*Original Article*

# Evaluating Diabetes Mellitus Susceptibility Among Pakistani Individuals With Grade-II Obesity: A Case-control Study

Allied Medical Research Journal
Vol:3 No.3: 71-76


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## ABSTRACT

**Background:** Although obesity is recognized as one risk factor for the development of diabetes, studies examining the relationship between obesity and type 2 diabetes among Asia's rapidly growing population remains a relatively unexplored area of study. Therefore, this research determines the association of Class II obesity (BMI ≥35 kg/m2) with type 2 diabetes among adults who reside in Karachi, Pakistan.

**Methods:** From October 2024 to February 2025, this case-control study was conducted at three tertiary care hospitals in Karachi, Pakistan. Convenience sampling was used to recruit the participants from outpatient endocrinology departments, with a total of 233 participants. Data on demographics, health history, and lifestyle factors were obtained via questionnaire. Diabetes status was established from self-reports of a diabetes diagnosis or diabetes medications. The data was analyzed using SPSS statistics and descriptive statistics. The association between the two groups was estimated using odds ratios and relative risk.

**Results:** The study sample comprised 48.5% males and 51.5% females, respectively, with males diagnosed with DM being 50.4%, and females 37.7%. However, 28.3% participants suffered from both diabetes and obesity. The odds ratio for diabetes for Class II Obese patients in comparison to all other patients was 2.995, and the relative risk of Class II Obese patients developing diabetes was 1.870 ($p < 0.05$).

**Conclusion:** Class II obesity substantially increases the incidence of diabetes in this population in Pakistan. Health promotion programs are required to support healthy lifestyle changes along with appropriate medical treatment to decrease the impact of diabetic obesity on society.

**Keywords:** *Diabetes Mellitus, Obesity, Physical Activity, Public Health, Quality of Life.*

**Received: January** 15, 2025**; Revised:** April 8, 2025**; Accepted:** July 1, 2025
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**DOI:** https://doi.org/10.59564/amrj/03.03/011

## INTRODUCTION

According to the report of the International Diabetes Federation (IDF), in 2015, the total number of people diagnosed with diabetes in the world was over four hundred fifteen million[1]. It is predicted that by the year 2040, there will be six hundred forty million people living with diabetes. This is a serious problem, considering that we spend more than twelve percent of the world's health-care dollars on the prevention and treatment of diabetes, but diabetes still kills approximately five million people each year[1]. In the United States, it is concerning that, between

1980 and 2014, the number of people living with diabetes increased from 3.8 to 6.8 per one-thousand people, or almost double[2].

Pakistan has some of the greatest obstacles to controlling their epidemic of diabetes. The IDF estimates that about twelve percent of Pakistanis will have diabetes. There were 8.8 million people with diabetes in Pakistan in 2000. The projected increase in diabetes cases in the Indian subcontinent from 1995 to 2025 is a staggering 195%, with predictions of having 14.5 million diabetic patients in Pakistan by the year 2025[3].

Being overweight or obese can be considered an ongoing or permanent state of having too much body fat. This is now seen as an ever-increasing problem worldwide - from developing countries to many other developed countries[4]. Obesity is associated with a greater likelihood of developing a wide range of health-related issues: such as Type 2 Diabetes Mellitus (T2DM), cardiovascular diseases; problems with the joints, as well as an increased risk of certain cancers[2]. People who are obese tend to have a diminished quality of life, with a shorter lifespan compared to those who do not suffer from obesity[5]. A research study evaluating the various diabetes-related complications showed the following ranges for the number of patients diagnosed with these complications: Cataracts, 26-62%; Diabetic Retinopathy, 17-50%, Blindness, 3%; Kidney Issues, 17-28%, Cardiac Issues, 10-22.5%, Strokes, 6-12%, Peripheral Neuropathy, 19-42%, Foot Problems, 5-23%. Death rates from these complications range between 14%-40%[6].

