

## Original Article

## Burden and Associated Factors of Overweight and Obesity among Type-2 Diabetes Mellitus Visiting a Private Healthcare Facility in South Punjab, Pakistan

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### Abstract

**Objective:** To determine the burden of overweight and obesity among type-2 diabetes mellitus (T2DM) patients visiting outpatient department of a private healthcare facility of South Punjab, Pakistan.

**Methods:** This cross-sectional study was performed at the outpatient department of medicine, Aleena Hospital, Bahawalpur, Pakistan from 1st January 2021 to 30th November 2022. We included 3030 known cases of T2DM with disease duration of  $\geq 6$  months. At the time of enrollment, medical history was taken and clinical examination performed. Demographic characteristics and body mass index (BMI) were noted while blood sample was sent to institutional laboratory for HbA1c evaluation.

**Results:** In a total of 3030 patients with T2DM, 1528 (50.4%) were females whereas the mean age was  $50.09 \pm 11.98$  years. The mean duration of diabetes was  $5.94 \pm 5.89$  years while the mean HbA1c was  $9.63 \pm 2.29\%$ . The mean BMI was noted to be  $26.42 \pm 5.65$  kg/m<sup>2</sup> while 149 (57.7%) patients were obese, 462 (15.2%) overweight and 819 (27.0%) had normal BMI. It was observed that age ( $p < 0.001$ ) and hypertension ( $p < 0.001$ ) were having significant association with BMI categories. Multiple logistic regression model showed that obesity was having a significant relationship with age between 31-45 years ( $p = 0.029$ ) with adjusted OR of 1.5 (95% CI: 1.05-2.27) and hypertension ( $p < 0.001$ ) with adjusted OR of 1.8 (95% CI: 1.49-2.14).

**Conclusion:** The burden of overweight and obesity was very high among T2DM. Age between 31-45 years and hypertension were having significant relationship with obesity.

**Keywords:** Body mass index, diabetes mellitus, hypertension, obesity, overweight.

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### Introduction

In South Asian population, the definition of overweight is the body mass index (BMI)  $\geq 23$  kg/m<sup>2</sup> and obesity as BMI  $\geq 25$  kg/m<sup>2</sup>.<sup>1</sup> During the period of 1980-2015, the occurrence of obesity became two fold in 73 countries of the world, and almost 604 million adults had obesity in 2015.<sup>2</sup> In a total of 2 billion people living with overweight and obesity all over the world, it is the cause of morbidity of mortality among 2.8 million people of these people annually.<sup>3</sup> Moreover, overweight and obesity is considered to be the 5th most important contributor to mortality globally.<sup>3</sup> It is roughly estimated

that owing to overweight and obesity, the occurrence of diabetes mellitus is 44%, IHD is 23% and certain cancer 41%.<sup>3</sup>

Among various populations, it has been consistently observed and established through extensive data that obesity has is strongly linked with "type 2 diabetes mellitus (T2DM)".<sup>4,5</sup> The mortality risk among the patients of T2DM having obesity increases due to cardiovascular disease.<sup>5,6</sup> According to five longitudinal cohort studies, mortality risk in diabetic patients presenting obesity was double than in the patients having ideal BMI range.<sup>6,7</sup> Glycemic targets become difficult to achieve as the chances of sub-optimal glycemic control are

increased with overweight and obesity.<sup>8</sup> Consequently, “American Diabetes Association” developed guidelines and recommended them for overweight or obese diabetic patients.<sup>9</sup>

In Pakistan, the data available on the occurrence of overweight and obesity in T2DM is insufficient and unreliable. Recent local data showed that the burden overweight and obesity was 62.0% in T2DM patients.<sup>10</sup> Global data reveals variation in the prevalence of overweight and obesity among T2DM patients with respect to age and location as 27–85%.<sup>11,12</sup> We planned this study with an objective to determine the burden of overweight and obesity among T2DM patients visiting outpatient department of a private healthcare facility of South Punjab, Pakistan.

