00
Continuity-Correction	156.0	0.00
Likelihood-Ratio	176.2	0.00
Fisher's-Exact-Test		
Linear by Linear	159.0	0.00
Association		
N of Valid Casesb	260	

Discussion:

Diabetes mellitus- type 2 and cardiovascular disorders are among the non-communicable diseases that are becoming more common due to the rise in metabolic syndrome. Little research has been conducted on the illness in Khyber Pakhtunkhwa, particularly in the Peshawar sub-region, despite the condition's rising incidence. Because the variables utilized are simply and readily observable, the NCEP/ATP III proposed criteria were selected to evaluate the prevalence of MetS[7]. Unlike Nsiah et al.'s work6, the current study employed logistic regression analysis to ascertain the MetS prevalence in type 2 diabetic patients as well as the key risk variables that require monitoring for diabetes regulation, prevention, and treatment. The key findings of this research study were that type 2 diabetics had a notable MetS prevalence (58%). Similar to a prior study by Nsiah et al6 and Ford et al[8], females had a higher prevalence (77.01%) due to having more MetS contributing risk factors compared to males (22.99%). According to the logistic regression study, women were at three times more risk of developing MetS compared to men. Given that the majority of women in this region of the world are unemployed, the cause could be attributed to either hereditary or comparatively sedentary lifestyles.[9]

Obesity was quite prevalent, accounting for 40.23% of the participants in the diabetic study. Compared to people of normal weight, obese had a five-fold greater chance of developing MetS. Increased synthesis of VLDL in the liver and the subsequent availability of large quantities of TGs in the blood are the results of obesity's contribution to insulin resistance. People having diabetes-type 2 and reduced glucose tolerance have higher levels of HDL catabolism, which lowers HDL levels, and hypertriglyceridemia.[10] The negative link between enhanced HDL catabolism and hypertriglyceridemia in insulin-resistant conditions, which results in low plasma HDL concentrations, could be explained by a variety of mechanisms. A potential explanation could be a decrease in the activity of enzyme LPL (lipoprotein lipase) which could hinder the development of HDL particles. It has been demonstrated that insulin resistance blunts the typical insulin-mediated activation of LPL function.[11] LPL activity is decreased in diabetes-type 2 affectees, especially in those with impaired glucose regulation and those who are somewhat insulin deficient. Therefore, it is imperative to control obesity which is a major contributing factor for type 2 diabetes and to halt or decelerate the development of certain problems.[12]Similar to a 2007 study by Moebus et al[13], showed considerably greater MetS prevalence among diabetic patients with lower literacy. Diabetes prevalence was much lower in those individuals with education level above senior high (3.45%) as well as tertiary level (12.64%) while in primary it was 14.94% and in junior high it was 56.32%. This may be because they are unaware of healthy eating practices, such as consuming more saturated fats and carbohydrates rich diets, as well as irregular exercise and inactivity. Fast food (12.79%) as well as soft energy drinks (1.92%) did not significantly contribute to the development of MetS in this study cohort because the majority of the diabetics avoided them both before and after they became ill.It has been suggested that family history accelerates the acquisition of MetS[14]. In this study, three or more MetS components were present in 79.31% of patients with a positive family diabetes history. The most prevalent factor among all type 2 diabetes study participants in this investigation was determined to be hypertension, central obesity and decreased HDL level. The most common factor

in the male population was hypertension, which was followed by hypertriglyceridemia and decreased HDL. These results are somewhat in agreement with that of Olufadi et al. (2008)7, who discovered that hypertension was the commonest condition in males, followed by hypertriglyceridemia, using the NCEP/ATP III. Before receiving a diabetes diagnosis, the majority of the men (76%) had a history of significant alcohol consumption, and alcohol is known to raise blood pressure[15]. Compared to patients with norm tension, hypertensive diabetics are more likely to experience micro- and macro vascular problems.The most prevalent factor in the female population was obesity, which was followed by higher triglycerides, decreased HDL, and hypertension. This may be because women exercise less frequently, lead sedentary lifestyles that are largely caused by their trade activities, and frequently eat carbohydrate rich foods, processed CHO, and late at night meals. Furthermore, it was discovered that central adiposity and reduced HDL in females was significantly more prevalent than male. Reduced HDL levels in blood is associated to carry a higher risk of cardio vascular and coronary heart disease, as is widely known.[16]

Conclusion:

This study shows that metabolic syndrome poses a serious health risk to Pakistani diabetes patients, who are prone to have problems like cardiovascular problems and early death. The predictor's female gender, age in the 50–60 age range, residency in an urban area, and single status are all changeable. Therefore, health authorities should offer these most at-risk diabetes patient subpopulations specific interventions including lifestyle changes.