According to studies, the rate of diabetic complications among those aged 65 and older is on the rise but not for eye complications[7]. Research indicates those affected by type 2 diabetes can have the same risk of suffering from a heart attack after having a previous heart attack as individuals not affected by diabetes who have also suffered from a heart attack[8,9]. Diabetic patients are at least 17 times more likely to undergo an amputation because they do not get sufficient blood circulation to their feet and legs, and diabetic patients are at an increased risk of developing kidney disease, having vision loss, and developing heart disease[8]. However, while many people are aware of the correlation between being overweight and developing diabetes, the presence of obesity also creates further complications making it easier to develop diabetes. There is minimal research conducted on the risk of developing diabetes among individuals with obesity specifically in Pakistan. As such, it is imperative that studies are executed in Pakistan to determine which individuals are at a higher risk of developing diabetes, provide information and materials to increase public awareness about obesity as a leading risk factor for diabetes, supply scientifically sound information for treatment protocols and develop prevention programs.

## METHODOLOGY

### *Research Design and Setting*

A case-control study was performed at three tertiary hospitals in Karachi, Pakistan. All data were collected between October 2024 and February 2025. EPI software was used to determine the appropriate sample size for this study. The sample consisted of 233 subjects, classified as either "cases" or "controls". If the subject was "case," then they would have a history of having type 2 diabetes (as reported by themselves or through diabetes medications) and if they were "control," they would be without Type 2 diabetes. There were 101 cases and 132 controls.

### *Participant Recruitment and Demographics*

To recruit subjects for this study, the researchers utilized convenience sampling and contacted potential subjects through the outpatient endocrinology clinic. They chose clinic events that occurred during peak clinic hours to obtain the maximum number of subjects possible.

### *Ethical Considerations*

To ensure ethical standards are adhered to, the researchers explained the objectives and methodology of the study in detail to all participants, including the potential benefits and the risks involved with their participation. Before participating in the study, all participants signed a written informed consent form indicating their agreement to be involved in the study, as well as

that their identities would remain confidential. Participants were able to withdraw from the study at any point, without repercussions.

### *Data Collection Procedure*

Data for this research were collected from participants through a standard questionnaire, which included demographic information, medical history, and lifestyle factors. All questions were defined by using a descriptive explanation, and participants were instructed to indicate if they answered "yes," "no," or "I don't know" to the question, should they not know the answer. In addition, if participant(s) needed further clarification, they were provided that clarification. Participant's body weight and height were measured with calibrated measuring devices. The participant stood with bare feet, and body mass index (BMI) was calculated using the following formula:

**BMI = Weight kg x Height (m²)**

### *Data Analysis Procedure*

The data were analyzed using SPSS (Statistical Package for the Social Sciences). Descriptive statistics were used to identify demographic characteristics of the participant and to calculate odds ratios and relative risks to examine the relationship between Class II obesity and Type II diabetes.

## RESULTS

This cross-sectional study comprised a sample size of 233 subjects, 113 of whom were male (48.5%), and 120 were female (51.5%). Demographic information included data for age, obesity classification, method of diagnosing diabetes, and whether or not a participant was actively using diabetes medications. The details are shown in Table-1.

The analysis indicates that in Karachi, male participants appear to be more likely than female participants to be diagnosed with diabetes and/or use diabetes medication based on the Preliminary analysis of participant report data for the present study. Out of a total of 113 male participants, 57 (50.4%) reported being diagnosed with diabetes or currently taking medication for diabetes, while the remaining 120 females represented 44 (37.7%). These results are further outlined in Table 2.

**Table 1. Demographic Characteristics**

| Characteristic | Category | n | % |
|---|---|---|---|
| **Age (years)** | <30 | 45 | 19.3% |
| | 30–44 | 78 | 33.5% |
| | 45–59 | 65 | 27.9% |
| | ≥60 | 45 | 19.3% |
| **Obesity Classification (BMI)** | Class II Obesity (≥35 kg/m²) | 117 | 50.2% |
| | Non-Class II Obesity (<35 kg/m²) | 116 | 49.8% |
| **Diabetes Diagnosis** | Yes (self-reported or medication) | 101 | 43.3% |
| | No | 132 | 56.7% |
| **Diabetes Medication Use** | Yes | 101 | 43.3% |
| | No | 132 | 56.7% |

