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ARTICLE

# Nutritional status, glycaemic control and barriers to treatment compliance among patients with type 2 diabetes attending public primary health clinics in Maseru, Lesotho

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**Objectives:** To evaluate the nutritional status, glycaemic control and barriers to treatment compliance of outpatients with type 2 diabetes mellitus (T2DM) attending two public primary health clinics in Maseru, Lesotho.
**Design**: Cross-sectional analytical study.
**Setting:** Lesotho Defence Force Clinic and Domiciliary Clinic.
**Subjects**: 124 participants with T2DM, 30–69 years.
**Outcome measures**: Sociodemography, medical history, diet, lifestyle, metabolic risk-related anthropometry, glycaemic and metabolic control, and barriers that may impact on treatment compliance.
**Results:** Participants (53.9; SD 9.4 years; 79.5% females; 53.3% diagnosed for > 5 years) were knowledgeable about basic lifestyle recommendations for diabetes, and reported being active (98.3%). However, 88.5% were overweight or obese; 93.4%, 78.1%; 66.1% did not meet the recommended intakes of dairy, vegetables and fruit; 10.7% used tobacco; and 52% of men drank excessively. None performed blood glucose self-monitoring, and 90.2% were ignorant of normal blood glucose ranges, while 94.3% had uncontrolled hypertension despite being on anti-hypertensive medication. Participants were rarely screened for long-term glycaemic control or comorbidities, or referred to dietitians, but 98.4% were satisfied with the services.
**Conclusions:** In this setting, patients were not meeting treatment goals for T2DM, and were not being screened or referred, rendering clinic visits a revolving door that poses the risk of costly complications.

**Keywords:** barriers to treatment compliance, glycaemic control, Lesotho, nutritional status, type 2 diabetes mellitus

## Introduction

According to the 2017 edition of the International Diabetes Federation (IDF) Diabetes Atlas, an estimated 451 million (one in 11) adults were living with diabetes; half of them undiagnosed.[1] These figures constitute a 2.8 fold increase in the global prevalence of diabetes since 2000.[2] Low- and middle-income countries carry almost 80% of the diabetes burden.[1] In sub-Saharan Africa, diabetes was estimated to affect 16 million adults in 2017, with 70% of these cases being undiagnosed.[1] By 2045, this figure is predicted to escalate by 156% to 41 million,[1] with projected crippling effects on emerging economies of developing countries in the region due to both the direct costs and the costs of complications.[3,4]

The vast majority of diabetes cases in Africa are type 2 diabetes (T2DM), which is mostly preventable.[1] The escalation in the prevalence of T2DM in the sub-Saharan region is attributed to globalisation of food markets and rapid urbanisation associated with demographic and socioeconomic changes that are causing an ongoing transition from traditional to more Westernised eating patterns.[3,5] Traditional high-fibre, low-fat diets, associated with diverse intake of wild and self-cultivated fruits and vegetables, and physically active lifestyles, have been replaced by diets high in ultra-processed, low-fibre, high-fat, sugar-laden foods, inadequate intakes of fruits and vegetables, little overall dietary diversity and increasingly sedentary lifestyles.[3,5] In parallel with the nutrition transition, the prevalence of obesity and associated non-communicable diseases, including diabetes, has been steadily increasing in sub-Saharan Africa.[5] Also, high prevalence of early childhood malnutrition and stunting in the region and the associated intrauterine physiological adaptations to a food insecure environment further predisposes the affected populations to adult obesity, T2DM and other non-communicable diseases,[6] particularly in the increasingly prevailing obesogenic food environments.[3,5]

Unmanaged, the diabetes epidemic leads to severe health complications, including cardiovascular disease, renal impairment and renal failure, impairment of eyesight, venous ulcers and amputations, amongst others, all of which further impact on already struggling healthcare systems.[4,5] Lifestyle interventions with proper diet and physical activity are effective in preventing and treating diabetes,[6,7] and many international diabetes organisations are continuously updating guidelines in this regard.[8] Guidelines, however, only achieve their goal if people know about and follow them; thus, understanding the barriers to compliance in different settings is very important to optimise diabetes care.[9]

