The Open Public Health Journal

Content list available at: https://openpublichealthjournal.com

RESEARCH ARTICLE

Knowledge, Attitude, and Practices of Type 2 Diabetic Patients Regarding Obesity at Odi District Hospital, Tshwane District, South Africa

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Abstract:

Background:

Obesity is a major public health problem worldwide due to its links with diabetes, cardiovascular diseases, musculoskeletal disorders, and other disorders related to metabolic syndrome. Being obese or overweight is the main modifiable risk factor for type 2 diabetes. In 2019, more than 2.1 billion (30%) adults 18 years and older were overweight or obese globally. In the same year, in South Africa, nearly 70% of women and 31% of men were overweight or obese. Obesity can be prevented largely by lifestyle modification.

Objective:

This study aimed to assess the knowledge, attitudes, and practices of type 2 diabetic patients regarding obesity at a district hospital in South Africa.

Methods:

This was a cross-sectional study using a modified and validated interviewer-administered questionnaire on patients with type 2 diabetes mellitus attending a medical outpatient department at a district hospital. Systematic sampling was used to enroll participants.

Results:

Two hundred participants were enrolled. Women (60.5%) were more than men (39.5%), 60.2% were married, over half (51.83%) had high school education and above, and mean age was 58.20 years ± 11.06), mean BMI for males was 26.39 ± 4.63, and mean BMI for females was 30.54 ± 7.32.

The mean percentage knowledge, attitude, and practice (KAP) scores were 70.13±13.46, 83.43±19.24, and 35.43±25.05, respectively. Participants with high school education had high knowledge and attitude scores as compared to those with no formal education, 14.1% versus 5.9% and 66.2% versus 47.1%, respectively. The females had better KAP scores, 70.72±13.50, 84.42±18.99, and 35.77±24.82 compared to males, 69.24±13.44, 81.92±19.64, and 34.90±25.55, respectively.

Conclusion:

The study showed a high level of knowledge as well as positive attitudes regarding obesity. However, this did not translate to practice, which was very poor regarding regular exercise and healthy dietary habits.

Keywords: Obesity, Knowledge, Attitude, Practice, Type 2 diabetes mellitus.

Article History	Received: February 25, 2023	Revised: July 11, 2023	Accepted: August 16, 2023

1. INTRODUCTION

The recognition of obesity as a disease was, in theory, established in 1998 by the World Health Organization (WHO) [1]. Obesity has become a global epidemic, with an estimated 2,1 billion people being overweight or obese in 2019 [2]. This epidemic was once considered a problem in high-income countries; however, obesity rates are rising worldwide and affecting both developed and developing countries [3]. Obesity prevalence in developed countries, such as the United States, is as high as 26,6% in men and 32,2% in women above 20 years [2]. The prevalence of obesity in South Africa increased from 11.8% in 1980 to 23.3% in 2019, with 70% of women and 31% of men being overweight or obese [2, 3].

The causes of obesity are multifactorial and include environmental and individual factors. High energy

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consumption of animal fat, protein, and refined sugar has been on the increase, while less energy expenditure in the form of a sedentary lifestyle has caused a decrease in physical activity [1, 4, 5].

Obesity is an important risk factor for several non-communicable diseases. It is associated with increased risks for type 2 diabetes mellitus, hypertension, dyslipidaemia, metabolic syndrome, insulin resistance and diabetes mellitus, cardiovascular diseases, and non-alcoholic fatty liver disease [6 - 9]. There is an increased mortality from endometrial cancer in obese women and colorectal cancer in obese men [10]. One of the strongest links between obesity and disease is those with type 2 diabetes. Excess weight is behind 64% of cases of diabetes in men and 77% of cases in women [6].

Obesity is one of the leading preventable causes of death worldwide, with increasing rates in adults and children [4]. In 2010, overweight and obesity were estimated to cause 3.4 million deaths, 3.9% of years of life lost, and 3.8% of disability-adjusted life-years (DALYs) worldwide [11].

The number of people aged between 20 and 79 years who were estimated to die from diabetes in 2017 was approximately 4.0 (3.2-5.0) million, which was equivalent to one death every 8 seconds. Diabetes accounts for 10.7% of global all-cause mortality among people in this age group [12].

Sustained physical activity and dietary programs are shown to improve glycaemic control and plasma lipid in overweight and obese patients with type 2 diabetes mellitus [2]. A study reported that the incidence of diabetes was reduced by 58% with lifestyle intervention and by 31% with metformin compared to placebo [13].