**Table 2. Diabetes Prevalence Among Male and Female Participants**

| Gender | Diabetes Present | Diabetes Absent | Total |
|---|---|---|---|
| **Male** | 57 (50.4%) | 56 (49.6%) | 113 |
| **Female** | 44 (37.7%) | 76 (63.3%) | 120 |
| **Total** | 101 (43.3%) | 132 (56.7%) | 233 |

### *Association between Obesity and Diabetes*

The analysis of the association between obesity and diabetes development shows a substantial link between these two diseases. The odds ratio calculated for all individuals having either Type II diabetes or Type II obesity together indicates that type II obese patients have an odds ratio of

approximately 2.995 times more likely to develop Type II diabetes than a patient who does not have obesity. In addition to this, by calculating the relative risk for obese patients compared to non-obese patients, it was found that obese patients have a relative risk of 1.870 times higher than non-obese patients to develop Type II diabetes. Thus, the conclusion drawn from this data is statistically significant ($p<0.005$). The total number of participants included in this analysis was 233 people; this data showed that there were three major groups of participants in the study.

almost twice as likely to develop Type II diabetes as people without obesity.

Therefore, there is a significant amount of clinically based probability that developing diabetes with obesity is a result of their relationship.

**Table 3. Diabetes Risk Assessment in Type-II Obesity**

| Variables | Diabetes Status | | Relative Risk | p-value | Odds Ratio | p-value |
|---|---|---|---|---|---|---|
| | Positive (n) | Negative (n) | | | | |
| **Obesity Type-II Positive (n)** | 66 | 51 | 1.870 | <0.05 | 2.995 | <0.05 |
| **Obesity Type-II Negative (n)** | 35 | 81 | | | | |

## Discussion

Out of 28.32% of participants in the study, diabetes was the most prevalent and serious health condition. The diabetes an incidence was significantly higher in male than female participants. Male participants had a diabetes incidence of 50.4%, whereas female participants had a diabetes incidence of 37.7%. Male and female participants also showed a strong correlation between risk factors for diabetes based on BMI. The BMI category of overweight (25-29.9 kg/m²) represented a lower risk level for both male and female participants compared to the BMI category of obesity (≥ 30 kg/m²). In male participants specifically, the increase in risk from There were 66 people (28.3%) who had both obesity and diabetes; 51 people (21.9%) had obesity and did not have diabetes; and 35 people (15%) had diabetes but did not meet the criteria for obesity. The remaining 81 people (34.8%) had neither condition. The pattern of results suggests that people with obesity are overweight to obesity was much greater than that from normal weight to overweight. These findings support other previous studies that have found that a person with a BMI > 30 kg/m² has a significantly higher risk for mortality[10,11].

Surprisingly, in a number of recent studies that examined the epidemiology of new cases of diabetes, the majority of new diabetes cases were found to have a BMI < 30 kg/m². This indicates that diabetes prevalence is increasing among individuals classified as non-obese and that diabetes is developing within a larger and more complex web of causative factors than previously believed[12]. The relationship between obesity and an increase in diabetes risk was examined in this study using a calculated relative risk of 1.870. ($p=0.005$). Based on this result, and previously published articles, it has been estimated that an average person with obesity has nearly seven times the risk of developing type II diabetes as a healthy weight

individual, and average overweight individual has approximately three times the risk[13].

Analyses conducted by the EPIC Potsdam research project have revealed that an increase of one unit of body mass index (BMI) from age 25 through age 40 corresponds to a 25% increase in the chances of developing type II diabetes. This study also found that the relationship between these two variables is strongest during this time frame, as opposed to a similar analysis from ages 40 to 55, which shows no significant association. This indicates that weight management occurs during important periods of life[14].

As evidenced by the findings of this study, significant changes in lifestyle are required to decrease the incidence of diabetes among individuals with obesity. Current best practice guidelines for evidence-based strategies to reduce the incidence of type II diabetes include recommendations for changing dietary habits, increasing physical activity levels, and creating a behavioral social support system. Additionally, some individuals may be considered for medications and/or medical supervision based on their specific situations[15].

