Libyan Journal of Medical and Applied Sciences LJMAS
Online ISSN: 3006-1113
Volume 3, Issue 3, 2025, Page No: 48-58
Website: https://ljmas.com/index.php/journal/index

Prevalence of obesity among type II diabetes patients attending Outpatient clinic at Alwahda Teaching Hospital: A Cross-Sectional Study.

Areej Mukhtar Masoud *[1], Ahmed Ali Ramadhan [2], Abdelwanees Abdelsaid Aljali [2]
[1] Department of Family and Community Medicine, Faculty of Medicine, Derna University, Derna, Libya
[2] Faculty of Medicine, Derna University, Derna, Libya
* Corresponding Email: arej.salem@uod.edu.ly

Received: June 09, 2025 Accepted: July 11, 2025 Published: July 19, 2025

Cite this article as: A, M, Masoud., A, A, Ramadhan., A, A, Aljali. (2025). Prevalence of obesity among type II diabetes patients attending Outpatient clinic at Alwahda Teaching Hospital: A Cross-Sectional Study. Libyan Journal of Medical and Applied Sciences (LJMAS). 2025;3(3):48-58.

Abstract:

Background: Type 2 diabetes mellitus (T2DM) and obesity are closely interlinked global health challenges, both contributing significantly to morbidity and mortality. In Libya and other countries in the Middle East and North Africa region, both conditions are rising in prevalence. However, there is limited local data on the co-prevalence of obesity among diabetic patients. This study aims to assess the prevalence of obesity among T2DM patients attending the outpatient clinic at Alwahda Teaching Hospital and to explore associated demographic and clinical characteristics.

Methods: A cross-sectional study was conducted among type 2 diabetic patients attending the outpatient clinic at Alwahda Teaching Hospital. Data were collected using a structured interview format and patient medical records. Anthropometric measurements, including weight and height, were obtained to calculate body mass index (BMI), which was categorized according to WHO classifications. Demographic and clinical data such as age, gender, duration of diabetes, and treatment type were also recorded.

Results: the study included 358 type 2 diabetic patients. Their median age was 54.0 years. 64.5% of them were female. The majority pf the participants were married and received secondary education or higher. The prevalence of obesity was 55.6%. The binary logistic regression model indicates a significant association with female sex, presence of other comorbid conditions, family history of obesity and /or diabetes and no / irregular exercise.

Conclusion: the study reveals a substantial burden of obesity among T2DM patients, particularly among women, those with chronic comorbidities, family history, and sedentary lifestyles. Addressing this multifaceted challenge demands personalized, gender-sensitive, and multidisciplinary approaches integrating lifestyle modification, medical care, and surgical options to improve health outcomes.

Keywords: Obesity, Type 2 Diabetes Mellitus, prevalence, Body Mass Index, Libya.

انتشار السمنة بين مرضى السكري من النوع الثاني المترددين على العيادات الخارجية في مستشفى الوحدة التعليمي: دراسة مقطعية.

اريج مختار مسعود *[1]، أحمد علي رمضان [2]، ، عبدالونيس عبدالسيد الجالي [2]
[1] قسم طب الأسرة والمجتمع، كلية الطب، جامعة درنة، درنة، ليبيا
[2]كلية الطب، جامعة درنة، درنة، ليبيا

الملخص

الخلفية: يُعدّ داء السكري من النوع الثاني (T2DM) والسمنة من التحديات الصحية العالمية المترابطة بشكل وثيق، حيث يُسهم كلاهما بشكل كبير في معدلات الاعتلال والوفيات. في ليبيا ودول أخرى في منطقة الشرق الأوسط وشمال أفريقيا، يتزايد انتشار كلتا الحالتين. ومع ذلك، لا توجد بيانات محلية كافية حول الانتشار المشترك للسمنة بين مرضى السكري. تهدف هذه الدراسة إلى تقييم انتشار السمنة بين مرضى داء السكري من النوع الثاني الذين يراجعون العيادة الخارجية في مستشفى الوحدة التعليمي، واستكشاف الخصائص الديموغرافية والسريرية المرتبطة بها.