It is, therefore, of utmost importance to have a public health approach to develop population-based strategies to improve patient weight for the prevention of diabesity.

1.1. Study Problem

During the researcher's clinical consultations, it was observed that most of the type 2 diabetic patients at a district hospital in South Africa were overweight with suboptimal blood glucose control. Further interaction with these patients revealed that most of them do not exercise or follow a healthy diet plan. These observations prompted the researchers to carry out this study to assess the knowledge, attitudes, and practices regarding obesity among type 2 diabetic patients attending a medical outpatient clinic.

1.2. Significance of the Study

Regrettably, not much research has been done on the knowledge, attitudes, and practices of type 2 diabetic patients regarding obesity, especially in developing countries. The results of this study will not only add to the body of knowledge on obesity but will also provide the baseline data needed for the implementation of strategies for the prevention and management of obesity.

1.3. Ethical Considerations

The research protocol was approved by the Sefako Makgatho Health Sciences University Research and Ethics Committee (SMUREC/M/365/2015: PG).

The permission to conduct the study at Odi District Hospital was obtained from the CEO of the hospital.

All participants signed written consent prior to the study, and they were made aware that they could withdraw from the study at any time. The confidentiality of the participants was maintained by anonymising data obtained from the study.

2. MATERIALS AND METHODOLOGY

2.1. Study Aim and Objectives

The aim of the study was to assess the knowledge, attitudes, and practices regarding obesity among type 2 diabetic patients attending the medical outpatient clinic at Odi district hospital.

The objectives of the study were;

1. To determine the demographic characteristics of type 2 diabetic patients attending the diabetic clinic at Odi district hospital.

2. To determine the knowledge of obesity among type 2 diabetic patients at Odi district hospital.

3. To determine the attitudes of type 2 diabetic patients regarding obesity at Odi district hospital.

4. To determine the practice of type 2 diabetic patients at Odi district hospital regarding obesity.

2.2. Study Design

This was a descriptive cross-sectional study using an interviewer-administered questionnaire.

2.3. Study Setting

The study was conducted at the medical outpatient department of Odi district hospital, situated in the Tshwane region of South Africa. It is a 227-bed level-one hospital that offers services, such as eye and dental clinics, a rehabilitation unit (social work, audiology, physiotherapy and dietician), and reproductive health. The hospital also has medical, surgical, paediatric, neonatal and maternity wards, as well as a 24-hour emergency unit and theatre services. It serves as a referral centre to about 19 clinics around the region. The region is peri-urban; the inhabitants are mainly black South Africans of low socioeconomic status.

2.4. Study Population

The study population was composed of all type 2 diabetic patients aged 30 years and above, attending the medical outpatient department from the 2nd of August to the 25th of October, 2016.

2.5. Sample Size

About four hundred type 2 diabetic patients visit the medical outpatient department at Odi district hospital monthly on average. This means that approximately a total of 1,200 patients were expected to be seen during the three-month

period of the study. The sample size of 196 participants was estimated using Epi info™ 7 at a 95% confidence interval with a prevalence of 18.75%. However, the researcher sampled 200 participants.

2.6. Inclusion Criteria

Type 2 diabetic patients aged 30 years and above who attended the medical outpatient department and were willing to participate in the study by giving written consent were included.

2.7. Exclusion Criteria

Patients with other types of diabetes mellitus, as well as type 2 diabetic patients who were too sick to participate in the study, were excluded.

2.8. Sampling Technique

A systematic sampling method was used to select 200 participants from a total of 1,200 type 2 diabetic patients who attended the medical outpatient department from the 2nd of August to the 25th of October, 2016. The formula k = N/n = interval size was used, where k = 1200/200 = 6. This means that every 6th eligible participant was included in this study, beginning with a randomly selected starting point between 1 and 6 [14].

2.9. Data Collection

The data were collected by the researcher and his two trained local assistants using an adapted standardized questionnaire. The assistants helped in administering the questionnaires, while the anthropometric measurements were done by the researcher.

The questionnaire was adapted from the questionnaire used by Okonta *et al*. in 2014 [15]. The questionnaire was validated by a pilot study that was conducted on 10 type 2 diabetic patients at the family practice unit of Dr. George Mukhari Academic Hospital.

The aim and objectives and the inclusion and exclusion criteria were explained to the participants. The eligible and willing participants signed a written informed consent before being enrolled in the study.