There are various ways that people who are obese can prevent prediabetes from developing into diabetes. Diet, exercise, medications, and complementary therapies have all been identified as effective methods of preventing the progression of diabetes in people who are obese[15]. A large amount of evidence consistently demonstrates that losing a significant amount of weight significantly reduces the likelihood of developing diabetes[16]. Through a 20-year study involving 7,176 men in the UK, it was discovered that the diabetes incidence rate among obese men was nearly 11 times higher than among men who were of a healthy weight( i.e., 11.4 vs. 1.6 diabetes cases per 1,000 people) ($p<0.0001$). Men who lost weight showed a lower relative risk of developing diabetes (0.62) than did men who maintained their weight (1.00) while men who gained 10% of their body weight demonstrated a higher relative risk (1.76) ($p<0.0001$) than did the men with stable weights[17]. Also, studies that were similar in nature to the one referenced above that studied individuals who had already been diagnosed with diabetes revealed that weight loss could reduce complications associated with diabetes[18,19]. Many randomized trials demonstrate that weight loss due to lifestyle changes that incorporate a balanced diet, increased physical activity, and sustained weight maintenance significantly lower the risk of developing type 2 diabetes and other comorbidities such as cardiovascular disease, when applied to a high-risk population[18-20]. Therefore, while it is well established that there is a large association between obesity and developing type 2 diabetes, losing excess weight represents a significant opportunity for people who are obese to improve health status and decrease their burden of illness.

## CONCLUSION

This findings from this study showed that Class II obesity increases the risk of developing Type 2 Diabetes significantly for the individuals living in Karachi, Pakistan. The odds ratio of 2.995 and relative risk of 1.870 for the individuals identified as obese represents meaningful and clinically relevant increases in the likelihood of developing type 2 diabetes therefore warranting immediate action for the public health system. The results of this study suggest an urgent need for obesity prevention programs on a population-wide basis, high-risk groups to be better screened for diabetes, and the development of culturally competent interventions tailored to the unique situation in Pakistan.

Future research should focus on long-term studies to determine the actual cause-and-effect of the relationship identified above, the overall effectiveness of the various interventions tested across different populations in Pakistan, as well as the identification of those modifiable risks to potentially be used for targeted prevention. The study of genetic influences, environmental influences, and socioeconomic effects on obesity and diabetes in Pakistan will help to further educate those working in the area of Public Health as well as their policymakers.

**Acknowledgments**
None.

**Author Contributions**
**Syed Muhammad Zaeem Hassan Zaidi** conceived and supervised the study. **Syed Meeran Hasnain** and **Rahat Akhlaq** collected and analyzed data. Anozia Sabir assisted with literature review and manuscript drafting. **Umeeda Baz Ali Imamzada** and **Maliha Sajid** managed data and revised the manuscript. All authors approved the final version.

**Ethical Approval**
The study received approval from the ethical review board of Foundation of Medical Research and Laboratory (FMRL/2024/017).

