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Prevalence and factors associated with overweight and obesity among patients with type 2 diabetes mellitus in Uganda—a descriptive retrospective study

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ABSTRACT

Objectives To assess the prevalence and risk factors of overweight and obesity among type 2 diabetes mellitus (T2DM) patients in Uganda.

Design Retrospective chart review.

Setting This study was conducted in the outpatient's T2DM clinic in St. Francis Hospital—Nsambya, Uganda between March and May 2017.

Participants Type 2 diabetes patients registered in the diabetes clinic between July 2003 and September 2016.

Outcome measures Overweight and obesity defined as body mass index (kg/m^2) of 25.0–29.9 and obesity as 30.0 or higher.

Results Of 1275 T2DM patients, the median age was 54 (IQR: 44–65) years, 770 (60.40%) were females, 887 (69.6%) had hypertension, 385 (28%) had controlled glycaemia, 349 (27%) were obese, while 455 (36%) were overweight. Overweight/obesity were lower among men (OR: 0.45, 95% CI: 0.340 to 0.593, p≤0.001) and among patients aged ≥65 years (OR: 0.52, 95% CI: 0.350 to 0.770, p=0.001); patients who rarely ate fruits and vegetables (OR: 0.66, 95% CI: 0.475 to 0.921, p=0.014) but higher among patients of middle (OR: 1.83, 95% CI: 1.320 to 2.550, p≤0.001) and upper (OR: 2.10, 95% CI: 1.450 to 2.990, p≤0.001) socioeconomic status; on dual therapy (OR: 2.17, 95% CI: 1.024 to 4.604, p=0.043); with peripheral neuropathy (OR: 1.40, 95% CI: 1.039 to 1.834, p=0.026) and hypertension (OR: 1.70, 95% CI: 1.264 to 2.293, p≤0.001).

Conclusions Overweight and obesity are high among T2DM patients in this population and may contribute significantly to poor outcomes of T2DM. Therefore, strategies to address this problem are urgently needed.

Strengths and limitations of this study

- This study is one of the first studies to report on the prevalence and factors associated with overweight and obesity among type 2 diabetes patients in Uganda.
- The use of patients' routine care data for this review has provided a large sample size which would not have been possible otherwise.
- The method used by the health facility to classify socioeconomic status and residence was not standardised and could have changed over the years.
- This study was conducted in outpatient diabetes clinics in a private not for profit facility and did not include those from public health facilities and the results may not be generalisable to the general population in Uganda.
- This operational programme data were not designed for research purposes, were not validated, had no quality checks done for completeness and plausibility and only limited number of variables were captured.

INTRODUCTION

Overweight, defined as a body mass index (BMI) of 25.0–29.9 kg/m^2, and obesity as BMI 30.0 kg/m^2 or above, represent progressive buildup of adipose tissue to levels that damage the physical and psychosocial health and well-being of an individual. Globally, the prevalence of obesity doubled in 73 countries between 1980 and 2015, and in 2015 about 604 million adults were obese.[1] Overweight and obesity are a major threat to health, causing morbidity in over 2 billion people worldwide and accounting for at least 2.8 million (fifth leading cause) of deaths per year in adults.[2] Approximately, 44% of the burden of diabetes mellitus, 23% of the ischaemic heart disease and up to 41% of certain cancer are attributable to overweight and obesity.

The correlation between obesity and type 2 diabetes mellitus (T2DM) has been constantly proven and reproducibly observed in a wide range of studies across different populations.[3–5] Obesity is the most important risk factor for T2DM and has been postulated to be the major contributor to the current

epidemics of T2DM. Moreover, the presence of obesity among type 2 diabetes patients increases the risk of mortality from cardiovascular disease.[4 6] A meta-analysis of five longitudinal cohort studies demonstrated that overweight or obese diabetes patients had a twofold greater relative risk of mortality than normal-weight patients.[7] Obesity also promotes insulin resistance and metabolic syndrome whose other components besides hyperglycaemic are hypertension, dyslipidaemia, proinflammatory and prothrombotic state.[8] Overweight and obesity also increases the likelihoods of suboptimal glycaemic control making it difficult to achieve glycaemic targets.[9] As a result, the American Diabetes Association recommends and has developed guidelines for weight management in diabetic patients with overweight or obesity.[10 11]

