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Prevalence and Determinants Metabolic Syndrome in DM 2 Patient A Cross Sectional Study

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ABSTRACT
Metabolic syndrome represents a significant risk factor for cardiovascular diseases and type 2 diabetes mellitus (T2DM). Understanding its prevalence and determinants in diabetic patients is crucial for developing targeted interventions. This study aimed to determine the prevalence of metabolic syndrome and its associated determinants among patients with type 2 diabetes mellitus. A cross-sectional study was conducted involving 250 patients with type 2 diabetes attending a tertiary care hospital. The prevalence of metabolic syndrome was assessed using the ATP III criteria. Data on age, gender and lifestyle factors such as physical activity were collected through structured questionnaires and hospital records. Of the 250 patients, 40% met the criteria for metabolic syndrome. The prevalence was slightly higher among patients aged 40-60 years (OR=1.282., 95% CI: 0.771 to 2.132., P=0.616) but did not reach statistical significance. Similarly, females showed a non-significantly lower risk (OR=0.940., 95% CI: 0.566 to 1.562., P=0.353). Regarding lifestyle factors, neither high nor low levels of physical activity were significantly associated with the prevalence of metabolic syndrome (High activity OR=0.983., 95% CI: 0.535 to 1.807., P = 0.154., Low activity OR = 0.781., 95% CI: 0.466 to 1.310., P=0.313). While the study indicated a considerable prevalence of metabolic syndrome among T2DM patients, the associations with age, gender, and physical activity were not statistically significant. These findings suggest the need for larger, more detailed studies to explore these associations further.

INTRODUCTION

Metabolic syndrome (MetS) is a cluster of metabolic disorders that includes abdominal obesity, dyslipidemia, hypertension and insulin resistance. Individuals with metabolic syndrome are at a higher risk of developing cardiovascular diseases and type 2 diabetes mellitus (T2DM). The global prevalence of MetS has been increasing, paralleling the rise in the rates of obesity and T2DM. This escalation poses significant health challenges worldwide, especially in developing countries where urbanization and lifestyle changes contribute to its sprea[1].

Type 2 diabetes mellitus is a chronic metabolic condition characterized by high blood sugar, insulin resistance, and relative lack of insulin. It is often associated with the components of metabolic syndrome, which can complicate the management of the disease and worsen patient outcomes. Understanding the prevalence and determinants of metabolic syndrome among patients with T2DM is crucial for effective disease management and prevention strategies[2].

Numerous studies have identified various genetic, lifestyle, and environmental factors that contribute to the development of MetS in diabetic patients. These include age, gender, race, body mass index, physical activity level, dietary habits and socio-economic status. Additionally, certain genetic predispositions have been linked to an increased risk of MetS in T2DM patients, highlighting the importance of personalized medical approaches[3].

The role of lifestyle interventions, such as diet and exercise, in managing MetS among T2DM patients cannot be overstated. Research has consistently shown that modifications in lifestyle can lead to significant improvements in all components of MetS, thereby reducing the overall cardiovascular risk. However, the effectiveness of these interventions can vary based on the demographic and socio-economic backgrounds of the patients, suggesting the need for tailored approaches in treatment planning[4].

In light of the rising prevalence of both MetS and T2DM, particularly in settings with limited healthcare resources, this study aims to investigate the prevalence and determinants of metabolic syndrome among patients with type 2 diabetes in a hospital setting. This research will provide valuable insights into the patterns and predictors of MetS in this high-risk group, thereby informing more targeted and effective public health interventions[5].

Aim: To determine the prevalence and associated risk factors of metabolic syndrome in patients with type 2 diabetes mellitus.

Objectives:

- To estimate the prevalence of metabolic syndrome in type 2 diabetes mellitus patients attending a tertiary care hospital.
- To identify demographic and clinical determinants associated with metabolic syndrome among these patients.
- To analyze the impact of lifestyle factors on the prevalence of metabolic syndrome in this patient population.

MATERIALS AND METHODS

Source of Data: The data for this study was collected from patients diagnosed with type 2 diabetes mellitus who attended the outpatient department of a tertiary care hospital.

Study Design: A cross-sectional study design was employed to assess the prevalence and determinants of metabolic syndrome among type 2 diabetes patients.

Study Location: The study was conducted at the Department of Endocrinology at a tertiary care hospital.

Study Duration: Data collection took place over a period of six months, from January to June 2024.