**Methods**

This cross-sectional study was performed at the outpatient department of medicine, Aleena Hospital, Bahawalpur, Pakistan from 1<sup>st</sup> January 2021 to 30<sup>th</sup> November 2022. Taking anticipated proportion of overweight and obesity among T2DM patients as 62.5%<sup>10</sup> with 95% confidence level and 2% margin of error, the sample size of 2251 was calculated.

We included a total of 3030 patients of both genders aged above 18 years and known cases of T2DM with disease duration of ≥6 months. Exclusion criteria were patients unwilling to be part of this research. Approval from “Hospital Research Committee” was acquired (Ref#HRC/3/2022). Informed and written consents were obtained. At the time of enrollment, medical history was taken and clinical examination performed. Demographic characteristics were noted while blood sample was sent to institutional laboratory for HbA1c evaluation. Body mass indexed was classified as “normal (BMI <23 kg/m<sup>2</sup>), overweight (BMI ≥23 kg/m<sup>2</sup>) and obesity (BMI

≥ 25 kg/m<sup>2</sup>).<sup>1</sup> Hypertension was labeled if “systolic blood pressure ≥ 140 mmHg” and/or “diastolic blood pressure ≥ 90 mmHg” or patients on anti-hypertensive drugs or a known case of hypertension as verified by the medical record.

Data analysis was performed employing “Statistical Package for Social Sciences (SPSS)” version 26.0. Frequency and percentages were shown for categorical data whereas mean and standard deviation (SD) were calculated for numeric data. With respect to distribution of BMI, qualitative data was compared using chi-square or fisher’s exact test while quantitative variables were compared adopting analysis of variance taking p<0.05 as statistically significant. Variables showing significant association with BMI distribution as p<0.02 were further analyzed through multiple logistic regression.

**Results**

In a total of 3030 patients with T2DM, 1528 (50.4%) were females. The mean age was 50.09±11.98 years (ranging between 18-100 years) while 1605 (53.0%) patients were aged between 46—65 years (table-1).

**Table 1:** Demographic and Clinical Characteristics (n=3030)

Characteristics		Number (%)
<b>Gender</b>	Male	1502 (49.6%)
	Female	1528 (50.4%)
<b>Age (years)</b>	18-30	155 (5.1%)
	31-45	1008 (33.3%)
	46-65	1605 (53.0%)
	>65	262 (8.6%)
<b>Smoking</b>		215 (7.1%)
<b>Hypertension</b>		1165 (38.4%)

**Table 2:** Demographic and Clinical Characteristics of T2DM Patients with respect to Overweight and Obesity (n=3030)

Characteristics	BMI Distribution			P-Value	
	Normal (n=819)	Overweight (n=462)	Obese (n=1749)		
<b>Gender</b>	Male	412 (50.3%)	237 (51.3%)	853 (48.8%)	0.555
	Female	407 (49.7%)	225 (48.7%)	896 (51.2%)	
<b>Age (years)</b>	18-30	48 (58.6%)	21 (4.5%)	86 (4.9%)	<0.001
	31-45	217 (26.5%)	143 (31.0%)	648 (37.0%)	
	46-65	440 (53.7%)	265 (57.4%)	900 (51.5%)	
	>65	114 (13.9%)	33 (7.1%)	115 (6.6%)	
<b>Duration of Diabetes (years)</b>	6.03±6.31	6.39±5.92	5.77±5.67	0.177	
<b>Smoking</b>	57 (7.0%)	36 (7.8%)	122 (7.0%)	0.818	
<b>Hypertension</b>	253 (30.9%)	175 (37.9%)	737 (42.1%)	<0.001	
<b>HbA1c (%)</b>	9.76±2.55	9.80±2.51	9.52±2.11	0.192	

The mean duration of diabetes was  $5.94 \pm 5.89$  years while the mean HbA1c was  $9.63 \pm 2.29\%$ .

The mean BMI was noted to be  $26.42 \pm 5.65$  kg/m<sup>2</sup> while there were 149 (57.7%) patients who were obese (BMI >25 kg/m<sup>2</sup>), 462 (15.2%) overweight (BMI 23.0-24.9 kg/m<sup>2</sup>) while remaining 819 (27.0%) patients had BMI below 23.0 kg/m<sup>2</sup>. It was observed that age ( $p < 0.001$ ) and hypertension ( $p < 0.001$ ) were having significant association with BMI categories. Distribution of overweight and obese patients with respect to study variables is shown in table-2.