المنهجية: أُجريت دراسة مقطعية بين مرضى السكري من النوع الثاني الذين يراجعون العيادة الخارجية في مستشفى الوحدة التعليمي. جُمعت البيانات باستخدام نموذج مقابلة مُنظّم وسجلات المرضى الطبية. تم الحصول على قياسات أنثروبومترية، بما في ذلك الوزن والطول، لحساب مؤشر كتلة

الجسم(BMI) ، والذي صُنّف وفقًا لتصنيفات منظمة الصحة العالمية. كما سُجّلت بيانات ديموغرافية وسريرية مثل العمر والجنس ومدة الإصابة بالسكري ونوع العلاج.
النتائج: شملت الدراسة 358 مريضًا مصابًا بالسكري من النوع الثاني. كان متوسط أعمارهم 54 عامًا، و64.5% منهم إناث. وكانت غالبية المشاركين متزوجين وحاصلين على تعليم ثانوي أو أعلى. وبلغ معدل انتشار السمنة 55.6%. ويشير نموذج الانحدار اللوجستي الثنائي إلى وجود ارتباط كبير بين الجنس الأنثوي، ووجود أمراض مصاحبة أخرى، والتاريخ العائلي للسمنة و/أو داء السكري، وعدم ممارسة التمارين الرياضية أو عدم انتظامها.
الخلاصة: تكشف الدراسة عن عبء كبير من السمنة بين مرضى السكري من النوع الثاني، وخاصة بين النساء، وأولئك اللاتي يعانين من أمراض مصاحبة مزمنة، وتاريخ عائلي، وأنماط حياة خاملة. ويتطلب التصدي لهذا التحدي متعدد الأوجه اتباع مناهج شخصية ومراعية للفروق بين الجنسين ومتعددة التخصصات، تدمج تعديل نمط الحياة والرعاية الطبية والخيارات الجراحية لتحسين النتائج الصحية.

الكلمات المفتاحية: السمنة، السكري من النوع الثاني، انتشار، مؤشر كتلة الجسم، ليبيا.

Introduction

Type II diabetes mellitus (T2DM) is a chronic metabolic disorder characterized by insulin resistance and relative insulin deficiency. Over the past few decades, it has emerged as a global public health concern due to its rising prevalence, significant morbidity, and associated economic burden. According to the International Diabetes Federation (IDF), approximately 537 million adults were living with diabetes worldwide in 2021, and this number is projected to reach 643 million by 2030 if current trends continue (1). A major factor contributing to the escalating incidence of T2DM is the global rise in overweight and obesity.

Obesity, defined as abnormal or excessive fat accumulation that may impair health, is one of the most important modifiable risk factors for type II diabetes. The World Health Organization (WHO) estimates that more than 1.9 billion adults were overweight in 2016, of whom over 650 million were obese (2). Obesity is intricately linked to insulin resistance, and individuals with central or abdominal obesity are particularly at increased risk of developing T2DM (3). The relationship between obesity and diabetes is bidirectional: while obesity increases the risk of T2DM, the presence of diabetes may also promote weight gain through various mechanisms, including decreased physical activity, dietary habits, and use of certain medications such as insulin or sulfonylureas (4).

Numerous epidemiological studies have demonstrated a strong association between body mass index (BMI) and the risk of developing T2DM. The Nurses' Health Study, one of the largest prospective cohorts, found that the risk of diabetes increased 93-fold among women with a BMI >35 kg/m² compared to those with BMI <22 kg/m² (5). Similarly, the Health Professionals Follow-up Study indicated that more than 90% of T2DM cases could be attributed to excess weight (6). Beyond BMI, measures of central obesity such as waist circumference and waist-to-hip ratio have also shown a strong predictive value for diabetes risk (7).

The prevalence of obesity among patients with T2DM varies widely across countries and regions, depending on cultural, socioeconomic, and dietary factors. In the Middle East and North Africa (MENA) region, both obesity and diabetes are increasing at alarming rates. The region is characterized by sedentary lifestyles, high-calorie diets, and rapid urbanization—all contributing to the double burden of obesity and diabetes (8). In Libya, non-communicable diseases including obesity and diabetes are leading causes of morbidity and mortality. However, local data on the co-prevalence of these two conditions remain scarce. A study conducted in Benghazi reported a prevalence of obesity of 44.8% among patients with T2DM, emphasizing the urgent need for targeted interventions (9).

Understanding the prevalence of obesity among patients with type II diabetes is crucial for several reasons. Firstly, obesity exacerbates the clinical course of diabetes by increasing the risk of cardiovascular disease, hypertension, dyslipidemia, and certain cancers (10). Secondly, it impairs glycemic control, making diabetes management more challenging and increasing the likelihood of complications. Thirdly, obesity negatively impacts quality of life and increases healthcare utilization and costs (11). Recognizing obesity as a comorbidity in diabetic patients allows for more comprehensive management strategies, including lifestyle modification, nutritional counseling, pharmacological interventions, and in some cases, bariatric surgery (12).

Furthermore, obesity in diabetic patients often remains under-recognized or under-addressed in clinical practice. Despite clear guidelines recommending regular screening and management of weight in T2DM patients, there is evidence that weight loss interventions are underutilized (13). Primary care and outpatient settings play a vital role in early identification and management of obesity in diabetic patients, especially in resource-limited countries where tertiary care may be less accessible.