The IDF Africa Region currently represents 35 diabetes organisations in 32 countries, including Lesotho.[10] In 2015, the IDF reported 30 300 known cases of diabetes in this landlocked mountainous kingdom, which constituted a prevalence of 2.7%.[10] While these obesity and diabetes rates are still lower than those in surrounding South Africa, upward trends in both these parameters are evident in Lesotho.[11] Also, the true prevalence of diabetes in Lesotho is probably grossly underestimated, as comprehensive surveys are lacking,[12] while under-diagnosis in sub-Saharan Africa is common due to a lack of access to healthcare facilities, poorly trained healthcare providers, and lack of screening and referral systems.[3] As in many other developing countries, very little research has focused on compliance with recommendations for managing diabetes effectively. This study, therefore, aimed to describe the nutritional status, glycaemic and metabolic control, and barriers to treatment compliance among patients with T2DM, treated in outpatient facilities in Maseru, Lesotho.

## Methods

### Study design, setting and study population

A cross-sectional analytical study was conducted amongst outpatients with T2DM attending clinics in Maseru. At the time of data collection, from October 2012 to March 2013, outpatients with diabetes were being managed at the Queen Mamohato Memorial Hospital, three private–public partnership clinics, and two District Health Management Team (DHMT) clinics around Maseru. Based on available clinic statistics, the number of patients managed at these six clinics was projected to be between 1 300 and 2 050 at the time of data collection. A sample size of 120 was, thus, estimated to represent 10% of the population with T2DM who were being managed by all the clinics in Maseru at the time.

### Ethical considerations

The Ethics Committee of the Faculty of Health Sciences, University of the Free State (reference number ECUFS 162/2012) and the Ethics Committee of the Ministry of Health (MOH) (ID 45/2012) approved this study. Unfortunately, permission to perform the research was only granted for the DHMT clinics by the District Focal Officer for Maseru, through the Director-General Ministry of Health. All participants signed informed consent.

### Sampling

A convenience sample of 122 participants with T2DM, who attended the Domiciliary Clinic (on Tuesdays and Wednesdays) and Lesotho Defence Force (LDF) clinic (on Wednesdays and Thursdays), and who had been formally diagnosed with T2DM by a healthcare professional, were recruited for the study. Patients were eligible for inclusion in the study if they were receiving dietary and lifestyle treatment, oral glucose-lowering therapy, alone or in combination with insulin, and were between 30 and 69 years old (which is the age range accommodated in the International Physical Activity Questionnaire [IPAQ]).

### Data collection

Questionnaires, available in English and Sesotho, were administered during structured interviews with the participants to collect data regarding sociodemographic factors, dietary intakes, lifestyle factors and barriers that may impact on treatment compliance. These interviews were conducted in private rooms at the clinics by a registered dietitian, who was native to Maseru, Lesotho, and, therefore, familiar with the culture of the area, as well as fluent in English and the Sesotho dialect spoken in Lesotho.

After completion of the structured interview, the researcher took the anthropometric measurements of each participant. Height and weight were measured according to standardised techniques,[13] recording an average of three readings. Waist circumference (WC) was measured in the horizontal plane, halfway between the lowest ribs and the iliac crest, as proposed by the IDF and WHO.[14]

A non-quantified food frequency questionnaire (FFQ) was compiled to reflect the frequency (daily, weekly, monthly or occasionally) with which locally available foods were consumed. Thus, overall dietary patterns, rather than precise nutrient intakes, were assessed.[15] Participants were also asked in a separate part of the questionnaire to recall what foods and beverages they ate on a typical weekday, to obtain an estimate of daily amounts in the various food groups that were typically consumed. Food photographs, packaging and local household utensils were used to estimate usual portion sizes. During the structured interviews, smoking habits and alcohol intake were also recorded, and the validated IPAQ Long Form (IPAQ-L) was used to assess physical activity levels.[16,17]

Data on medical history and biochemical parameters to assess glycaemic control and risk for diabetes-associated long-term complications were obtained from the participants' medical files and *bukanas* (patients' health passports, which they bring to each clinic visit for the recording of relevant medical information).