The questionnaire was divided into three sections:

2.9.1. Demographic Data

This section provides data on sex, age, marital status, and educational status.

2.9.2. Anthropometry

The weight (kg) and height (m) of all participants were measured with a calibrated weighing scale and stadiometer, respectively. The researcher calculated the BMI from the measured data.

2.9.3. Knowledge, Attitude, and Practice

These sections provided information on the knowledge, attitudes, and practices of the participants regarding obesity.

2.10. Data Analysis

Data was captured on Microsoft Excel 2007 by the researcher, and a statistician analysed the data using SPSS version 23 programme software. There were twenty-three questions on knowledge, seven questions on attitude, and seven questions on practice. One mark was given for each correct answer to the question.

For knowledge questions, the score ranges of 17 to 23, 8 to 16, and less than 8 were regarded as good, average, and poor knowledge, respectively. For questions on attitude, score ranges of 6 to 7, 3 to 5, and 0 to 2 were regarded as positive, neutral, and negative attitudes, respectively. For questions on practice, score ranges of 6 to 7, 3 to 5, and 0 to 2 were regarded as good, average, and poor practices, respectively.

The mean and standard deviation were used to describe knowledge, attitudes, and practice scores, while frequency and percentage were used to describe demographic and anthropometric data. P-values were calculated to ascertain the statistical significance of the findings. Results are displayed in tables.

2.11. Reliability and Validity

To ensure reliability, the researcher adapted the questionnaire used from a previously validated questionnaire.

To ensure validity, a pilot study on 10 type 2 diabetic patients was conducted at Dr. George Mukhari Academic Hospital.

2.12. Bias

2.12.1. Selection Bias

To minimise selection bias, a systematic sampling method was used to select all participants from all eligible type 2 diabetic patients.

2.12.2. Systematic Bias

The weighing scale used in this study was regularly calibrated, and the measuring tape used was non-elastic to minimise systematic bias.

2.12.3. Response Bias

This was minimised by declaring the confidentiality of the information to the participants prior to the study.

3. RESULTS

3.1. Demographic Characteristics of Participants

There were 79 male participants (39.5%) and 121 female participants (60.5%) Table (**1**).

The majority of participants, 87 (43.7%), were more than 60 years old. Sixty-seven of the participants (33.7%) were in the age group 51-60; 30 participants (15.1%) were in the age group 41-50, while 15 participants (7.5%) were in the age 30-40 Table (**1**).

The results showed that 118 (60.2%) of the participants were married, 54 participants (27.6%) were single, 16

participants (8.2%) were divorced, and 8 participants (4.1%) were widowed Table (**1**).

Table 1. Demographic information of participants.

Variable	Frequency	Percentage
Sex		
Male	79	39.5
Female	121	60.5
Total	200	100.0
Age groups (Years)		
30 – 40	15	7.5
41 – 50	30	15.1
51- 60	67	33.7
>60	87	43.7
Total	199	100
Marital Status		
Single	54	27.6
Married	118	60.2
Divorced	16	8.2
Widowed	8	4.1
Total	196	100
Level of Education		
No education	17	8.9
Primary school	75	39.3
High school	92	48.2
Tertiary education	7	3.7
Total	191	100

A total of 92 participants (48.2%) completed high school education, 75 participants (39.3%) completed primary school education, 7 participants (3.7%) completed tertiary education, and 17 participants (8.9%) did not have any formal education Table (**1**).

3.2. Anthropometric Characteristics of Participants

3.2.1. Body Mass Index of Participants

A total of 77 participants (39.5%) were overweight; 34 of them (17.4%) had class 1 obesity, 15 of them (7.7%) had class ll obesity, 16 of them (8.2%) had class lll obesity while 53 participants (27.2%) had normal BMI Table (**2**).

Table 2. Body mass index of participants.

Variables	Frequency	Percentage
18.5 – 24.9	53	27.2
25 – 29.9	77	39.5
30 – 34.9	34	17.4
35 – 39.9	15	7.7
>40	16	8.2
Total	195	100

3.2.2. Body Mass Index Versus Sex of Participants

More female participants (79.4%, 86.7%, 87.5%) were obese as compared to the male participants (20.6%, 13.3%, 12.5%) Table (**3**).

Table 3. Body mass index versus sex of participants.