Given the growing burden of diabetes and obesity in Libya and the wider MENA region, local studies are essential to inform health policy, clinical guidelines, and public health programs. Alwahda Teaching Hospital, being a major referral center in eastern Libya, serves a diverse population and provides an ideal setting to assess the burden of obesity among diabetic patients attending outpatient services. Understanding the magnitude and characteristics of this dual epidemic can guide more effective screening, counseling, and resource allocation.

This study aims to determine the prevalence of obesity among type II diabetes patients attending the outpatient clinic at Alwahda Teaching Hospital and to examine associations between obesity and demographic or clinical variables. By providing updated local data, this research seeks to support evidence-based interventions aimed at improving the health outcomes of diabetic patients and reducing the long-term burden of obesity-related complications.

Study Objectives:

General objective

To determine the prevalence of obesity among patients with Type 2 Diabetes Mellitus attending outpatient clinics.

Specific objectives

- To assess the Body Mass Index (BMI) distribution among T2DM patients.
- To assess the association between obesity and demographic/clinical characteristics such as age, gender, duration of diabetes, and glycemic control.
- To explore the relationship between obesity and other comorbidities like hypertension and dyslipidemia.
- To identify lifestyle factors (e.g., physical activity, diet) associated with obesity in T2DM.

Methods

Study design and setting

An observational cross sectional study design was selected to achieve the objectives of the study.

Participants

Adult patients aged 20 years and above diagnosed with Type 2 Diabetes Mellitus attending Diabetic Outpatient department in Alwahda Teaching Hospital in Derna.

Inclusion criteria:

- Adults aged 20 and above.
- Confirmed diagnosis of Type 2 Diabetes.
- Willing to participate and provide informed consent.

Exclusion criteria:

- Patients with Type 1 Diabetes Mellitus.
- Pregnant women

Sample size:

The minimum sample size required was 358 participants, calculated using a two-sided, Binomial hypothesis test at 0.05 significance level by Epi Info 7 (14) Considering 80% power and the expected prevalence of obesity among type 2 diabetic patients (63.0%) (15).

Data collection tool

- **A structured interview format** administered through face-to-face interviews. It included three sections as follows:

First section: the participants' general characteristics including: gender, age, nationality, marital status, education, occupation, monthly income, number of family members and duration of diabetes.

Second section: the participants' medical history including medication use, presence of Comorbid conditions (hypertension, dyslipidemia, etc.) and family history of diabetes and obesity.

Third section: dietary habits as number of meals and their nature, lifestyle habits as exercise and regular follow up for diabetes and obesity.

- **A Transfer sheet for clinical data** including weight, height, body mass index (BMI), fasting blood glucose and Hb A1c

Categorization of BMI (16)

- Underweight (less than 18.5)
- Healthy Weight (18.5 to 24.9)
- Overweight (25 to 29.9)
- Obese (30 or greater). Obesity is further divided into Class 1 (30 to 34.9), Class 2 (35 to 39.9), and Class 3 or Severe Obesity (40 or greater).

Statistical analysis:

Statistical analysis was carried out using SPSS (Statistical Package for the Social Sciences) (version 25.0, IBM, New York, USA). General characteristics were presented using descriptive statistics, including numbers and percentages. Group comparisons were assessed using Pearson Chi Square test. Continuous variables were evaluated using Mann Whitney test, wherein findings were displayed using median and Inter-Quartile Range (IQR). Binary logistic regression analysis was conducted to identify independent associations with obesity in comparison to the group of the non-obese. The findings were reported as odds ratios (OR) with corresponding 95% confidence intervals (CI). All p-values reported in the study were calculated using a two-tailed test, and statistical significance was determined as $p<0.05$.

Ethical approval:

The current study obtained official approvals from the Research ethics committee of Derna Faculty of Medicine. The study was performed in accordance with Helsinki declaration.

Participants' consent:
The researchers explained the purpose of the study to the participants. They obtained an oral informed consent to participate emphasizing the respondent's anonymity and confidentiality.

Results
The total participants were 358 type II diabetic patients with a median age of 54.0 years (IQR 47.0-62.0). Around two thirds of them were females (64.5%). Furthermore, the great majority of them were Libyan (93.3%) and most of them were married (83.2%). Regarding their education, 36.0% of them had secondary education and 34.8% of them had a university degree. Slightly less than two thirds of them were employees (63.4%) and 18.4% of them were retired. Slightly more than half the participants (56.8%) had a monthly income of 1000-2000 LYD. 57% of them had families up to five members. (Table 1)

Table1. Distribution of the general characteristics of the participating patients (n=358)