Multiple logistic regression model showed that hypertension was having a significantly positive relationship

(coefficient beta = 0.35,  $p = 0.005$ ) with overweight having adjusted OR of 1.4 (95% CI: 1.11-1.81). No significant relationship of overweight was found with age categories ( $p > 0.05$ ). Obesity was having a significant relationship with age between 31-45 years (coefficient beta = 0.43,  $p = 0.029$ ) with adjusted OR of 1.5 (95% CI: 1.05-2.27) while age above 65 years had a significantly negative relationship with obesity (coefficient beta = -0.77,  $p = 0.001$ ), with adjusted OR of 0.5 (95% CI: 0.30-0.72). Hypertension was having a significant relationship with obesity (beta coefficient = 0.52,  $p < 0.001$ ) with adjusted OR of 1.8 (95% CI: 1.49-2.14).

**Table 3:** Multiple Logistic Regression Showing Relationship between BMI categories, Age and Hypertension

BMI Categories	Variables	Coefficient (B)	Adjusted OR	95% Confidence Interval	P-Value	
<b>Overweight</b> (23-24.9 kg/m <sup>2</sup> )	Age (years)	18-30		Reference		
		31-45	0.37	1.4	0.83-2.51	0.198
		46-65	0.23	1.3	0.73-2.16	0.405
		>65	-0.53	0.9	0.31-1.13	0.112
	Hypertension	No			Reference	
Yes		0.35	1.4	1.11-1.81	0.005	
<b>Obesity</b> (≥25 kg/m <sup>2</sup> )	Age (years)	18-30		Reference		
		31-45	0.43	1.5	1.05-2.27	0.029
		46-65	-0.03	0.9	0.67-1.42	0.897
		>65	-0.77	0.5	0.30-0.72	0.001
	Hypertension	No			Reference	
Yes		0.58	1.8	1.49-2.14	<0.001	

OR: Odds ratio

## Discussion

We observed that 73% T2DM patients were either overweight (15.2%) or obese (57.7%). A study conducted by Tino S et al from Uganda calculated the proportion of overweight and obesity as 65% which is nearly what we observed in the current set of patients<sup>13</sup> while another recent study estimated it as 85.8% in T2DM cases which is more than what we observed<sup>14</sup>. Our findings are pretty consistent with what has been reported earlier from the same study center.<sup>15</sup> Data from UK revealed the proportion of overweight and obesity ranging between 86%–90% while statistics from Australia revealed it to be 86%.<sup>16,17</sup> Variation in the occurrence rates have been found in the African countries.<sup>18,19</sup> In the developing parts of the world, the existence of overweight and obesity in T2DM and related complications like cardiovascular diseases are expected to rise sharply because the people are being urbanized and globalized and likely to adopt associated behaviors (eating practices

and physically inactiveness).<sup>19</sup> The Community base data from the developing world has shown the proportion of overweight and obesity as 24.8% which showed which gets us to a point where we perceived that the burden of obesity soars significantly in T2DM patients.<sup>20</sup>

Several studies have also described the linkage of overweight and obesity with diabetic complications, specifically the KORA study and “The National Health and Nutrition Examination Survey III” which showed clear correlation of overweight and obesity with diabetic peripheral neuropathy in diabetic population.<sup>21,22</sup> Identically, numerous studies have established the association of hypertension with overweight or obesity among diabetic patients indicating that components of the metabolic syndrome might have gathered.<sup>23-25</sup> The present research showed that hypertension was having a significant relationship with obesity with OR of 1.8 (95% CI: 1.49-2.14).