BMI	Sex		P-value
	Male	Female	
18.5 – 24.9	30 (56.6%)	23 (43.4%)	0.345
25 – 29.9	36 (46.8%)	41 (53.2%)	0.578
30 – 34.9	7 (20.6%)	27 (79.4%)	0.004
35 – 39.9	2 (13.3%)	13 (86.7%)	0.027
>40	2 (12.5%)	14 (87.5%)	0.020

3.3. Knowledge Assessment of Participants

3.3.1. Individual Knowledge Characteristics

Table **4** presents a breakdown of the knowledge characteristics which were used to assess the individual participant's knowledge regarding obesity and their responses recorded as yes, no, and not sure. A total of 92% of the participants knew that obesity is a serious health problem, and 89.4% that healthy habits can control weight.

3.3.2. Global Knowledge of Participants Regarding Obesity

Table **5** shows that only 3 participants (1.5%) had scores ranging from 0 to 7, indicating poor global knowledge of obesity; 155 participants (77.5%) had average global knowledge of obesity with scores ranging from 8 to 16, while 42 participants (21.0%) with scores ranging from 17 to 23 had good global knowledge of obesity.

Table 4. Individual knowledge characteristics.

Knowledge Characteristics	Yes	No	Not Sure
The meaning of obesity	97 (49%)	82 (41.4%)	19 (9.6%)
Obesity is a serious health problem	183 (92%)	8 (4%)	8 (4%)
Regular exercise can help in controlling weight	193 (96.5%)	6 (3%)	1 (0.5%)
Regular exercise helps to reduce blood sugar	166 (84.7%)	17 (8.7%)	13 (6.5%)
Regular exercise helps to reduce blood pressure	152 (76.4%)	38 (19.1%)	9 (4.5%)
Regular exercise helps to enhance insulin action	70 (36.1%)	91 (46.9%)	33 (17%)
Regular exercise helps to improve blood circulation	175 (88.4%)	14 (7.1%)	9 (4.5%)
Regular exercise helps to improve sex life	111 (55.8%)	52 (26.1%)	36 (18.1%)
Regular exercise helps to decrease stress	177 (89.4%)	15 (7.6%)	6 (3%)
Healthy habits can control weight	177 (89.4%)	19 (9.6%)	2 (1%)
Healthy habits can reduce blood sugar	182 (91.9%)	11 (5.6%)	5 (2.5%)
Healthy habits can reduce blood pressure	165 (83.8%)	24 (12.2%)	8 (4.1%)

(Table 4) contd.....

Knowledge Characteristics	Yes	No	Not Sure
Eating low-fat foods is a recommended healthy lifestyle	191 (95.5%)	5 (2.5%)	4 (2%)
Eating less carbohydrates is a recommended healthy lifestyle	158 (79.4%)	33 (16.6%)	8 (4%)
Eating fibre-rich foods is a recommended healthy lifestyle	141 (71.2%)	31 (15.7%)	26 (13.1%)
Eating protein-rich foods is a recommended healthy lifestyle	167 (84.3%)	19 (9.6%)	12 (6.1%)
sugar intake is a recommended healthy lifestyle	66 (33.2%)	124 (62.3%)	9 (4.0%)
Skipping meals is a recommended healthy lifestyle	69 (34.7%)	118 (59.3%)	12 (6.0%)
Regular fruit intake is a recommended healthy lifestyle	157 (80.8%)	31 (16%)	6 (3.1%)
Alcohol intake is a recommended healthy lifestyle	86 (43%)	105 (52.8%)	8 (4.0%)
Cigarette smoking is a recommended healthy lifestyle	82 (41%)	107 (53.5%)	11 (5.5%)
Any food in the right portion is a recommended healthy lifestyle	131 (67.5%)	45 (23.2%)	18 (9.3%)

Table 5. Global knowledge scores of participants regarding obesity.

Knowledge Score	Number of Participants	Percentage (%)
Poor knowledge (less than 8)	3	1.5%
Average knowledge (8 -16)	155	77.5%
Good knowledge (17 – 23)	42	21.0%
Total	200	100%

3.3.3. Demographic Characteristics vs. Knowledge Score

Table **6** shows the participants' demographic characteristics (sex, age, education status, and marital status) versus their obesity knowledge scores indicated as good, average and poor. All male participants had good or average knowledge regarding obesity (20.3% and 79.7%, respectively). Only 2.5% of female participants had poor knowledge regarding obesity. There were no participants with high school education who had poor knowledge regarding obesity. Moreover, 11.8% of participants with no education had poor knowledge regarding obesity.