General characteristics (n=358)	**no.**	**%**
Age (years) Mean± SD Median IQR Min-max	 53.91±10.53 **54.00** **47.00-62.00** **19.00-76.00**	
Sex		
Male	127	35.5
female	231	64.5
Nationality		
Libyan	334	93.3
Non-Libyan	24	6.7
Marital status		
Married	298	83.2
Single	24	6.7
Divorced	11	3.1
Widow	25	7.0
Education		
Uneducated	28	7.8
Basic education	48	13.4
Secondary education	129	36.0
Higher education	153	34.8
Occupation		
Employee	227	63.4
A freelance	35	9.8
Unemployed	30	8.4
Retired	66	18.4
Monthly income		
0LYD	27	7.5
Less than 1000 LYD	86	24.0
1000-2000 LYD	203	56.8
>2000 LYD	42	11.7
Number of family members		
Up to 5	204	57.0
6-10	154	43.0

SD: Standard Deviation IQR: Inter-Quartile Range

Table 2 illustrates that the median duration of diabetes was 7.5 years (IQR 3.00-15.00). The majority of them were taking diabetes medications (97.2%), mostly oral hypoglycemic drugs (59.5%). Around three quarters of the patients had chronic diseases, mostly cardiovascular diseases (56.3%). Around two thirds of them (62.6%) had family history of diabetes and/or obesity in a first degree relative in their families.

Table 2. Distribution of the studied participants regarding their medical history (n=358)

Medical history (n=358)	no.	%
Disease duration (years)		
Mean± SD	9.28± 7.65	
Median	7.50	
IQR	3.00-15.00	
Min-max	1.00-39.00	
Taking diabetes medications		
No	10	2.8
Yes	348	97.2
Types of medications taken (n=348)		
Oral hypoglycemic drugs	207	59.5
Insulin injections	61	17.6
both	80	22.9
Presence of chronic diseases		
No	86	24.0
Cardiovascular disorders (hypertension, CHD)	202	56.3
Thyroid disorders	19	5.3
Cardiovascular and thyroid disorders	31	8.7
Ophthalmic disorders (cataract, retinopathy)	13	3.6
Cardiovascular and ophthalmic disorders	4	1.1
Fatty liver	3	0.8
Family history of obesity and/or diabetes in first degree relatives		
Yes	224	62.6
No	134	37.4

SD: Standard Deviation IQR: Inter-Quartile Range

Table 3 shows that slightly more than half the patients were obese (55.6%) classified as (35.8% obese grade I, 10.9% obese grade II, 8.9% obese grade III). Three quarters of them (75.7%) considered the specialized physicians as their main source of information on weight control and 41.3% of them consulted a nutritionist for weight management. Only 3.4% of them had undergone a bariatric surgery for weight control.

Many of them (79.3%) had health problems because of their weight, mainly joint pain and musculoskeletal disorders (50.0%). 41.3% of them reported that their weight affects their mental health and 53.4% wanted to lose weight and needed help.

Table 3. Distribution of the studied participants regarding their BMI and weight management (n=358)

	no.	%
Body Mass Index (kg/ m^2)		
Non-obese (<30)	159	44.4
Obese (30 or more)	199	55.6
Body Mass Index (kg/ m^2)		
<18.5 (underweight)	0	0.0
18.5-24.9 (normal)	33	9.2
25-29.9 (overweight)	126	35.2
30-34.9 (obesity grade I)	128	35.8
35-39.9 (obesity grade II)	39	10.9
40 or more (obesity grade III)	32	8.9
Your source of information on weight control		
A specialized physician	271	75.7
Social media/ the internet	87	24.3
Have you consulted a nutritionist for weight management?		
No	210	58.7
Yes	148	41.3

Have you undergone a bariatric surgery for weight management?		
Yes	12	3.4
No	346	96.6
Are you having health problems because of your weight?		
No	74	20.7
Yes	284	79.3
If yes, what health problems do you have? (n=284)		
Dyspnea	61	21.5
Joint pain/ musculoskeletal disorders	142	50.0
Both	81	28.5
Does your weight affect your mental health?		
Yes	148	41.3
No	210	58.7
Do you want to lose weight and need help?		
Yes	191	53.4
No	167	46.6

Table 4 shows that female participants had significantly a higher prevalence of obesity (62.8%) compared to their male counterparts (42.5%). Moreover, patients, who had chronic diseases, had significantly a higher prevalence of obesity (59.9%) compared to those who were free of chronic diseases (41.9%). Also, those with family history of obesity had significantly a higher prevalence of obesity compared to those without family history (59.8% compared to 48.5%). Participants who practiced regular exercise per week had significantly less prevalence of obesity than those who didn't exercise or those who exercised irregularly (39.3% compared to 58.4% and 59.0%).