Sub-Saharan Africa is experiencing a rapidly increasing burden of obesity, diabetes and other non-communicable diseases.[12 13] However, there are limited reliable data on the prevalence of obesity and how this contributes to the risk of T2DM in the region. A few studies indicate that overweight and obesity affects up to half of the type 2 diabetes patients, with prevalence varying according to age and setting; 85% in Tanzania[14] and 27.4%–83% in Nigeria.[15 16]

In Uganda, nationwide health and demographic surveys showed a significant rise in the prevalence of overweight (9.77% vs 16.21%) and obesity (1.99% vs 6.21%) in the general population between 1995 and 2016, respectively.[17] However, the prevalence of overweight and obesity among type 2 diabetes patient in Uganda is not known. This study was therefore undertaken to document the prevalence of overweight and obesity among type 2 diabetes patients, and the associated factors.

METHODS

Study design, setting and population

This descriptive retrospective study reviewed 2518 medical records of adult patients with T2DM who had registered at St. Francis Hospital Nsambya in Kampala-Uganda. The hospital is a private not for profit health facility which conducts a weekly diabetes mellitus clinic managing an average of 60 patients on every clinic day. During each clinic visit, trained nurses offer diabetes mellitus health education, biophysical and fasting blood glucose measurements are done prior to being reviewed by the doctors.[18] The study population consisted of T2DM patients registered at the clinic between July 2003 and September 2016. Patients clinic records (paper-based) were reviewed by a trained medical doctor, clinical officer and registered nurses between March and May 2017.

Sample size and sampling procedure

To achieve a desired level of precision and a higher power all the 2518 patients registered in the T2DM clinic were considered. Consecutive convenience sampling method was used because of a substantial number of missing files and missing information. Patients whose records could not be located, those with missing information including height and weight, type 1 diabetes mellitus or with gestational diabetes were excluded.

Data source and collection

The data for this research were secondary data collected routinely in the hospital for patients' clinical monitoring and evaluation purposes. Data were abstracted from the hospital records and entered into a Microsoft Excel 2010 database (Microsoft Corp., Redmond, WA), checked for consistencies, outliers and completeness and then exported to STATA V.15 (Stata Corp, College Station, TX, USA) for further data cleaning, management and analysis. Data collected for this review included sociodemographics, medical history, glycaemic levels, medication use, complications of diabetes and biophysical measurements.

The primary outcome variable was overweight taken as a BMI of 25.0–29.9 kg/m^2, and obesity as BMI 30.0 kg/m^2 or above.

Clinical description of predictor and outcome variables

BMI was calculated as weight in kilograms divided by the square of height in metres (kg/m^2). We used the WHO BMI (in kg/m^2) definition as follows: normal weight: 18.0–24.9, overweight: 25.0–29.9 and obesity: 30.0 or higher.[19]

Hypertension was defined as systolic blood pressure ≥140 mm Hg and/or diastolic pressure of ≥90 mm Hg or on antihypertensive medication or a recorded diagnosis of hypertension.

Optimal glycaemic control was defined as preprandial glucose 4.4–7.2 mmol/L. Fasting glucose reading of >7.2 mmol/L was considered as uncontrolled glycaemia among diabetes patients. Glucose reading was recorded as an average of the last three measurements on three separate clinic visits.

Diabetes mellitus treatment options: life style alone was defined as non-pharmacological treatment involving changes in diet and increased exercise; monotherapy as use of metformin only or any other single oral hypoglycemic; dual therapy as a combination of metformin and another oral hypoglycemic agent or metformin and insulin; triple therapy as a combination of metformin and two other oral hypoglycemic agents or metformin and another oral hypoglycemic plus insulin and combination injection therapy was defined as the use of different insulin regimens.

Residence: the host hospital's definitions were used; urban was defined as living within 1 km of a town council; peri-urban as living within 1 km of a shop selling soft drinks and rural as living more than 1 km of a shop selling soft drinks.

Socioeconomic status (SES) was defined based on household assets. Upper SES defined as living in a house with electricity or solar power supply, piped water, flushing toilet and kitchen inside; middle SES as living in a house with at least one but not all the utilities above; lower SES

as living in a house without the above and not mud or wattle and not grass hatched; poor SES as living in mud and wattle grass hatched house and none of the amenities above.

Potential confounders were age, sex, SES and residence.