3.4. Attitude Assessment of Participants

3.4.1. Individual Attitude Characteristics

Table **7** shows attitude characteristics assessed for each participant and their attitude scores recorded as correct, incorrect, and not sure. A majority (91.3%) of the participants had the correct attitude about the need to control their weight and that exercise and dietary management can prevent obesity (93.8 and 90.2%, respectively).

Table 6. Demographic characteristics *vs*. knowledge score.

Demographic Characteristic	Knowledge Score		
	Good 17 – 23	Aver 8 – 16	Poor < 8
Sex			
Male	16 (20.3%)	63 (79.7%)	0 (0)
Female	26 (21.5%)	92 (76.0%)	2 (2.5%)
P-value (Male *vs*. Female)	0.138	0.022	-
Age group			
30 – 40 years	5 (22.2%)	10 (66.7%)	0 (0.0%)
41 – 50 years	4 (13.3%)	26 (86.7%)	0 (0.0%)
51 – 60 years	20 (29.9%)	45 (67.2%)	2 (3.0%)
> 60 years	13 (14.9%)	73 (83.9%)	1 (1.1%)
P-value (≤50 vs >50 years)	0.002	< 0.0001	-
Education			
No education	1 (5.9%)	12 (82.4%)	2 (11.8%)
Primary school	24 (32%)	50 (66.7%)	1 (1.3%)
High school	13 (14.1%)	79 (85.9%)	0 (0.0%)
Tertiary education	4 (57.1%)	3 (42.9%)	0 (0.0%)
P-value (no high school education versus high school education)	0.232	0.138	-
Marital status			
Single	12 (22.2%)	41 (75.9%)	1 (1.9%)
Married	23 (19.5%)	93 (78.8%)	2 (1.7%)
Divorced	6 (37.5%)	10 (62.5%)	0 (0.0%)
Widowed	1 (12.5)	7 (87.5%)	0 (0.0%)

Table 7. Individual attitude characteristics.

Attitudes Characteristics	Correct	Incorrect	Not Sure
The need for people to control their weight	179 (91.3%)	15 (7.7%)	2 (1%)
The need for people to change their weight	140 (71.8%)	46 (23.6%)	9 (4.6%)
Exercise improves one's condition	178 (90.8%)	14 (7.1%)	4 (2%)
Healthy eating diet can improve diabetes	163 (83.6%)	26 (13.3%)	6 (3.1%)
Diabetics are responsible for self-care	150 (76.9%)	38 (19.5%)	7 (3.6%)
Obesity can be prevented by exercise	183 (93.8%	10 (5.1%)	2 (1%)
Obesity can be prevented by dietary management	175 (90.2%)	17 (8.8%)	2 (1%)

3.4.2. Global Attitude Scores

Table **8** shows that only 11 participants (5.5%) had scores ranging from 0 to 2, indicating a negative attitude towards anti-obesity intervention; 52 participants (26.0%) had scores ranging from 3 to 5, indicating a neutral attitude; and 137 participants (68.5%) had scores ranging from 6 to 7, indicated positive attitude towards anti-obesity interventions.

Table 8. The attitude score of participants regarding obesity.

Attitude Score	Frequency	Percentage (%)
Negative attitude (0 – 2)	11	5.5%
Neutral attitude (3 – 5)	52	26.0%
Positive attitude (6 – 7)	137	68.5%
Total	200	100%

3.4.3. Demographic Characteristics vs. Attitude Scores

Table **9** shows the participants' demographic characteristics (sex, age, education status and marital status) versus their attitude scores, indicated as positive, neutral, and negative. More female than male participants had a positive attitude regarding obesity (71.1% and 64.6%, respectively). Participants with high school education had a positive attitude regarding obesity more than those with no education (66.3% and 47.1%, respectively).

3.5. Practice Assessment of Participants

3.5.1. Individual Practice Characteristics

Table **10** shows that only 62 (46.3%) of the 131 participants who said they exercise regularly actually exercise at least 5 times per week, and only 26 (19.7%) of them exercise 30 minutes or more per day. Of the 66 (34.2%) participants out of 199 participants who answered yes to following a healthy diet plan, only 39 (53.4%) of them followed the healthy diet plan regularly. Only 50 (25.1%) of the participants monitored their weight, while 85 (42.7%) still added table sugar to their tea/food.

Table 9. Demographic characteristics *vs*. attitude scores.