Table 4. Contrasting general characteristics, medical history, clinical features and dietary habits and lifestyle between obese and non-obese patients (n=358)

	BMI<30(non-obese) (n=159)		**BMI>30 (obese) (n=199)**		**p- value**	**Test of sig**
	n	**%**	**n**	**%**		
General characteristics						
Age Mean± SD Median IQR Min-max	54.11± 11.47 53.00 47.00-63.00 19.00-76.00		53.75± 9.73 54.00 47.00-62.00 29.00-70.00		0.499	**Mann Whitney U** U= 15164.00
Sex						
Male	73	57.5	54	42.5	**<0.00***	**Chi Square** X^2 = 13.612
Female	86	37.2	145	62.8		
Marital status						
Married	131	44.0	167	56.0	0.190	**Chi Square** X^2 = 4.711
Single	15	62.5	9	37.5		
Divorced	3	27.3	8	72.7		
Widow	10	40.0	15	60.0		
Education						
Uneducated	9	32.1	19	67.9	0.382	**Chi Square** X^2 = 3.056
Basic education	22	45.8	26	54.2		
Secondary education	54	41.9	75	58.1		
Higher education	74	48.4	79	51.6		
Occupation						
Employee	98	43.2	129	56.8	0.749	**Chi Square** X^2 = 1.237
A freelance	16	45.7	19	54.3		
Unemployed	12	40.0	18	60.0		
Retired	33	50.0	33	50.0		
Monthly income						
0LYD	9	33.3	18	66.7	0.273	**Chi Square** X^2 = 3.880
Less than 1000 LYD	45	52.3	41	47.7		
1000-2000 LYD	88	43.3	115	56.7		
>2000 LYD	17	40.5	25	59.5		
Medical history						
Disease duration						

Mean± SD Median IQR Min-max	9.47± 7.67 8.00 3.00-15.00 1.00-38.00		9.14 ±7.65 7.00 3.00-15.00 1.00-39.00		0.623	**Mann Whitney U** U= 15343.00
Presence of chronic diseases						
No	50	58.1	36	41.9	**0.003***	**Chi Square** X^2 = 8.638
Yes	109	40.1	163	59.9		
Family history of obesity and/or diabetes in first degree relatives						
Yes	90	40.2	134	59.8	**0.037***	**Chi Square** X^2 = 4.347
No	69	51.5	65	48.5		
Nutritionist consultation						
Yes	63	42.6	85	57.4	0.555	**Chi Square** X^2 = 0.348
No	96	45.7	114	54.3		
Clinical features						
Fasting blood glucose (mg/dl) Mean± SD Median IQR Min-max	190.72± 73.50 176.00 135.00-223.00 87.00-500.00		190.46± 67.06 186.00 138.00-232.00 75.00-580.00		0.666	**Mann Whitney U** U= 15401.00
HbA1c Mean± SD Median IQR Min-max	8.49± 1.93 8.00 7.00-9.90 2.90-13.70		9.19± 7.53 8.54 7.30-10.00 4.30-112.00		0.174	**Mann Whitney U** U= 14500.00
Dietary habits and lifestyle						
Number of meals /days						
2	24	51.1	23	48.9	0.601	**Chi Square** X^2 = 1.017
3	114	43.7	147	56.3		
4-6	21	42.0	29	58.0		
The usual nature of food						
High fat	11	29.7	26	70.3	0.276	**Chi Square** X^2 = 3.871
High sugar	17	43.6	22	56.4		
High carb	107	45.9	126	54.1		
Healthy diet	24	49.0	25	51.0		
Following a dietary regimen						
Yes	25	50.0	25	50.0	0.391	**Chi Square** X^2 = 0.735
No	134	43.5	174	56.5		
Practicing exercise /week						
No	91	41.6	128	58.4	**0.028***	**Chi Square** X^2 = 7.153
Regular (2 or more times/week)	34	60.7	22	39.3		
Irregular (<2times/ week)	34	41.0	49	59.0		
Regular follow up for diabetes and weight control						
Yes	68	49.3	70	50.7	0.143	**Chi Square** X^2 = 2.150
no	91	41.4	129	58.6		

The (*) signify statistically significant results, typically with a p-value less than 0.05

Table 5 illustrates the binary logistic regression model for risk factors associated with occurrence of obesity among type 2 diabetic patients. The model was statistically significant where $X^2 = 31.225$, $p < 0.001$*. It was proved to be fitting by Hosmer-Lemeshow test where $p = 0.935$.