Statistical analysis

Statistical analysis was performed using STATA V.15 (Stata Corp, College Station, TX, USA). All variables were checked for missing data and inconsistencies. Distribution of the data using summary measures and graphical displays was examined to identify outliers and verified against source documentation. The patients' characteristics were summarised using means±SD or medians and percentages. The Kruskal-Wallis equality of proportions test was used to assess the association between participants age and the various BMI categories. Categorical variables were reported as numbers and percentages. Chi-square test (χ^2) was used to determine differences in prevalence of overweight and obesity and baseline characteristics of patients. Based on the χ^2 test and Kruskal-Wallis equality of proportions test, variables that were significantly associated ($p<0.05$) with the different BMI categories were used in the subsequent analysis.

Bivariate logistic regression analysis was used to determine whether patients' characteristics including age, sex, education, area of residence, hypertension, diabetes complications, diabetes treatment, smoking, socioeconomic status and participants adherence to study visits (lost to follow-up) were associated with overweight/obesity. Based on the results obtained from the bivariate logistic regression models, variables that were found to have an independent association, that is, gender/sex, education, area of residence, hypertension, fruit/vegetable intake, smoking, socioeconomic status, diabetes complications and participant's adherence to study visits with the outcome in addition to age and diabetes treatment were added to the final multivariate logistic regression model. Age and diabetes treatment were added to this model based a priori knowledge of a known confounding effect of these variables with the outcome. From the unadjusted and adjusted models, p-values, OR and corresponding 95% CIs were reported.

Results

Patients' characteristics and prevalence of overweight and obesity

Between July 2003 and September 2016, a total of 2518 diabetes mellitus patients were registered in the diabetes clinic of St. Francis Hospital Nsambya in Kampala, Uganda. We excluded 1243 (49.4%) records due to missing files, files with missing information/biophysical measurements, type 1 diabetes mellitus or gestational diabetes mellitus (figure 1). The median age at enrolment of the 1275 patients included in this analysis was 54 (IQR: 44–65) years. Most of the participants were female—770 (60.40%), majority lived in an urban setting—809 (63.45%) and 544 (42.7%) had attained at least primary level education. Of the 1275 participants, 349 (27%) were obese, 455 (36%) were overweight, 44 (3.5%) were underweight and 427 (33.5%) had normal BMI (table 1).

Factors associated with overweight/obesity

The factors found to be associated with overweight and obesity among T2DM patients were female gender, age, SES, fruit and vegetable intake, diabetes treatment options, neuropathy and hypertension (table 2). In general, the risk of being overweight or obese was lower in men than in women (OR: 0.45, 95% CI: 0.340 to 0.593, p≤0.001). Among the different age categories, the highest

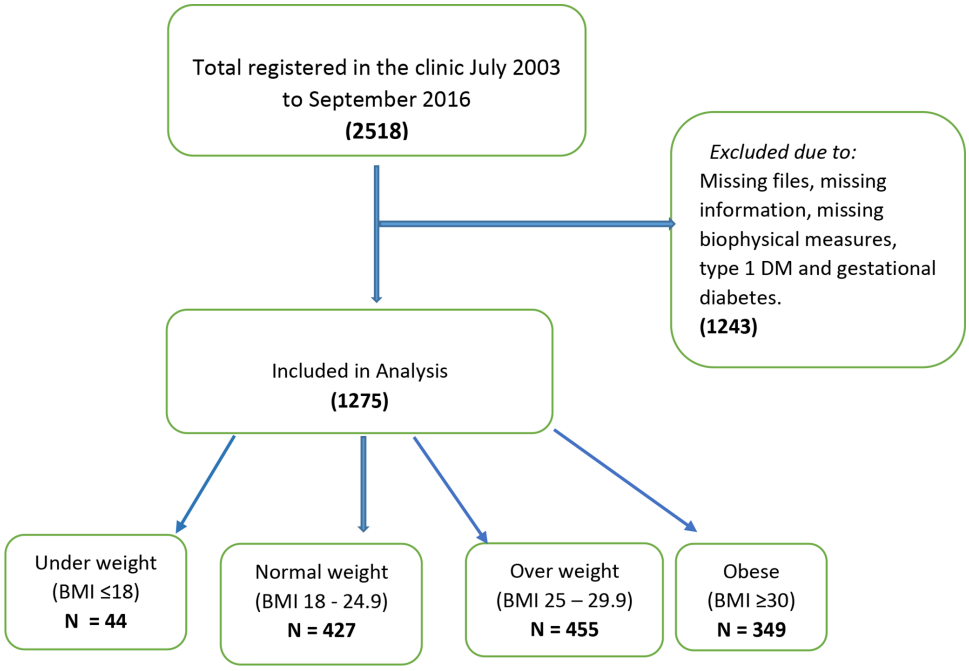

Figure 1 Study organogram.BMI, body mass index; DM, diabetes mellitus.