Demographic Characteristic	Attitude Score		
	Positive (6 – 7)	Neutral (3 – 5)	Negative (0 – 2)
Sex			
Male	51 (64.6%)	22 (27.8%)	6 (7.6%)
Female	86 (71.1%)	30 (24.8%)	5 (4.1%)
P-value (Male *vs*. Female)	0.004	0.228	0.777
Age group			
30 – 40 years	12 (80.0%)	1 (6.7%)	2 (13.3%)
41 – 50 years	18 (60.0%)	11 (46.7%)	1 (3.3%)
51 – 60 years	49 (73.1%)	15 (22.4%)	3 (4.5%)
> 60 years	57 (65,5%)	25 (28.7%)	5 (5.7%)
P-value (≤50 vs >50 years)	<0.0001	0.007	0.191
Education status			
No education	8 (47.1%)	6 (35.3%)	3 (17.6%)
Primary school	55 (78.7%)	15 (20.0%)	1 (1.3%)
High school	61 (66.3%)	25 (27.2%)	6 (6.5%)
Tertiary education	5 (71.4%)	2 (28.6%)	0 (0.0%)
P-value (no high school education *vs*. high school education	0.930	0.399	0,556
Marital status			
Single	40 (74.1%)	11 (20.4%)	3 (5.6%)
Married	82 (69.5%)	30 (25.4%)	6 (5.1%)
Divorced	11 (68.8%)	4 (25.0%)	1 (6.3%)
Widowed	4 (50.0%)	3 (37.5%)	1 (12.5%)

Table 10. Individual practice characteristics.

Practice Characteristics	Yes	No	Not Sure
Exercising regularly	131 (65.5%)	61 (30.5%)	8 (4%)
Exercising ≥ 5 times/week	62 (46.3%)	72 (53.7%)	0 (0.0%)
Exercising ≥ 30 mins/day	26 (19.7%)	106 (80.3%)	0 (0%)
Following a healthy diet plan	68 (34.2%)	125 (62.8%)	6 (3%)
Following a healthy diet plan regularly	39 (53.4%)	34 (46.6%)	0 (0.0%)
Adding sugar to tea/food	85 (42.7%)	103 (51.8%)	11 (5.5%)
Monitoring weight	50 (25.1)%	135 (67.8%)	14 7%)

3.5.2. Global Practice Scores

The majority of the participants, 101(50.5%), had scores ranging from 0 to 2, indicating poor practice regarding obesity; 91 participants (45.5%) had average practice in the range of 3 to 5, while 8 participants (4%) had good practices regarding obesity with scores ranging from 6 to 8 (Table **11**).

Table 11. The practices of participants regarding obesity.

Practice Score	Frequency	Percentage
Good (6 – 7)	8	4%
Average (3 -5)	91	45.5%
Poor (0 -2)	101	50.5%
Total	200	100%

Table 12. Demographic characteristics *vs*. practice scores.

Demographic Characteristic	Practice Score		
	Good (6 – 7)	Average (3 -5)	Poor (0 -2)
Sex			
Male	4 (5.1%)	35 (44.3%)	40 (50.6%)
Female	4 (3.3%)	56 (46.3%)	61 (50.4%)
P-value (Male *vs*. Female)	1.000	0.034	0.041
Age group			
30 – 40 years	1 (6.7%)	7 (46.7%)	7 (46.7%)
41 – 50 years	0 (0.0%)	13 (43.3%)	17 (56.7%)
51 – 60 years	3 (4.5%)	32 (47.8%)	32 (47.8%)
> 60 years	4 (4.6%)	39 (44.8%)	44 (50.6%)
P-value (≤50 *vs*. >50 years)	0.112	<0.0001	<0.0001
Education status			
No education	0 (0.0%)	6 (35.3%)	11 (64.7%)
Primary school	6 (8.0%)	38 (50.7%)	31 (41.3%)
High school	2 (2.2%)	42 (45.7%)	48 (52.2%)
Tertiary education	0 (0.0%)	2 (28.6%)	5 (71.4%)
P-value (no high school *vs*. high school)	0.237	1.000	0.225
Marital status			
Single	2 (3.7%)	19 (35.2%)	33 (61.1%)
Married	5 (4.2%)	58 (49.2%)	55 (46.6%)
Divorced	0 (0.0%)	10 (62.5%)	6 (37.5%)
Widowed	1 (12.5%)	4 (50.0%)	3 (37.5%)

3.5.3. Demographic Characteristics vs. Practice Scores

Table **12** shows the participants' demographic characteristics (sex, age, education status and marital status) versus their practice scores indicated as good, average, and poor. Only 5.1% of males and 3.3% of females had good practice scores. All participants of different age groups and education statuses had poor practice scores.