Table 5. multivariate analysis (Binary logistic regression model) for risk factors associated with obesity among type II diabetic patients

Covariates	OR	95% CI	p- value
Sex Male (ref) Female	 1 2.141	 1.35- 3.41	 P=0.001*
Presence of chronic diseases No (ref) Yes	 1 1.97	 1.18- 3.28	 P=0.010*
Family history of obesity and/or diabetes in first degree relatives No (ref) Yes	 1 1.72	 1.10- 2.71	 P= 0.019*
Practicing exercise Regular (ref) Irregular No exercise	 1 1.93 2.42	1.02- 3.63 1.17- 4.98	P=0.049* P= 0.043* P= 0.017*
Constant (-1.060)	0.346		P=0.001*

The (*) signify statistically significant results, typically with a p-value less than 0.05

CI: Confidence Interval

The model shows that:

- Female participants had significantly higher odds of obesity compared to males (OR= 2.14, 95% CI: 1.35-3.41, *P*=0.001).
- Participants who suffered chronic diseases had significantly higher odds of obesity compared to those who were free of chronic diseases (OR= 1.97, 95% CI: 1.18- 3.28, *P*=0.010).
- Participants with positive family history of obesity had significantly higher odds of obesity compared to those who with no family history (OR= 1.72, 95% CI: 1.10-2.71, *P*=0.019).
- Participants who didn't exercise or irregularly exercised had significantly higher odds of obesity compared to those who regularly exercised (OR= 2.42, 95% CI: 1.17-4.98, *P*=0.017) and (OR= 1.93, 95% CI: 1.02-3.63, *P*=0.043) respectively.

Discussion:

Obesity and type 2 diabetes mellitus (T2DM) are closely linked and represent significant, overlapping global public health challenges. Excess adiposity contributes to insulin resistance, a main pathophysiological mechanism promoting the onset and progression of T2DM. Moreover, obesity aggravates diabetes-related complications, including cardiovascular disease, thus amplifying morbidity and healthcare costs worldwide.

The present study highlights a markedly high prevalence of overweight and obesity among type II diabetic patients, with a total of 55.6% classified as obese (BMI≥30kg/m²) and an additional 35.2% as overweight, confirming the link between excess weight and diabetes management challenges.

These findings are consistent with the global trend of elevated obesity rates amongst diabetics. it is estimated that 85% of people with type 2 diabetes are either overweight or obese, according to the American Society for Metabolic and Bariatric Surgery. (17). In addition, these findings agree with those of a study conducted earlier in Libya in 2020 by Alawaini Kh and Abugila M (18) which found that 36% of the diabetic patients in the study were overweight and 44.4% were obese.

These findings are also consistent with the findings of a study in Bisha, Saudi Arabia, 2021 which reported a similar combined prevalence of overweight and obesity at 85.8%, with 27.9% of participants being overweight, 57.8% being obese, and only 13.2% having normal weight. (19) Another study by Alharbi AS et al in Saudi Arabia 2022 reported a prevalence of overweight and obesity among type 2 diabetics by (55.6%). (20)

The high prevalence underscores the urgent need for integrated approaches targeting weight reduction as a core component of diabetes management. Obesity and diabetes are recognized to coexist in a "vicious cycle," each helping the development and complications of the other.

The current study demonstrates a higher obesity prevalence among female patients (62.8%) compared to males (42.5%) which aligns with the findings of Alawaini Kh and Abugila M in libya 2020 (18) and those of Damian

Dj et al., 2017 in Tanzania (21) suggesting sex differences in obesity within diabetic populations. The result of ALJarad FAS in Saudi Arabia also found that prevalence of obesity in female is twice as males. (22) Such differences may be attributed to variations in hormonal profile, physical activity levels, and socio-cultural factors that disproportionately affect women's health behaviors. This necessitates gender-sensitive interventions to effectively address weight control in diabetic care. Such disparities reinforce the need for gender-sensitive intervention programs.

A positive association was observed between obesity and the coexistence of chronic diseases, particularly cardiovascular disorders. This finding is supported by research from the American Diabetes Association (ADA), which reports that co-morbidities such as hypertension and dyslipidemia are common in obese diabetic participants, exacerbating their health risks. (23) Additionally, our logistic regression analysis confirmed that a family history of obesity or diabetes in first-degree relatives significantly increases the risk of obesity (OR=1.72), which agree with findings of AlJarad FAS in Saudi Arabia (22) confirming the contribution of genetic predisposition and shared lifestyle factors in the development of obesity among diabetics

These findings highlight the necessity of targeted prevention strategies for individuals with a positive family history, as they represent a high-risk group for both obesity and type 2 diabetes.

Physical inactivity was strongly associated with obesity in this cohort; patients who exercised regularly showed notably lower obesity rates (39.3%) than those inactive or irregularly active (58.4% and 59.0%, respectively). This is supported by the findings of Jayedi A et al in their systematic review and meta-analysis in 2020 (24) indicating extensive evidence that regular physical activity improves insulin sensitivity and promotes weight loss, reinforcing its critical role in diabetes and obesity management.