Table 1 Baseline characteristics of patients basing on BMI category

Variable name/category	Overall N (%)	Normal 18.5–24.9 N (%)	Underweight below 18.5 N (%)	Overweight 25.0–29.9 N (%)	Obese ≥30 N (%)	P value
Sociodemographic characteristics						
Gender						
Female	770 (60.40)	208 (48.71)	20 (45.45)	277 (60.88)	265 (75.93)	**<0.001***
Male	505 (39.60)	219 (51.29)	24 (54.55)	178 (39.12)	84 (24.07)	
Median age (IQR) (years)	54 (44–65)	55 (44–65)	44.5 (40.5–63)	54 (44–64)	53 (45–62)	0.268
Age group (years)						
19–44	326 (25.57)	108 (25 29)	20 (45.45)	120 (26.37)	78 (22.35)	**0.003***
45–64	629 (49.33)	195 (45.57)	14 (31.82	224 (49.23)	196 (56.16)	
Above 64	320 (25.10)	124 (29.04)	10 (22.73)	111 (24.40)	75 (21.49)	
Residence						
Rural	138 (10.82)	55 (12.88)	3 (6.82)	53 (11.69)	27 (7.74)	0.294
Peri-urban	328 (25.73)	110 (25.76)	14 (31.82)	115 (25.27)	89 (25.50)	
Urban	809 (63.45)	262 (61.36)	27 (61.36)	287 (63.08)	233 (66.76)	
Education level						
≤Primary education	544 (42.70)	175 (40.98)	18 (40.91)	193 (42.42)	158 (45.27)	0.608
Secondary	460 (36.00)	151 (35.36)	15 (34.09)	165 (36.26)	129 (36.96)	
Postsecondary	271 (21.30)	101 (23.63)	11 (25.00)	97 (21.32)	62 (17.77)	
Socioeconomic status						
Lower	283 (22.20)	125 (29.27)	13 (29.55)	83 (18.25)	62 (17.77)	**<0.001***
Middle	586 (45.96)	187 (43.79)	18 (40.91)	221 (48.57)	160 (45.85)	
Upper	406 (31.84)	115 (26.93)	13 (29.55)	151 (33.19)	127 (36.39)	
Life style characteristics						
Smoking						
No	1137 (89.1)	370 (86.65)	38 (86.36)	408 (89.67)	320 (91.69)	0.136
Yes	139 (10.9)	57 (13.35)	6 (13.64)	47 (10.33)	29 (8.31)	
Fruit/vegetable intake						
Rarely	462 (38.12)	178 (43.95)	22 (50.00)	154 (35.73)	108 (32.53)	**0.007***
Once a week	406 (33.50)	134 (33.09)	9 (20.45)	145 (33.64)	118 (35.54)	
Daily	344 (28.38)	93 (22.96)	13 (29.55)	132 (330.63)	106 (31.93)	
Alcohol intake						
No	909 (71.29)	319 (74.71)	29 (65.91)	316 (69.45)	245 (70.20)	0.260
Yes	366 (28.71)	108 (25.29)	15 (34.09)	139 (30.55)	104 (29.80)	
DM treatment characteristics						
Life style alone	34 (2.69)	16 (3.79)	1 (2.33)	8 (1.66)	9 (2.62)	**0.002***
Monotherapy	292 (23.14)	113 (26.78)	8 (18.60)	98 (21.63)	73 (21.22)	
Dual therapy	711 (56.34)	202 (47.87)	24 (55.81)	281 (62.03)	204 (59.30)	
Triple therapy	109 (8.64)	38 (39.00)	2 (4.65)	36 (7.95)	33 (9.59)	
Combination injection therapy	116 (9.19)	53 (12.56)	8 (18.60)	30 (6.62)	25 (7.27)	
DM complications and comorbidities						
Peripheral neuropathy						
No	795 (62.35)	293 (68.61)	28 (63.64)	278 (61.10)	196 (56.16)	**0.004***
Yes	480 (37.65)	134 (31.39)	16 (36.36)	177 (38.90)	153 (43.84)	