We noted the mean age of T2DM patients to be  $50.09 \pm 11.98$  years. A study analyzing 4007 T2DM patients from China noted the mean age of the patients to be  $48.78 \pm 14.95$  which correlates well with the present data.<sup>26</sup> This study also found that obesity had a significant relationship with age between 31-45 years ( $p=0.029$ ). A study by Nianogo RA and Arah OA from USA estimated the 16-year risks of obesity as 81% (95% CI: 80.8-81.3%) for adults.<sup>27</sup> A study depicted that among patients of T2DM, 78.2% overweight or obese patients were aged between 41-60 showing that middle age is the most vulnerable for higher BMI.<sup>28</sup> Our findings are in accordance with the literature that age affects the burden of overweight and obesity among individuals having T2DM.<sup>29,30</sup>

The present research is the first one documenting real world data about the burden of overweight and obesity in South Punjab inhabitants accompanying T2DM visiting a private healthcare facility which could be a good reflection of our region. Overweight and obesity can directly increase morbidity and mortality not only in T2DM but in whole community, so it is necessary to assess its true prevalence in the patients. Data regarding routine care of the patients enabled us to have such a large sample size. The present study highlighted that there is a need for the implementation of strategies and interventions for weight loss among patients having T2DM.

Being a single center study was a limitation of this study while large sample size exceeding minimum required sample size was one of the strengths of this study. Some important information like socio-economic status and educational status of the patients were missed which would have further given us important insights.

## Conclusion

The burden of overweight and obesity was very high among T2DM patients. Age between 31-45 years and hypertension were found to have significant relationship with obesity.

**Conflict of Interest:** *None*

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## References

- Misra A. Ethnic-specific criteria for classification of body mass index: A perspective for Asian Indians and American Diabetes Association Position Statement. *Diabetes Technol Ther.* 2015;17(9):667-671.
- Afshin A, Forouzanfar MH, Reitsma MB, Sur P, Estep K, GBD 2015 Obesity Collaborators, et al. Health Effects of Overweight and Obesity in 195 Countries over 25 Years. *N Engl J Med.* 2017;377(1):13-27.
- Awosan, KJ, Ibrahim, MTO, Essien, E, Yusuf Aa, Okolo ACI. Dietary pattern, lifestyle, nutrition status and prevalence of hypertension among traders in Sokoto central market, Sokoto, Nigeria. *Int J Nutr Metab.* 2014; 6:9 – 17.
- Wang S, Ma W, Yuan Z, Wang S, Yi X, Jia H, et al. Association between obesity indices and type 2 diabetes mellitus among middle-aged and elderly people in Jinan, China: a cross-sectional study. *BMJ Open.* 2016; 6(11): e012742.
- Han SJ, Boyko EJ. The Evidence for an Obesity Paradox in Type 2 Diabetes Mellitus. *Diabetes Metab J.* 2018;42(3):179-87.
- Gao F, Wang ZJ, Shen H, Yang SW, Nie B, Zhou YJ. Impact of obesity on mortality in patients with diabetes: Meta-analysis of 20 studies including 250,016 patients. *J Diabetes Investig.* 2018;9(1):44-54.
- La Sala L, Pontiroli AE. Prevention of diabetes and cardiovascular disease in obesity. *Int J Mol Sci.* 2020; 21(21):8178.
- Bae JP, Lage MJ, Mo D, Nelson DR, Hoogwerf BJ. Obesity and glycemic control in patients with diabetes mellitus: Analysis of physician electronic health records in the US from 2009-2011. *J Diabetes Complications.* 2016;30(2):212-20.
- American Diabetes Association. Obesity management for the treatment of Type 2 Diabetes: Standards of Medical Care in Diabetes-2019. *Diabetes Care.* 2019; 42(Suppl 1):S81-S89.
- 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; doi:10.1136/bmjopen-2018-025300.
- Gezawa ID, Uloko AE, Gwaram BA, Ibrahim DA, Ugwu ET, Mohammed IY. Pattern of obesity among patients with type 2 diabetes at a tertiary healthcare center in northern Nigeria. *Diabetes Metab Syndr Obes.* 2019; doi:10.2147/DMSO.S226054
- Fadupin GT, Joseph EU, Keshinro OO. Prevalence of obesity among type 2 diabetics in Nigeria a case study of patients in Ibadan, Oyo State, Nigeria. *Afr J Med Med Sci.* 2004;33(4):381-384.
- Tino S, Mayanja BN, Mubiru MC, Eling E, Ddumba E, Kaleebu P, et al. Prevalence and factors associated with overweight and obesity among patients with type 2 diabetes mellitus in Uganda—a descriptive retrospective study. *BMJ Open* 2020;doi:10.1136/bmjopen-2020-039258
- AlShahrani MS. Prevalence of obesity and overweight among type 2 diabetic patients in Bisha, Saudi Arabia. *J Family Med Prim Care.* 2021; doi: 10.4103/jfmpc.jfmpc\_