A questionnaire was compiled to assess barriers to compliance with SEMDSA guidelines for the management of T2DM,[8] and included questions related to clinic visits, knowledge, attitudes, and practices regarding diet and lifestyle and self-management of diabetes, as well as the perceived role of supernatural powers, and the use of traditional medicine and supplements for the treatment of diabetes. Questions were also included regarding the sources from which participants had received information on self-management of their condition. All questions were directly related to the aim and the objectives of the study and based on an in-depth review of the literature to increase the content validity of the questionnaire. Four registered dietitians who were experts in the field also evaluated the questionnaire to ensure content validity.

The questionnaires and anthropometric data collection were piloted on five patients attending one of the clinics, who met the inclusion criteria. The data from these patients were included in the study as only very minor adjustments to the questionnaire were necessary after the pilot study.

### Data analysis

Data were analysed with the assistance of the Department of Biostatistics of the Faculty of Health Science of the University of the Free State, using SAS® software 9.3 (SAS Institute, Cary, NC, USA). Categorical data are presented as frequencies and percentages, and continuous data as medians and ranges or means and standard deviations.

BMI (kg/m$^2$) was calculated and interpreted according to WHO international BMI categories.[18] Waist circumference was interpreted according to the IDF cut-offs for sub-Saharan populations to indicate cardio-metabolic risk, which defines central obesity as WC of $\geq$ 94 cm in males and $\geq$ 80 cm in females.[19] Waist-to-height ratio (WHtR; calculated as WC/height), which is another sensitive indicator of health risks associated with central obesity, was interpreted according to the universal cut-off of 0.5.[20]

Standard exchange lists, compiled according to the recommendations of the American Dietetic Association,[21] were used to quantify estimated food intake into the number of portions from each food group consumed on a typical weekday. Daily intake per food group was compared with recommendations for metabolic health in adults.[15,22] The level of physical activity was interpreted according to published guidelines for the IPAQ-L.[23]

Cardio-metabolic control was assessed according to SEMDSA targets[8] for cardiovascular risk factors (fasting blood glucose between 4.0 and 7.0 mmol/l, total serum triglycerides < 1.7 mmol/l, total serum cholesterol < 4.5 mmol/l, HDL cholesterol > 1.0 mmol/l in men, and > 1.2 mmol/l in women, and blood pressure ≤ 140/80 mmHg. Glycaemic control was assessed according to the SEMDSA targets of HbA1c < 7%, and fasting capillary blood glucose levels, 4.0–7.0 mmol/l.[8]

## Results

The final sample comprised 122 participants, mostly females (79.5%). All of the participants indicated that they visited the clinics only every third month when their medication was dispensed for collection. The mean age was 53.9 (SD 9.4) years for the whole group (females: 54.6 (SD 9.2) years; males: 51.0 (SD 9.9) years). The sociodemographic information, duration of diagnosis, treatment modality and previously diagnosed comorbidities of the participants are presented in Table 1. Slightly more than half of the participants (53.3%) had been diagnosed with T2DM within five years of the study. Most were being treated with oral agents only (68.0%), a fifth with insulin only (19.7%), and less than a tenth with a combination of the two (8.2%), while only 4.1% were being treated with lifestyle adaptations alone. A few reported that, to their knowledge, they had been diagnosed with microvascular complications before the study (Table 1). However, no evidence of routine screening for comorbidities was indicated in the *bukanas* or clinic files of the majority of the participants.

Overall, 72.1% of the sample were married, and 12.3% of the women were widowed. About a third (30.3%) of the participants had only some primary school education, and about half (48.4%) had some secondary school education; 69.2% were formally or self-employed (65% of the females and 84.0% of the males), and 53.7% had an income at the lower end of the income range. Most females (63.9%) had income at the lower end of the income range, with only about 9.3% earning income at the higher end of the range. Conversely, 37.5% of the males had income at the higher end of the range, with only 12.5% at the lower end of the range. While most participants had three to four dependants, 41.3% of the females had more than four dependants.

Table 2 summarises the anthropometric data. Only 11.5% of the sample had a normal BMI (7.2% of females; 28% of males), while 86.8% (92.9% of females; 72.0% of males) were overweight or obese. Similarly, less than 2% had normal WC and WHtR.

Table 3 summarises the dietary patterns according to the FFQ. The only starchy foods that participants consumed daily were maize porridge and brown bread, while cereals, namely *mobile* (sorghum) porridge, oat porridge, *motoho* (sour porridge), Weet-Bix, mealie rice and dried beans (legumes), were consumed only on a weekly basis.