Continued

Table 1 Continued

Variable name/category	Overall N (%)	Normal 18.5–24.9 N (%)	Underweight below 18.5 N (%)	Overweight 25.0–29.9 N (%)	Obese ≥30 N (%)	P value
Nephropathy						
No	1194 (93.65)	401 (93.91)	42 (95.45)	422 (92.75)	329 (94.27)	0.768
Yes	81 (6.35)	26 (6.09)	2 (4.55)	33 (7.25)	20 (5.73)	
Retinopathy						
No	1019 (79.92)	349 (81.73)	38 (86.36)	352 (77.36)	280 (80.23)	0.274
Yes	256 (20.08)	78 (18.27)	6 (13.64)	103 (22.64)	69 (19.77)	
Macroangiopathy						
No	1246 (97.73)	416 (97.42)	43 (97.73)	450 (98.90)	337 (96.56)	0.162
Yes	27 (2.27)	11 (2.58)	1 (2.27)	5 (1.10)	12 (3.44)	
Cerebrovascular accident						
No	1261 (98.90)	422 (98.83)	44 (100)	451 (99.12)	344 (98.57)	0.784
Yes	14 (1.10)	5 (1.17)	0 (0)	4 (0.88)	5 (8.43)	
Hypertension						
No	388 (30.40)	160 (37.50)	22 (50.00)	127 (27.90)	79 (22.60)	**<0.001***
Yes	887 (69.60)	267 (62.50)	22 (50.00)	328 (72.10)	270 (77.40)	
Glycaemic control (n=1234)						
Hypoglycaemic	18 (1.46)	9 (2.20)	1 (2.38)	4 (0.90)	4 (1.18)	0.509
Optimal glycaemic control	326 (26.42)	103 (25.18)	11 (26.19)	113 (25.51)	99 (29.12)	
Uncontrolled glycaemia	890 (72.12)	297 (72.6)	30 (71.43)	326 (73.59)	237 (69.71)	
Erectile dysfunction (n=505)						
No	396 (78.42)	176 (80.37)	22 (91.69)	131 (73.60)	67 (79.76)	0.150
Yes	109 (21.58)	43 (19.63)	2 (8.33)	47 (26.40)	17 (20.24)	
Lost to follow-up (≥6 months consecutively)						
No	108 (8.5)	23 (5.39)	1 (2.27)	46 (10.11)	38 (10.89)	**0.009***
Yes	1167 (91.53)	404 (94.61)	43 (97.73)	409 (89.89)	311 (89.11)	

*Statistically significant at level p<0.05.
BMI, body mass index; DM, diabetes mellitus.

prevalence of overweight/obesity was between the age of 45 and 65 years; those age 65 years and more had the least risk (OR: 0.52, 95% CI: 0.350 to 0.770, p=0.001). Middle and upper SES were associated with increased risk of obesity and overweight (OR: 1.83, 95% CI: 1.320 to 2.550, p≤0.001) and (OR: 2.10, 95% CI: 1.450 to 2.990, p<0.001), respectively. Intriguingly, those who reported to rarely consuming fruits and vegetables were less likely to be overweight or obese than those who had regular intake of fruits and vegetables (OR: 0.66, 95% CI: 0.475 to 0.921, p=0.014). Patients who were on dual therapy were more than 2.2 times more likely to be overweight and obese (OR: 2.17, 95% CI: 1.024 to 4.604 and p=0.043). Patients who had neuropathy complications were 1.4 times more likely to be overweight and obese (OR: 1.40, 95% CI: 1.039 to 1.834, p=0.026). Diabetic patients who also had hyperte nsion were more than 1.7 times more likely to be overweight or obese (OR: 1.70, 95% CI: 1.264 to 2.293, p<0.001) (table 2).

Discussion

In this study, we observed nearly 65% of patients with T2DM were either overweight or obese. The prevalence was particularly high among female patients, those with middle or higher SES, between 40 and 65 years of age, on multiple antidiabetic drugs and those with comorbidity or complications.