Sample Size: The study included a total of 250 patients with type 2 diabetes mellitus.

Inclusion Criteria: Patients aged 18 years and older, diagnosed with type 2 diabetes mellitus and willing to participate in the study were included.

Exclusion Criteria: Patients were excluded if they had type 1 diabetes mellitus, were pregnant, had any acute infections or terminal illnesses, or were unwilling to provide informed consent.

Procedure and Methodology: Patients underwent a detailed clinical assessment, including medical history, physical examination and laboratory tests to evaluate the components of metabolic syndrome as defined by the ATP III criteria.

Sample Processing: Blood samples were collected following a 12-hour fast to measure fasting glucose, HbA1c, serum lipids, and other relevant biomarkers.

Statistical Methods: Data were analyzed using SPSS version 25. Descriptive statistics, chi-square tests for categorical variables and logistic regression analysis

were used to identify determinants of metabolic syndrome.

Data Collection: Data were collected using a structured questionnaire, which included sections on demographic information, medical history, lifestyle factors and a review of medical records for laboratory results.

RESULTS AND DISCUSSIONS

Table 1: Prevalence and Associated Risk Factors of Metabolic Syndrome

Age Group	Odds Ratio (OR)	95% CI Lower	95% CI Upper	P-value
40-60	1.282	0.771	2.132	0.616
<40	0.999	0.525	1.902	0.384
Gender				
Female	0.940	0.566	1.562	0.353

Table 1 evaluates the association between age, gender, and the prevalence of metabolic syndrome among type 2 diabetes mellitus patients. For the age groups, individuals aged 40-60 show an Odds Ratio (OR) of 1.282, indicating a slightly higher likelihood of having metabolic syndrome compared to other age groups, though this result is not statistically significant (P-value=0.616). The confidence interval for this age group ranges from 0.771-2.132. Those under 40 have an OR close to 1 (OR=0.999), with a confidence interval spanning from 0.525-1.902, showing no substantial difference from the baseline, supported by a P-value of 0.384. Gender-wise, females have an OR of 0.940, suggesting a slightly lower but not significantly different risk of metabolic syndrome compared to males. The confidence interval for females ranges from 0.566-1.562 and the association also lacks statistical significance (P-value=0.353).

Table 2: Impact of Lifestyle Factors on the Prevalence of Metabolic Syndrome

Physical Activity	Odds Ratio (OR)	95% CI Lower	95% CI Upper	P-value
High	0.983	0.535	1.807	0.154
Low	0.781	0.466	1.310	0.313

Table 2 investigates the impact of physical activity levels on the prevalence of metabolic syndrome. Participants with high physical activity levels exhibit an OR of 0.983, suggesting no substantial protective effect against metabolic syndrome, as reflected by a broad confidence interval of 0.535-1.807 and a P-value of 0.154. Similarly, those with low physical activity have an OR of 0.781, indicating a potential reduction in risk, though this finding is not statistically significant, with a confidence interval of 0.466-1.310 and a P-value of 0.313. Both groups' findings indicate no statistically significant associations between levels of physical activity and the likelihood of developing metabolic syndrome among this patient population.

Table 1 highlights the prevalence and associated risk factors of metabolic syndrome among individuals with

type 2 diabetes mellitus. The analysis demonstrates that the age group 40-60 years shows a marginally higher likelihood (OR=1.282) of developing metabolic syndrome compared to other age groups, although this result is not statistically significant (P-value=0.616). This finding is consistent with previous studies that indicate an increase in metabolic syndrome risk with age, which can be attributed to decreased physical activity and age-related adiposity increases. Lu[6] Individuals under 40 showed no significant difference in risk compared to the baseline, which aligns with studies suggesting that younger populations have a lower incidence of metabolic syndrome components due to higher metabolic rates and healthier lifestyle choices Ramírez-Manent[7].

In terms of gender, females had a slightly lower odds ratio (OR=0.940), suggesting a reduced risk of metabolic syndrome, although this too was not statistically significant (P-value=0.353). This finding diverges from some literature that suggests women, particularly post-menopausal, are at a higher risk due to hormonal changes affecting fat distribution and insulin sensitivity Bowo-Ngandji[8]. However, the protective effect in younger females could be linked to estrogen's role in improving insulin sensitivity and lipid profiles Bolla[9].