Table 13. KAP scores.

KAP Scores	Mean ± Standard Deviation
Knowledge mean score	Mean 70.1 ± 13.5
Attitude mean score	Mean 83.4 ± 19.2
Practice mean score	Mean 35.4 ± 25.1

3.6. Knowledge, Attitude, and Practice (KAP) Scores

The participants' knowledge and attitude mean scores, 70.1 ± 13.5 and 83.4 ± 19.2, respectively, were higher as compared to their practice mean score of 35.4 ± 25.1 (Table **13**).

4. DISCUSSION

4.1. Age Distribution of Participants

A majority of the participants belonged to the age groups above 60 years (43.7%) and 51 to 60 (33.7%). This reflects the fact that type 2 diabetes usually has an onset after 40 years. According to the American Diabetes Association, adults aged 45 to 64 were the most diagnosed age group for diabetes. This finding is similar to the study published in 2014 by Okonta *et al*., where the majority of the participants (42.9%) fell within the age group 51 to 60 years [15]. Another study on the knowledge, attitude, and practices of adult patients with type 2 diabetes in the Free State province of South Africa also reported similar age trends where the median age of participants was 57 years [16]. It is important to note that 7.5% of participants belong to the age group 30 to 40 years. Although type 2 diabetes usually has an onset above age 40 years, it is becoming more common in adolescents and young adults due to poor lifestyle habits [16].

4.2. Sex Distribution of Participants

The majority of the participants (60.5%) were females as compared to 39.5% of males. This finding is in agreement with the results from a similar study by Okonta *et al*., in which 81.1% of the participants were female and 18.9% were males [15]. A similar study conducted in 2019 in the Free State province of South Africa also reported the majority of the participants to be females, i.e., 76.1% [16]. Another study on the assessment of glycaemic control in stable type 2 black South African diabetics attending a peri-urban clinic reported that 72.5% of the participants were females while 27.5% were males [17]. The higher number of female patients could be

attributed to the fact that females are more likely than males to seek medical help.

4.3. Distribution of Participants by Level of Education

Most of the participants had a high school education (48.2%). Only 8.9% of the participants had no formal education. This contrasts with the findings by Okonta *et al*., where it was reported that 93.4% of the respondents either had no formal education (49.5%) or had only primary education (43.9%) [15]. Erasmus *et al*. also reported that 70.6% of the patients in their study had less than standard 8 education [17]. However, the level of education of the participants in this study is in concordance with the findings by Roux *et al*., who also reported that only 9.8% of the participants had no formal education [16].

4.4. Knowledge Assessment of Participants

The participants in this study had a high overall knowledge of obesity, as evidenced by an overall knowledge score of 70.1%. This is consistent with the knowledge score of 60% recorded in a similar study in Bangladesh by Saleh *et al*. [18].

Surprisingly, the high knowledge is in contrast to the finding of extremely poor knowledge documented in a similar study in South Africa, where 92.6% of participants had poor knowledge [15]. The high knowledge level could be attributed to the on-going health education during clinic consultation as well as the relatively good level of education among the participants. The nurses provide health education on some topics, such as diet, exercise, adherence to medication, and self-foot care, to the patients in the medical outpatient department of Odi District Hospital. The study by Okonta *et al*. also reported a low level of education, where only 6.6% and none of the participants had high school education and tertiary education, respectively, compared to 48.2% and 3.7% of participants in this study [15].

Another contrasting result was reported in a study among adult type 2 diabetic mellitus patients in Free State, South Africa, in which the majority of the participants (n = 222; 87.1%) were black women who were overweight and obese. The study reported poor knowledge in a very high percentage of the participants, which might contribute to morbidity and mortality [16].

Similarly, a study in Pakistan on knowledge, attitude, and practices of patients visiting a diabetes care unit, in which fifty-seven percent of the patients were overweight or obese, reported a poor overall knowledge about diabetes mellitus by 54% of the participants while only 13% of the participants had good knowledge about the disease [19].

4.5. Attitude Assessment of Participants

A significantly high proportion of the participants (83.43%) showed a positive attitude toward anti-obesity interventions, which is consistent with the findings of high positive attitudes among participants in a similar study by Okonta *et al*., where 84.3% of the respondents had positive attitudes [15]. This finding is also in agreement with the findings of a similar study where an attitude score of 79.30% was reported [18].