The prevalence of overweight and obesity among type 2 diabetes patients in this study was markedly higher than the 24.8% found in the general (non-diabetic) population in Eastern Uganda in 2013,[20] but was consistent with data from other settings which showed high levels of overweight and obesity among T2DM patients. Indeed, high prevalence has been reported in higher income countries. For

Table 2 Unadjusted and adjusted logistic regression model of overweight and obesity among type 2 diabetic patients in St. Francis Hospital Nsambya

	Unadjusted model			Adjusted model		
Variable	**OR**	**95% CI**	**P value**	**OR**	**95% CI**	**P value**
Sex						
Female	**Ref**					
Male	**1.60**	**1.092 to 2.4**	**0.017***	**0.45**	**0.340 to 0.593**	**<0.001***
Age (years)						
19–44	Ref	Ref		Ref	Ref	
45–64	1.20	0.879 to 1.569	0.275	0.86	0.620 to 1.190	0.356
65+	0.81	0.590 to 1.134	0.228	**0.52**	0.353 to 0.770	**0.001***
Lost to follow-up						
No	Ref	Ref		Ref	Ref	
Yes	0.49	0.303 to 0.786	**0.003***	0.68	0.400 to 1.150	0.150
Socioeconomic status						
Lower	Ref	Ref		Ref	Ref	
Middle	1.76	1.305 to 2.362	**<0.001***	1.83	1.320 to 2.550	**<0.001***
Upper	2.10	1.508 to 2.879	**<0.001***	2.10	1.452 to 2.994	**<0.001***
Smoking status						
No	Ref	Ref		Ref	Ref	
Yes	0.68	0.470 to 0.976	**0.037***	0.99	0.643 to 1.490	0.920
Fruit and vegetable intake						
Daily	Ref	Ref		Ref	Ref	
Once a week	0.77	0.558 to 1.053	1.101	0.87	0.619 to 1.227	0.432
Rarely	0.58	0.423 to 0.781	**<0.001***	0.66	0.475 to 0.921	**0.014***
Treatment of diabetes						
Exercise and diet alone	Ref	Ref		Ref	Ref	
Monotherapy	1.42	0.691 to 2.934	0.338	1.40	0.644 to 3.017	0.43
Dual therapy	2.26	1.120 to 4.560	**0.023***	2.17	1.024 to 4.604	**0.043***
Triple therapy	1.71	0.776 to 3.763	0.183	1.43	0.613 to 3.334	0.407
Combination injection therapy	0.98	0.448 to 2.130	0.953	0.96	0.414 to 2.204	0.914
Complications of diabetes						
Peripheral neuropathy						
No	Ref	Ref		Ref	Ref	
Yes	1.52	1.188 to 1.951	0.001	1.40	1.039 to 1.834	**0.026***
Hypertension						
No	Ref	Ref		Ref	Ref	
Yes	1.74	1.352 to 2.237	<0.001*	1.70	1.264 to 2.293	**<0.001***

*Indicating significant values based on χ^2 value p-value <0.05.
Ref, reference category.; .

example, in the UK, approximately 86%–90% of patients with T2DM had BMI≥25;[21 22] in Australia, 53% were obese and 32.8% were overweight;[23] in Saudi Arabia, 87.5% had BMI≥25 with the prevalence being higher among females (87.7%) than males (83.1%).[24] Although data from sub-Saharan Africa are limited, varying rates have been observed in Ethiopia (40%),[25] Tanzania (85.0%),[14] Nigeria (27.4%–83%)[15 16] and Sudan (64.4%).[26] It is likely that with the current trends towards urbanisation and globalisation and adoption of associated behaviours (eating habits and reduced physical activity), the prevalence of overweight and obesity in sub-Saharan Africa, including among patients with T2DM, will increase sharply[27]—with a parallel increase in complications such as cardiovascular diseases. Unlike in high-income countries where overweight and obesity are common among individuals with lower SES, in sub-Saharan Africa, the prevalence is higher among the educated and affluent and higher BMI has a number of positive social connotations.[28]

As with other studies in the region, our study showed that overweight and obesity among T2DM patients were more common among women. The reasons for this are not fully understood, but may relate to social drivers as well as biological factors.[29] Nonetheless, as associations with age, education and SES, these findings underscore the importance of understanding the local context when designing potential interventions to target at risk groups.