- 1349\_20.
15. Ali QM, Anjum S, Imran A, Shafique S, Masroor M. Obesity and hypertension among Type-2 diabetes mellitus patients: Analysis of gender and age matched rural population of South Punjab, Pakistan. *J Pak Soc Intern Med.* 2023;4(1):15-9.
  16. Whitmore C. Type 2 diabetes and obesity in adults. *Br J Nurs.* 2010;19(14):880-6.
  17. Thomas MC, Zimmet P, Shaw JE. Identification of obesity in patients with type 2 diabetes from Australian primary care: the NEFRON-5 study. *Diabetes Care.* 2006;29(12):2723-5.
  18. Ali YA, Almobarak AO, Awadalla H, Elmadhoun WM, Ahmed MH. Obesity among Sudanese adults with diabetes: a population-based survey. *Ann Transl Med* 2017;5(12):1-8.
  19. Hillier TA, Pedula KL. Characteristics of an adult population with newly diagnosed type 2 diabetes: the relation of obesity and age of onset. *Diabetes Care.* 2001;24(9):1522-7.
  20. Kirunda BE, Fadnes LT, Wamani H, Van den Broeck J, Tylleskär T. Population-based survey of overweight and obesity and the associated factors in peri-urban and rural Eastern Uganda. *BMC Public Health.* 2015; 15:1168. doi:10.1186/s12889-015-2506-7
  21. Oh TJ, Lee JE, Choi SH, Jang HC. Association between body fat and diabetic peripheral neuropathy in middle-aged adults with type 2 diabetes mellitus: A preliminary report. *J Obes Metab Syndr.* 2019;28(2):112-7.
  22. Ylitalo KR, Sowers M, Heeringa S. Peripheral vascular disease and peripheral neuropathy in individuals with cardiometabolic clustering and obesity: National Health and Nutrition Examination Survey 2001-2004. *Diabetes Care.* 2011;34(7):1642-7.
  23. Leggio M, Lombardi M, Caldarone E, Severi P, D'Emidio S, Armeni M, et al. The relationship between obesity and hypertension: an updated comprehensive overview on vicious twins. *Hypertens Res.* 2017;40(12):947-63.
  24. Hall JE. The kidney, hypertension, and obesity. *Hypertension.* 2003;41(3 Pt 2):625-33.
  25. Landsberg L, Aronne LJ, Beilin LJ, Burke B, Igel LI, Lloyd-Jones D, et al. Obesity-related hypertension: pathogenesis, cardiovascular risk, and treatment: a position paper of The Obesity Society and the American Society of Hypertension. *J Clin Hypertens (Greenwich).* 2013;15(1):14-33.
  26. Ge Q, Li M, Xu Z, Qi Z, Zheng H, Cao Y, et al. Comparison of different obesity indices associated with type 2 diabetes mellitus among different sex and age groups in Nantong, China: a cross-section study. *BMC Geriatr.* 2022;22(1):20.
  27. Nianogo RA, Arah OA. Forecasting Obesity and Type 2 Diabetes Incidence and Burden: The ViLA-Obesity Simulation Model. *Front Public Health.* 2022; doi: 10.3389/fpubh.2022.818816.
  28. AlShahrani MS. Prevalence of obesity and overweight among type 2 diabetic patients in Bisha, Saudi Arabia. *J Family Med Prim Care.* 2021;10(1):143-8.
  29. Alhazmi RS, Ahmed AAB, Alshalan MH, et al. Prevalence of diabetes mellitus and its relation with obesity in Turaif (Saudi Arabia) in 2017. *Electron Physician.* 2017;9(10):5531-5.
  30. Chen Y, Zhang XP, Yuan J, Cai B, Wang X, Wu X, et al. Association of body mass index and age with incident diabetes in Chinese adults: a population-based cohort study. *BMJ Open.* 2018;8(9):e021768.