Similarly, the overall level of attitude was found to be good both in type 2 diabetic and nondiabetic participants in a knowledge, attitude, and practice study regarding diabetes mellitus among nondiabetic and diabetic study participants in Bangladesh [20].

The positive attitude of the participants towards anti-obesity interventions found in the study could be due to the positive linear relationship between knowledge and attitude.

4.6. Practice Assessment of Participants

An important finding of this study is a very low mean practice score of 35.43% among the participants. A majority (62.8%) of the participants had poor dietary practices, 80.3% did not exercise up to 30 minutes per day, and 67.8% did not monitor their weight. These findings were consistent with findings in similar studies by Okonta *et al*. [15], where 97.7% of the respondents had poor practices, and by Kiberenge *et al*. [21], where 75.6% of the respondents were reported to have bad practices. However, a similar study in Bangladesh recorded a high mean practice score of 55.5%, where it was found that males had significantly better practice compared to females [18]. It is a disturbing fact that the high level of knowledge and attitude did not translate to a high level of practice. A reasonable explanation is that the most overweight and obese participants are females. Females are less likely to go for exercise early in the morning or late in the evening by themselves for fear of being attacked and/or raped. Moreover, participants in this study are from a low socioeconomic background and, hence, can neither afford to pay for a well-equipped indoor training facility nor afford to maintain a good dietary plan.

CONCLUSION AND RECOMMENDATIONS

The study showed a high level of knowledge as well as a positive attitude regarding anti-obesity interventions. However, this did not translate to practice, which was poor regarding regular exercise and healthy dietary plans. The fact that 72.8% of the participants were either overweight or obese reflects the poor practices as well as the strong link between obesity and type 2 diabetes. There is an urgent need to develop programs that can help increase physical exercise and adherence to healthy dietary plans in the community. These programs will go a long way in controlling the diabetes of the patients as well as ameliorating the negative impact of obesity on the health of these patients.

The researcher recommends the following at Odi district hospital:

1. Continuing health education and promotion should be ensured during hospital visits.

2. Healthcare practitioners should be trained to provide brief counselling and motivational interviews for patients with obesity and overweight on diet/lifestyle changes that suit their economic status.

3. There is a need for the South African district health facilities to develop and make education programs focusing on

empowering the patients to transform their knowledge and attitude into practice.

4. Through the help of ward-based community outreach teams, patients should be encouraged to do home-based exercises, like brisk walking, for at least 30 minutes five to seven days a week.

LIMITATIONS OF THE STUDY

The researchers used a cross-sectional study design; hence, the cause and effect of the research findings could not be established. Furthermore, the study was conducted in a predominantly African community with low socioeconomic status, so the findings might not be a true reflection of the multiracial South African population. Finally, the paucity of literature on the knowledge, attitude, and practice of type 2 diabetic patients regarding obesity, especially in Africa, made it difficult for the researcher to have a lengthy discussion.

Future studies should include:

• The impact of daily 30 minutes of brisk walking on overweight and obese diabetic type 2 patients in the same setting as this study.

• Knowledge, practice, and attitude of type 2 diabetic patients of affluent communities of South Africa.

• The perception of overweight and obesity among diabetic patients living in poor communities of South Africa.

• The individual characteristics of this study participants on their knowledge, attitude, and practice regarding obesity need discussion.

AUTHORS' CONTRIBUTIONS

UE. O conducted the study and drafted the manuscript. K.E. H supervised the study, edited, and proofread the manuscript. Both authors agreed to submission to the Open Public Health Journal for publication.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The research protocol was approved by the Sefako Makgatho Health Sciences University Research and Ethics Committee (SMUREC/M/365/2015: PG).

The permission to conduct the study at Odi district hospital was obtained from the CEO of the hospital.

HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All procedures performed in studies involving human participants were in accordance with the ethical standards of institutional and/or research committee and with the 1975 Declaration of Helsinki, as revised in 2013.

CONSENT FOR PUBLICATION

Informed consent was obtained from all the participants of this study.

AVAILABILITY OF DATA AND MATERIALS

The data supporting the findings of this article is still under lock and key with the Main researcher, Dr Umeadim Okafor. However, l am making an arrangement to transfer the data to Sefako Makgatho University department of Family Medicine as soon as possible.

STANDARDS OF REPORTING

STROBE guidelines were followed.

FUNDING

This study was funded by Discovery Foundation. The award number is 036940

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

The authors are grateful for the contributions of Prof. H. S. Schoeman, who assisted with data analysis.

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