According to the FFQ, 63.1% of participants ate fruit daily; however, 66.1% of participants consumed fewer than the recommended two to four servings of fruit per day (Table 4). Overall, 32.0% of participants consumed fruit only on a weekly basis. Participants reported that they did not commonly consume wild fruits, fruit juice, dried and canned fruits.

**Table 1:** Sociodemographics, duration of diagnosis, treatment modality and previously diagnosed comorbidities

| Variables | Frequency/percentages | | | | | |
|---|---|---|---|---|---|---|
| | Total group (*n* = 122) | | Females (*n* = 97) | | Males (*n* = 25) | |
| | *n* | % | *n* | % | *n* | % |
| **Area of residence:** | | | | | | |
| Urban Maseru | 111 | 91.1 | 86 | 88.7 | 25 | 100.0 |
| Rural Maseru | 11 | 9.0 | 11 | 11.3 | 0 | 0.0 |
| **Marital status:** | | | | | | |
| Married | 88 | 72.1 | 67 | 69.1 | 21 | 84.0 |
| Single | 16 | 13.1 | 14 | 14.4 | 2 | 8.0 |
| Divorced | 1 | 0.8 | 0 | 0.0 | 1 | 4.0 |
| Separated | 2 | 1.6 | 1 | 0.0 | 1 | 4.0 |
| Widowed | 15 | 12.3 | 15 | 15.5 | 0 | 0.0 |
| **Number of dependants:** | | | | | | |
| 1–2 | 24 | 19.4 | 16 | 16.5 | 8 | 32.0 |
| 3–4 | 54 | 44.4 | 41 | 42.3 | 13 | 52.0 |
| 5–6 | 35 | 28.7 | 31 | 32.0 | 4 | 16.0 |
| 7–8 | 6 | 4.9 | 6 | 6.2 | 0 | 0.0 |
| > 8 | 3 | 2.5 | 3 | 3.1 | 0 | 0.0 |
| **Level of education:** | | | | | | |
| Tertiary education | 10 | 8.2 | 5 | 5.2 | 5 | 20.0 |
| College or vocational schools | 15 | 12.3 | 12 | 12.4 | 3 | 12.0 |
| Some secondary school | 59 | 48.4 | 47 | 48.5 | 12 | 48.0 |
| Some primary school | 37 | 30.3 | 33 | 34.0 | 4 | 16.0 |
| No schooling | 1 | 0.8 | 0 | 0.0 | 1 | 4.0 |
| **Employment status:** | | | | | | |
| Employed | 52 | 42.6 | 41 | 42.3 | 11 | 44.0 |
| Self-employed | 32 | 26.6 | 22 | 22.7 | 10 | 40.0 |
| Unemployed | 14 | 12.6 | 14 | 14.4 | 4 | 16.0 |
| Pensioner | 12 | 9.8 | 8 | 8.3 | 0 | 0.0 |
| Homemaker | 12 | 9.8 | 12 | 12.4 | 0 | 0.0 |
| **Income level:** | *n* = 121 | | *n* = 97 | | *n* = 24 | |
| M0.300–M1 500 | 65 | 53.7 | 62 | 63.9 | 3 | 12.5 |
| M1 500–M2 700 | 13 | 10.7 | 7 | 7.2 | 6 | 25.0 |
| M2 700–M3 900 | 15 | 12.4 | 9 | 9.3 | 6 | 25.0 |
| M3 900–M4 100 | 10 | 8.3 | 10 | 10.3 | 0 | 0.0 |
| M4 100–M5 300 | 18 | 14.9 | 9 | 9.3 | 9 | 37.5 |
| **Duration of diabetes:** | | | | | | |
| 0–5 years | 65 | 53.3 | 48 | 49.5 | 17 | 68.0 |
| 6–10 years | 32 | 26.2 | 28 | 28.9 | 4 | 16.0 |
| 11–15 years | 20 | 16.4 | 17 | 17.5 | 3 | 12.0 |
| > 15 years | 5 | 4.1 | 4 | 4.1 | 1 | 1.0 |
| **Treatment modality:** | | | | | *n* = 25 | |
| No insulin or oral agents | 5 | 4.1 | 4 | 4.1 | 1 | 4.0 |
| Oral agents | 83 | 68.0 | 67 | 69.1 | 16 | 64.0 |
| Insulin | 24 | 19.7 | 17 | 17.5 | 7 | 28.0 |
| Oral agents and insulin | 10 | 8.2 | 9 | 9.3 | 1 | 4.0 |
| **Existing diagnosed comorbidities (self-reported; no evidence in *bukanas* or patient files):** | | | | | | |
| Hypertension | 115 | 94.3 | 90 | 92.8 | 25 | 100 |
| Retinopathy | 9 | 7.4 | 9 | 9.3 | 0 | 0.0 |
| Neuropathy | 5 | 4.1 | 4 | 4.1 | 1 | 4.0 |
| Nephropathy | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |

Table 2: Anthropometry measurements related to cardio-metabolic risk

| Variable categories | | Total group ($n = 122$) | | Females ($n = 97$) | | Males ($n = 25$) | |
|---|---|---|---|---|---|---|---|
| | | *n* | % | *n* | % | *n* | % |
| **Body mass index (BMI):** | | | | | | | |
| Underweight | < 18.5 kg/m$^2$ | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Normal | 18.5–24.9 kg/m$^2$ | 14 | 11.5 | 7 | 7.2 | 7 | 28.0 |
| Overweight | 25.0–29.9 kg/m$^2$ | 39 | 31.1 | 31 | 32.0 | 8 | 32.0 |
| Obese class I | 30.0–34.9 kg/m$^2$ | 39 | 31.1 | 31 | 32.0 | 8 | 32.0 |
| Obese class II | 35.0–39.9 kg/m$^2$ | 22 | 18.0 | 20 | 20.6 | 2 | 8.0 |
| Obese class III | ≥ 40.0 kg/m$^2$ | 8 | 6.6 | 8 | 8.3 | 0 | 0.0 |
| **Waist circumference (WC):** | | | | | | | |
| No risk | males: < 94 cm<br>females: < 80 cm | 2 | 1.6 | 2 | 2.1 | 0 | 0.0 |
| Increased risk | males: ≥ 94 cm<br>females: ≥ 80 cm | 120 | 98.3 | 95 | 97.9 | 25 | 100.0 |
| **Waist-to-height ratio (WHtR):** | | | | | | | |
| No risk | ≤ 0.5 | 2 | 1.6 | 0 | 0.0 | 2 | 8.0 |
| Increased risk | > 0.5 | 120 | 98.3 | 97 | 100.0 | 23 | 92.0 |

According to the FFQ, green leafy vegetables, including spinach, Swiss chard, *sepaile* (wild parsley leaves) and cabbage, as well as onion, green peppers, tomatoes and carrots, were consumed weekly, but rarely daily. Participants reported that they rarely consumed other vegetables. Overall, 78.5% of participants consumed fewer than the recommended three to five servings of vegetables per day (Table 4).

Only 28.7% of participants consumed dairy daily (in the form of fresh milk), while *maas* (sour milk) was consumed weekly basis by around half (54.1%). Other dairy products were rarely or never consumed. Overall, 93.4% consumed fewer than the recommended two to three servings of dairy per day (Table 4).

Participants did not report daily consumption of meat and meat substitutes (except for eggs, which 13.9% consumed daily). Foods consumed weekly from this food group were mostly chicken (96.7%) and canned fish (pilchards/tuna) (93.4%). Overall, 58.2% consumed processed meats (including Russians, polony, viennas which are high in fat and salt) weekly.

Sunflower oil (referred to as 'fish oil' in this setting as it is used to fry fish) was the most widely used food from the fats and oil group, consumed daily by 91.8%% of the participants. Overall, half (55.7%) of participants reported adding granular sugar to food and beverages daily. Reported intake of other sugary foods and sugary drinks was low. Similarly, all participants reported adding salt to meals during preparation or at the table but reported low intakes of other salty foods.