Although the majority of patients (75.7%) received information on weight management from specialized physicians, only 41.3% consulted nutritionists, and a minimal 3.4% underwent bariatric surgery. The findings of Menghui Liu et al. 2022 suggest that individuals who actively attempted to control their weight had significantly lower odds of obesity (OR = 0.26, p = 0.001), and that weight management strategies can be effective in diabetic population (25). This indicates missed opportunities for multidisciplinary intervention, which has been shown to enhance weight loss and metabolic outcomes in diabetic patients. Strengthening access to nutritional counseling and considering surgical options when appropriate could optimize obesity management in this population.

Limitations

The cross-sectional design, which precludes causal inference, and reliance on self-reported data for lifestyle behaviors that may introduce bias. Nonetheless, the study provides valuable insight into the distribution and determinants of obesity among type II diabetics in the region.

Implications of the study

The findings of this study have important implications for public health practice and community-based interventions targeting type 2 diabetes management. The high prevalence of obesity among diabetic patients underscores the urgent need for integrated obesity prevention strategies within diabetes care programs. By identifying key associated factors such as female sex, comorbidities, family history, and lack of regular physical activity, the study provides actionable evidence for tailoring health promotion efforts. Community health initiatives can leverage this data to design targeted educational campaigns, screening programs, and lifestyle modification interventions, particularly focusing on high-risk groups. Moreover, these insights can guide local policymakers and healthcare providers in resource allocation and in developing culturally appropriate, gender-sensitive interventions to reduce the dual burden of diabetes and obesity.

In conclusion, the study reveals a substantial burden of obesity among T2DM patients, particularly among women, those with chronic comorbidities, family history, and sedentary lifestyles. Addressing this multifaceted challenge demands personalized, gender-sensitive, and multidisciplinary approaches integrating lifestyle modification, medical care, and surgical options to improve health outcomes.

Funding declaration:

No funding was received to assist with the current study or preparation of this manuscript.

Competing interests:

The authors have no financial or non-financial interests that are directly or indirectly related to the current study.

Data availability:

The data supporting the results reported in this paper can be provided by contacting the corresponding author confirming that anonymity of participants is ensured.

References

1. International Diabetes Federation. (2021). *IDF Diabetes Atlas* (10th ed.). International Diabetes Federation.
2. World Health Organization. (2021). *Obesity and overweight*. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