**Grant Support and Funding Disclosure**
None.

**Conflict of Interests**
None.

## REFERENCES

1. Saeedi P, Petersohn I, Salpea P, Malanda B, Karuranga S, Unwin N, et al. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas. Diabetes Res Clin Pract. 2019 Nov;157:107843. **DOI:** https://doi.org/10.1016/j.diabres.2019.107843
2. Martín-Timón I, Sevillano-Collantes C, Segura-Galindo A, del Cañizo-Gómez FJ. Type 2 diabetes and cardiovascular disease: have all risk factors the same strength? World J Diabetes. 2014 Aug 8;5(4):444. **DOI:** https://doi.org/10.4239/wjd.v5.i4.444
3. Aamir AH, Ul-Haq Z, Mahar SA, Qureshi FM, Ahmad I, Jawa A, et al. 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. **DOI:** https://doi.org/10.1136/bmjopen-2018-025300
4. World Health Organization. Obesity: preventing and managing the global epidemic. Report of a WHO consultation. World Health Organ Tech Rep Ser. 2000;894:i-xii, 1-253.
5. Stephenson J, Smith CM, Kearns B, Haywood A, Bissell P. The association between obesity and quality of life: a retrospective analysis of a large-scale population-based cohort study. BMC Public Health. 2021 Dec;21(1):1-9. **DOI:** https://doi.org/10.1186/s12889-021-10692-6
6. Piché ME, Tchernof A, Després JP. Obesity phenotypes, diabetes, and cardiovascular diseases. Circ Res. 2020;126(11):1477-500. **DOI:** https://doi.org/10.1161/CIRCRESAHA.120.316101
7. Sloan FA, Belsky D, Ruiz D, Lee P. Changes in incidence of diabetes mellitus-related eye disease among US elderly persons, 1994-2005. Arch Ophthalmol. 2008 Nov 10;126(11):1548-53. **DOI:** https://doi.org/10.1001/archopht.126.11.1548
8. Gray N, Picone G, Sloan F, Yashkin A. The relationship between BMI and onset of diabetes mellitus and its complications. South Med J. 2015 Jan;108(1):29. **DOI:** https://doi.org/10.14423/SMJ.0000000000000214
9. Haffner SM, Lehto S, Rönnemaa T, Pyörälä K, Laakso M. Mortality from coronary heart disease in subjects with type 2 diabetes and in nondiabetic subjects with and without prior myocardial infarction. N Engl J Med. 1998 Jul 23;339(4):229-34. **DOI:** https://doi.org/10.1056/NEJM199807233390404
10. Fruh SM. Obesity: Risk factors, complications, and strategies for sustainable long-term weight management. J Am Assoc Nurse Pract. 2017 Oct;29(S1):S3-S14. **DOI:** https://doi.org/10.1002/2327-6924.12510
11. Zucker I, Zloof Y, Bardugo A, Tsur AM, Lutski M, Cohen Y, et al. Obesity in late adolescence and incident type 1 diabetes in young adulthood. Diabetologia. 2022 Jun 5:1-0. **DOI:** https://doi.org/10.1007/s00125-022-05712-8
12. Mathur P, Leburu S, Kulothungan V. Prevalence, awareness, treatment and control of diabetes in India from the countrywide National NCD Monitoring Survey (NNMS). Front Public Health. 2022 Mar 14:205. **DOI:** https://doi.org/10.3389/fpubh.2022.853647
13. Abdullah A, Peeters A, de Courten M, Stoelwinder J. The magnitude of association between overweight and obesity and the risk of diabetes: a meta-analysis of prospective cohort studies. Diabetes Res Clin Pract. 2010 Sep 1;89(3):309-19. **DOI:** https://doi.org/10.1016/j.diabres.2010.04.012
14. Holt RIG. Textbook of diabetes. Chichester, West Sussex, UK: Wiley-Blackwell; 2017.
15. La Sala L, Pontiroli AE. Prevention of diabetes and cardiovascular disease in obesity. Int J Mol Sci. 2020 Oct 31;21(21):8178. **DOI:** https://doi.org/10.3390/ijms21218178
16. Wilding J. The importance of weight management in type 2 diabetes mellitus. Int J Clin Pract. 2014 Jun;68(6):682-91. **DOI:** https://doi.org/10.1111/ijcp.12384
17. Papatheodorou K, Banach M, Bekiari E, Rizzo M, Edmonds M. Complications of diabetes 2017. J Diabetes Res. 2018 Mar 11;2018. **DOI:** https://doi.org/10.1155/2018/3086167
18. Tuomilehto J, Lindström J, Eriksson JG, Valle TT, Hämäläinen H, Ilanne-Parikka P, et al. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. N Engl J Med. 2001 May 3;344(18):1343-50. **DOI:** https://doi.org/10.1056/NEJM200105033441801
19. Lindström J, Ilanne-Parikka P, Peltonen M, Aunola S, Eriksson JG, Hemiö K, et al. Sustained reduction in the incidence of type 2 diabetes by lifestyle intervention: follow-up of the Finnish Diabetes Prevention Study. Lancet. 2006 Nov 11;368(9548):1673-9. **DOI:** https://doi.org/10.1016/S0140-6736(06)69701-8
20. Pan XR, Li GW, Hu YH, Wang JX, Yang WY, An ZX, et al. Effects of diet and exercise in preventing NIDDM in people with impaired glucose tolerance: the Da Qing IGT and Diabetes Study. Diabetes Care. 1997 Apr 1;20(4):537-44. **DOI:** https://doi.org/10.2337/diacare.20.4.537