Table 5 summarises lifestyle aspects. According to the IPAQ, which rates self-reported activity over the last seven days based on duration, frequency and intensity, most participants were moderate to highly active (98.3%). The participants reported mostly job-related activities (mean MET-min/week for all work activities (vigorous and moderate): 2982.9 (SD 5260.0) and chores done at a moderate pace around the home and yard (mean MET-min/week for moderate home and domestic yard activities: 490.3 [SD 545.6] and 1119.7 [SD 1187.8], respectively). Minimal recreational walking (mean MET-min/week: 144.6 [SD 165.4]) and almost no sport and leisure time physical activities were reported (mean MET/week: 8.5 [SD 78.0]). The mean MET-min/week total for all activity was 6108.4 (SD 790.5).

Most reported not using any alcohol (82.9%) or tobacco (89.3%). Notably, 52.0% of the male participants reported drinking (mostly commercial beer) more than the recommended limit of two units of alcohol per day and/or at a time.

Table 6 summarises the parameters of glycaemic and metabolic control. On the day of data collection, 92.8% of females and all of the males had blood pressure readings of ≥ 140/80 mmHg. Only two participants had blood lipid measurements noted in their *bukanas* and files; both these participants had lipid levels in the normal range. The rest indicated that, to their knowledge, they had not had their blood lipids tested. Participants were expected to arrive for their assessment in a fasting state; fasting capillary blood glucose levels were tested at the clinic before the structured interviews and were > 7 mmol/l in about two-thirds (63.6%) of the participants (median 9.5 mmol/l; range 2.4–20.9 mmol/l). $HbA_{1c}$ levels were available only for 74 females and 13 males and were optimal (< 7%) in only 40.4% of participants (44.6% of females and 20% of males) (median 7.7%; range 3.4–14.9%). None of the participants indicated that they did self-monitoring of blood glucose levels because none of them had access to the required equipment and consumables.

Overall, 75.4% ($n = 92$) travelled to the clinics by taxi, 17.2% ($n = 21$) walked, and 7.4% ($n = 9$) came with a lift by car (none drove themselves). More than a third (39.3%; $n = 48$) reported that they sometimes missed a scheduled clinic visit due to lack of money for transport. Most participants (85.2%; $n = 104$) arrived at the clinics between 6:00 and 8:00 in the morning (13.9% [$n = 17$] arrived even earlier, between 4:00 and 6:00), and all indicated that they arrived back at home or work between 12:00 and 13:00. About a third (29.5%; $n = 36$) reported that they usually received services at the clinic within an hour of arrival, but most (57.4%; $n = 70$) reported that they waited between one and two hours, and 13.1% ($n = 16$) between two and three hours, before being seen. Between having blood pressure and blood glucose measured by a nurse, and consulting with a doctor, 40.1% ($n = 49$) reported that they usually waited less

Table 3: Overall dietary intake patterns for starchy foods, fruit, vegetables, dairy and meat and meat substitutes ($n = 122$)