3. Kahn, S. E., Hull, R. L., & Utzschneider, K. M. (2006). Mechanisms linking obesity to insulin resistance and type 2 diabetes. *Nature*, *444*(7121), 840–846. https://doi.org/10.1038/nature05482
4. Bays, H. E., Chapman, R. H., Grandy, S., & SHIELD Investigators' Group (2007). The relationship of body mass index to diabetes mellitus, hypertension and dyslipidaemia: comparison of data from two national surveys. *International journal of clinical practice*, *61*(5), 737–747. https://doi.org/10.1111/j.1742-1241.2007.01336.x
5. Colditz, G. A., Willett, W. C., Rotnitzky, A., & Manson, J. E. (1995). Weight gain as a risk factor for clinical diabetes mellitus in women. *Annals of internal medicine*, *122*(7), 481–486. https://doi.org/10.7326/0003-4819-122-7-199504010-00001
6. Hu, F. B., Manson, J. E., Stampfer, M. J., Colditz, G., Liu, S., Solomon, C. G., & Willett, W. C. (2001). Diet, lifestyle, and the risk of type 2 diabetes mellitus in women. *The New England journal of medicine*, *345*(11), 790–797. https://doi.org/10.1056/NEJMoa010492
7. Vazquez, G., Duval, S., Jacobs, D. R., Jr, & Silventoinen, K. (2007). Comparison of body mass index, waist circumference, and waist/hip ratio in predicting incident diabetes: a meta-analysis. *Epidemiologic reviews*, *29*, 115–128. https://doi.org/10.1093/epirev/mxm008
8. Ng, S. W., Zaghloul, S., Ali, H. I., Harrison, G., & Popkin, B. M. (2011). The prevalence and trends of overweight, obesity and nutrition-related non-communicable diseases in the Arabian Gulf States. *Obesity reviews : an official journal of the International Association for the Study of Obesity*, *12*(1), 1–13. https://doi.org/10.1111/j.1467-789X.2010.00750.x
9. Alshkri, M., & Elmehdawi, R. (2008). Metabolic Syndrome among Type-2 Diabetic Patients in Benghazi-Libya: A pilot study. *The Libyan journal of medicine*, *3*(4), 177–180. https://doi.org/10.4176/080715
10. Eckel, R. H., Kahn, S. E., Ferrannini, E., Goldfine, A. B., Nathan, D. M., Schwartz, M. W., Smith, R. J., & Smith, S. R. (2011). Obesity and type 2 diabetes: what can be unified and what needs to be individualized?. *The Journal of clinical endocrinology and metabolism*, *96*(6), 1654–1663. https://doi.org/10.1210/jc.2011-0585
11. American Diabetes Association Professional Practice Committee (2022). Obesity and Weight Management for the Prevention and Treatment of Type 2 Diabetes: Standards of Medical Care in Diabetes-2022. *Diabetes care*, *45*(Suppl 1), S113–S124. https://doi.org/10.2337/dc22-S008
12. Apovian, C. M., Okemah, J., & O'Neil, P. M. (2019). Body Weight Considerations in the Management of Type 2 Diabetes. *Advances in therapy*, *36*(1), 44–58. https://doi.org/10.1007/s12325-018-0824-8
13. Look AHEAD Research Group, & Wing, R. R. (2010). Long-term effects of a lifestyle intervention on weight and cardiovascular risk factors in individuals with type 2 diabetes mellitus: four-year results of the Look AHEAD trial. *Archives of internal medicine*, *170*(17), 1566–1575. https://doi.org/10.1001/archinternmed.2010.334
14. Dean, A. G., Arner, T. G., Sunki, G. G., Friedman, R., Lantinga, M., Sangam, S., et al. (2021). *Epi Info™: A database and statistics program for public health professionals*. Centers for Disease Control and Prevention.
15. Benghazi Diabetes and Endocrine Center. (2009). *Statistics*. Ministry of Health–Libya.
16. World Health Organization. (2000). *Obesity: Preventing and managing the global epidemic. Report of a WHO consultation* (WHO Technical Report Series No. 894). World Health Organization.
17. American Society for Metabolic and Bariatric Surgery. (2018, October). *Type 2 diabetes and metabolic surgery* [Fact sheet]. https://asmbs.org/resources/type-2-diabetes-and-metabolic-surgery-fact-sheet/
18. Alawaini, Kh. A., Abugila, M.A (2020). Prevalence of obesity in diabetic patients in the north west of Libya. GSC Biological and Pharmaceutical Sciences12(02), 212-16. DOI: https://doi.org/10.30574/gscbps.2020.12.2.0261
19. AlShahrani M. S. (2021). Prevalence of obesity and overweight among type 2 diabetic patients in Bisha, Saudi Arabia. *Journal of family medicine and primary care*, *10*(1), 143–148. https://doi.org/10.4103/jfmpc.jfmpc_1349_20
20. Alharbi, A. S., Alenezi, A. K., Alqahtani, A., Alsuliman, M. N., Alharbi, M. F., Alruwaili, T. Z., & others. (2022). Awareness and practice of diabetic participants about obesity in Saudi Arabia: Cross-sectional study. *Journal of Research in Medical and Dental Science*, *10*(1), 122–130.
21. Damian, D. J., Kimaro, K., Mselle, G., Kaaya, R., & Lyaruu, I. (2017). Prevalence of overweight and obesity among type 2 diabetic patients attending diabetes clinics in northern Tanzania. *BMC research notes*, *10*(1), 515. https://doi.org/10.1186/s13104-017-2861-9
22. Al Jarad, F. A. S., Narapureddy, B. R., Derkaoui, H. R., Aldayal, A. S. A., Alotaibi, M. M. H., Aladhyani, F. H. A., Mohammed Asif, S., & Muthugounder, K. (2025). Prevalence and Risk Factors of Obesity Among Type 2 Diabetic Participants in Abha, Saudi Arabia: A Cross-Sectional Study. *Healthcare (Basel, Switzerland)*, *13*(6), 658. https://doi.org/10.3390/healthcare13060658
23. American Diabetes Association. (2020). Comprehensive medical evaluation and assessment of comorbidities: Standards of medical care in diabetes—2020. *Diabetes Care, 43*(Suppl. 1), S37–S47. https://doi.org/10.2337/dc20-S004

24. Jayedi, A., Zargar, M. S., Emadi, A., & Aune, D. (2024). Walking speed and the risk of type 2 diabetes: a systematic review and meta-analysis. *British journal of sports medicine*, *58*(6), 334–342. https://doi.org/10.1136/bjsports-2023-107336
25. Liu, M., Huang, R., Xu, L., Zhang, S., Zhong, X., Chen, X., Lin, Y., Xiong, Z., Wang, L., Liao, X., & Zhuang, X. (2022). Cardiovascular effects of intensive lifestyle intervention in adults with overweight/obesity and type 2 diabetes according to body weight time in range. *EClinicalMedicine*, *49*, 101451. https://doi.org/10.1016/j.eclinm.2022.101451