Intriguingly, in our study, we found that patients who rarely took fruits and vegetables were less likely to be overweight or obese compared with those ate fruits and vegetables daily. The reasons for this discrepancy are unclear; it might relate to unreliability of self-reported data. It is also possible that this is a reflection of SES—individuals with higher SES are likely to eat more vegetables, but are also more likely to be overweight or obese because of other dietary habits and/or other behaviours (such as physical inactivity). Indeed, most studies have shown that for increased fruit and vegetable intake to be successful in controlling overweight and obesity, it needs to be combined with other weight loss programmes like advice to reduce energy intake.[30]

T2DM patients who were on more than one antidiabetic agent were twice more likely to be overweight and obese. The majority of these patients were on thiazolinediones and sulphonylureas which, together with insulin, cause weight gain. This makes it difficult to determine how much of the excessive body weight was primary and how much was due to the effect of medication. Findings from other studies have shown that secretagogues which include sulfonylureas (glyburide, glipizide and glimepiride), insulin and thiazolidinediones cause weight gain of 2–3 kg,[31] of up to 1.8 kg[32] and 1.5–4 kg,[33 34] respectively.

The association between overweight or obese and diabetic complications has also been reported in other studies, such as the KORA study and the National Health and Nutrition Examination Survey III where overweight and obesity among diabetes patients were associated with diabetic peripheral neuropathy.[35 36] Similarly, a number of studies have document associations between hypertension and overweight and/or obesity among T2DM patients,[37–40] perhaps reflecting clustering of components of the metabolic syndrome.[37 41]

Study strengths

To our understanding, this study is one of the first studies to report on the prevalence and factors associated with overweight and obesity among type 2 diabetes patients receiving diabetes care in a private not for profit health facility in Uganda. Determining the prevalence of overweight and obesity among type 2 diabetes patients is important as these are directly related to increased morbidity and mortality among diabetes patients as well as in the general population. The use of patients' routine care data over a 13-year period for this review has provided us with a large sample size which would not have been feasible otherwise.

Study limitations

Our study findings might have been affected by a selection bias and thus may not be generalisable to all type 2 diabetes patients as we have not included those who sought care from public non-paying health facilities. As with most clinic care records, the quality of data recorded is usually less satisfactory for research purposes, and in our case, the incomplete and missing data on weight and height might have biassed our findings. Additionally, these operational programme data were not designed for research purposes, thus was not validated, had no quality checks done for completeness and plausibility and we were only able to look at a limited number of variables documented in the patient's charts. Due to the changes in the general economic status in the country, the patients' economic status might have changed over the 13-year duration of the study from what it was at registration in the clinic. The method used by the health facility to classify SES and residence were not standardised and could have changed over the years.

CONCLUSION

Overweight and obesity were high among T2DM patients in this population and may contribute significantly to the burden and poor outcomes of T2DM. Female gender, middle and higher SES, age between 40 and 60 years, being on multiple antidiabetic drugs and having comorbidity or complications were associated with overweight and obesity. Appropriate control strategies to improve nutrition and promote weight loss are urgently needed to mitigate this increasing health challenge.

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Patient consent for publication Not required.

Ethics approval This study was nested within the bigger H3A Diabetes Multicentre study whose main aim was to assess the prevalence, environmental and genetic determinants of type 2 diabetes in sub-Saharan Africa. This study received approval form Uganda Virus Research Institute Research and Ethics Committee, reference number: UVRI REC 456, the Uganda National Council for Science and Technology, reference number: UNCST HS 1671, and administrative clearance was obtained from the Research Ethics Committee of St. Francis Hospital Nsambya. Patient's names were not included in the data extraction forms and the study was conducted in accordance with ethical principles and confidentiality was ensured throughout the study.

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Data availability statement Data are available upon reasonable request. Availability of data and materials. Data will not be shared publicly due to the data sharing policy of the MRC/UVRI and LSHTM Uganda Research Unit, which requires a prior data sharing agreement. However, the study protocol and a full data set containing the data supporting the study findings in this report can be obtained from the Unit Director, by email to: mrc@mrcuganda.org or the corresponding author. More clarification on this can be accessed through this website: https://www.mrcuganda.org/publications/data-sharingpolicy

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