References:

1. Aamir AH, Ul-Haq Z, Mahar SA, Qureshi FM, Ahmad I, Jawa A, Sheikh A, Raza A, Fazid S, Jadoon Z, Ishtiaq O. Diabetes Prevalence Survey of Pakistan (DPS-PAK): prevalence of type 2 diabetes mellitus and prediabetes using HbA1c: a population-based survey from Pakistan. BMJ open. 2019 Feb 1;9(2):e025300.
2. Cho NH, Shaw JE, Karuranga S, Huang Y, da Rocha Fernandes JD, Ohlrogge AW, Malanda BI. IDF Diabetes Atlas: Global estimates of diabetes prevalence for 2017 and projections for 2045. Diabetes research and clinical practice. 2018 Apr 1;138:271-81.
3. Abdul Basit AB, Asher Fawwad AF, Huma Qureshi HQ, Shera AS. Prevalence of diabetes, pre-diabetes and associated risk factors: second National Diabetes Survey of Pakistan (NDSP), 2016-2017.
4. Ipadeola A, Adeleye JO. The metabolic syndrome and accurate cardiovascular risk prediction in persons with type 2 diabetes mellitus. Diabetes & Metabolic Syndrome: Clinical Research & Reviews. 2016 Jan 1;10(1):7-12.
5. Ashraf SS, Ziauddin F, Jahangeer U. Metabolic syndrome in type-2 diabetes mellitus. Pakistan Journal of Medical Sciences. 2006 Sep;22(3):295.
6. Nsiah K, Shang VO, Boateng KA, Mensah FO. Prevalence of metabolic syndrome in type 2 diabetes mellitus patients. International Journal of Applied and Basic Medical Research. 2015 May 1;5(2):133-8.
7. Olufadi R, Byrne CD. Clinical and laboratory diagnosis of the metabolic syndrome. Journal of clinical pathology. 2008 Jun 1;61(6):697-706.
8. Ford ES, Giles WH, Mokdad AH. Increasing prevalence of the metabolic syndrome among US adults. Diabetes care. 2004 Oct 1;27(10):2444-9.
9. Hernandez-Baixauli J, Quesada-Vázquez S, Mariné-Casadó R, Gil Cardoso K, Caimari A, Del Bas JM, Escoté X, Baselga-Escudero L. Detection of early disease risk factors associated with metabolic syndrome: a new era with the NMR metabolomics assessment. Nutrients. 2020 Mar 18;12(3):806.
10. Gami AS, Witt BJ, Howard DE, Erwin PJ, Gami LA, Somers VK, Montori VM. Metabolic syndrome and risk of incident cardiovascular events and death: a systematic review and meta-analysis of longitudinal studies. Journal of the American College of Cardiology. 2007 Jan 30;49(4):403-14.
11. AJ H. Prediction of type 2 diabetes mellitus with alternative definitions of the metabolic syndrome: the Insulin Resistance Atherosclerosis Study. Circulation. 2005;112(24):3675-6.
12. Goossens GH. The role of adipose tissue dysfunction in the pathogenesis of obesity-related insulin resistance. Physiology & behavior. 2008 May 23;94(2):206-18.
13. Moebus S, Hanisch JU, Aidelsburger P, Bramlage P, Wasem J, Jöckel KH. Impact of 4 different definitions used for the assessment of the prevalence of the Metabolic Syndrome in primary healthcare: The German Metabolic and Cardiovascular Risk Project (GEMCAS). Cardiovascular Diabetology. 2007 Dec;6:1-0.
14. Lovre D, Mauvais-Jarvis F. Trends in prevalence of the metabolic syndrome. Jama. 2015 Sep 1;314(9):950-.
15. Suzuki T, Homma S. Treatment of hypertension and other cardiovascular risk factors in patients with metabolic syndrome. Medical Clinics of North America. 2007 Nov 1;91(6):1211-23.
16. Stone NJ, Robinson JG, Lichtenstein AH. 2013 ACC/AHA Guideline on the Treatment of Blood Cholesterol to Reduce Atherosclerotic Cardiovascular Risk in Adults: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2013 Nov 12 [E-pub ahead of print]. Correction. Journal of the American College ofCardiology.2014;63(25):3024-5.