Table 2 Analysis: Table 2 explores the impact of lifestyle factors, particularly physical activity, on the prevalence of metabolic syndrome. Participants with high physical activity levels had an OR of 0.983, indicating no significant protective effect, which is surprising as numerous studies have documented the benefits of regular physical activity in reducing the risk of metabolic syndrome by improving weight management, enhancing insulin sensitivity and favorably altering lipids Ismail[10]. This lack of significant findings might be due to the cross-sectional nature of the study or variations in the intensity and type of physical activity not captured in the data.

Individuals with low physical activity demonstrated a lower odds ratio (OR=0.781) which suggests a potential protective trend, though not statistically significant (P-value=0.313). This inverse relationship aligns with global research indicating that sedentary lifestyles are a significant risk factor for developing metabolic syndrome components Ikwuka[11].

CONCLUSION

This cross-sectional study aimed to explore the prevalence and determinants of metabolic syndrome among patients with type 2 diabetes mellitus. The findings reveal that while there are tendencies in age, gender and lifestyle factors affecting the prevalence of

metabolic syndrome, these did not achieve statistical significance in our sample.

Specifically, the age group of 40-60 years exhibited a slightly increased risk of developing metabolic syndrome, but the associated odds ratio did not reflect a statistically significant impact. Similarly, gender differences suggested a marginally lower risk in females compared to males, which might be influenced by biological and hormonal factors, although this finding also lacked statistical significance. These results might indicate that other unmeasured factors or the limited power of the study due to the sample size could be influencing these outcomes.

Regarding lifestyle factors, notably physical activity, the data suggested that high levels of activity did not confer as significant a protective effect as hypothesized. Conversely, lower levels of physical activity appeared to show a trend towards reduced risk of metabolic syndrome, but this was also not statistically significant. This could be reflective of variations in the type or intensity of physical activity that were not captured in this study or could be indicative of the complex interplay between physical activity and metabolic health in a diabetic population. The study underscores the complex nature of metabolic syndrome in individuals with type 2 diabetes mellitus and highlights the need for more comprehensive, longitudinal studies to fully understand the interdependencies of these risk factors. Future research should consider larger and more diverse populations to validate these findings and potentially reveal significant trends that could inform targeted interventions. Additionally, it would be beneficial to incorporate more detailed assessments of lifestyle behaviors, including diet and specific types of physical activity, to better delineate their roles in the prevention and management of metabolic syndrome. In conclusion, while this study provides valuable insights into the factors associated with metabolic syndrome in type 2 diabetes patients, it also calls attention to the complexities of metabolic health and the need for further research to develop effective preventive and management strategies.

Limitations of Study:

- **Cross-Sectional Design:** The inherent nature of a cross-sectional study limits the ability to establish causality. This design captures data at a single point in time, which can only suggest associations rather than temporal relationships between the determinants and metabolic syndrome.
- **Sample Size:** Although a sample of 250 patients provides a reasonable basis for initial observations, it may not be sufficiently large to

detect small effect sizes, especially in subgroup analyses. The statistical power might be too low to ascertain the true relationships among variables, particularly when stratifying by age, gender and lifestyle factors.

- **Self-Reported Data:** Some of the data, especially regarding lifestyle factors such as diet and physical activity, were self-reported. This method is prone to biases such as recall bias and social desirability bias, which can affect the accuracy and reliability of the information collected.
- **Lack of Detailed Lifestyle Assessment:** The study did not incorporate detailed quantifications of physical activity or dietary patterns. The categories of 'high' and 'low' physical activity are broad and may not adequately reflect the intensity, duration, or type of exercise that impacts metabolic syndrome. Similarly, without a precise dietary analysis, it's difficult to assess the nutritional factors that could influence metabolic outcomes.
- **Homogeneity of the Sample:** The study was conducted in a single tertiary care hospital, which may limit the generalizability of the findings. Patients attending a tertiary care facility might not represent the broader population of individuals with type 2 diabetes, particularly those in different settings or with varying levels of disease management.
- **Potential Confounding Variables:** While the study attempted to control for various demographic and lifestyle factors, there might be additional confounding variables that were not considered. These could include genetic predispositions, medication use, psychological stress and socio-economic status, all of which could influence the prevalence of metabolic syndrome.
- **Diagnostic Criteria Variability:** The criteria used to define metabolic syndrome can vary and the application of one set of criteria may not capture all aspects or severities of the syndrome. This can lead to variations in diagnosing metabolic syndrome, potentially affecting the study's outcomes.

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