| | Daily | | Weekly | | Monthly | |
|---|---|---|---|---|---|---|
| **Food type** | ***n*** | **%** | ***n*** | **%** | ***n*** | **%** |
| **Bread, grains and cereals:** | | | | | | |
| *Papa* (mealie meal stiff porridge) | 114 | 93.4 | 5 | 4.1 | 2 | 1.6 |
| *Mabele* (sorghum) porridge | 9 | 7.4 | 101 | 82.8 | 3 | 2.5 |
| Oats porridge | 0 | 0.0 | 52 | 42.6 | 10 | 8.2 |
| *Motoho* (sour porridge) | 0 | 0.0 | 13 | 10.7 | 46 | 37.7 |
| Weet-Bix | 0 | 0.0 | 33 | 27.0 | 1 | 0.8 |
| Cornflakes | 0 | 0.0 | 3 | 2.5 | 0 | 0.0 |
| All Bran | 0 | 0.0 | 3 | 2.5 | 0 | 0.0 |
| Muesli | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Pronutro | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Morvite | 0 | 0.0 | 2 | 1.6 | 0 | 0.0 |
| White bread | 1 | 0.8 | 2 | 1.6 | 0 | 0.0 |
| Brown bread | 88 | 72.1 | 29 | 23.8 | 1 | 0.8 |
| Provita | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Pasta | 0 | 0.0 | 10 | 8.2 | 10 | 8.2 |
| Potatoes | 0 | 0.0 | 12 | 9.8 | 26 | 21.3 |
| Rice/Mealie rice | 0 | 0.0 | 111 | 91.0 | 8 | 6.6 |
| Samp | 0 | 0.0 | 26 | 21.3 | 65 | 53.3 |
| Dried beans | 2 | 1.6 | 114 | 93.4 | 4 | 3.3 |
| Baked beans | 0 | 0.0 | 0 | 0.0 | 10 | 8.2 |
| Corn on the cob | 0 | 0.0 | 34 | 27.9 | 15 | 12.3 |
| Popcorn | 0 | 0.0 | 2 | 1.6 | 0 | 0.0 |
| **Fruits:** | | | | | | |
| Fresh fruits | 77 | 63.1 | 39 | 32.0 | 3 | 2.5 |
| Dried fruits | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Fruit juice | 2 | 1.6 | 10 | 8.2 | 17 | 13.9 |
| Canned fruit | 0 | 0.0 | 0 | 0.0 | 2 | 1.6 |
| Wild fruits | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| **Vegetables with almost negligible carbohydrate content:** | | | | | | |
| Spinach/Swiss chard | 9 | 7.4 | 115 | 94.3 | 0 | 0.0 |
| *Lepu* (pumpkin leaves) | 2 | 1.6 | 13 | 10.7 | 56 | 45.9 |
| *Sepaile* (wild parsley leaves) | 5 | 4.1 | 114 | 93.4 | 2 | 1.6 |
| Radish | 0 | 0.0 | 17 | 13.9 | 11 | 9.0 |
| Wild vegetables | 0 | 0.0 | 10 | 8.2 | 2 | 1.6 |
| Cabbage | 1 | 0.8 | 113 | 92.6 | 3 | 2.5 |
| Green beans | 0 | 0.0 | 2 | 1.6 | 88 | 72.1 |
| Cauliflower | 0 | 0.0 | 4 | 3.3 | 4 | 3.3 |
| Broccoli | 0 | 0.0 | 1 | 0.8 | 3 | 2.5 |
| Mushrooms | 0 | 0.0 | 4 | 3.3 | 3 | 2.5 |
| Onions | 13 | 10.7 | 108 | 88.5 | 0 | 0.0 |
| Lettuce | 0 | 0.0 | 17 | 13.9 | 21 | 17.2 |
| Cucumber | 0 | 0.0 | 17 | 13.9 | 19 | 15.6 |
| Frozen vegetables | 0 | 0.0 | 5 | 4.1 | 9 | 7.4 |
| Mixed vegetables | 0 | 0.0 | 8 | 6.6 | 8 | 6.6 |
| Green pepper | 0 | 0.0 | 100 | 82.0 | 2 | 1.6 |
| Tomato | 0 | 0.0 | 120 | 98.4 | 2 | 1.6 |
| **Vegetables with higher carbohydrate content:** | | | | | | |
| Butternut | 0 | 0.0 | 37 | 30.3 | 80 | 65.6 |
| Carrots | 2 | 1.6 | 119 | 97.5 | 0 | 0.0 |
| Green peas | 0 | 0.0 | 37 | 30.3 | 48 | 39.3 |
| **Milk and milk products:** | | | | | | |
| Full-cream milk | 23 | 18.9 | 43 | 35.2 | 6 | 4.9 |

(*Continued*)

Table 3: Continued.

| Food type | Daily | | Weekly | | Monthly | |
|---|---|---|---|---|---|---|
| | *n* | % | *n* | % | *n* | % |
| Low-fat milk | 11 | 9.0 | 20 | 16.4 | 0 | 0.0 |
| Skimmed milk | 1 | 0.8 | 4 | 3.3 | 0 | 0.0 |
| Flavoured yoghurt | 0 | 0.0 | 1 | 0.8 | 2 | 1.6 |
| Plain yoghurt | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Maas/sour milk | 1 | 0.8 | 66 | 54.1 | 2 | 1.6 |
| **Meat and meat substitutes:** | | | | | | |
| Beef | 0 | 0.0 | 18 | 14.8 | 19 | 15.6 |
| Lamb | 0 | 0.0 | 1 | 0.8 | 13 | 10.7 |
| Pork | 0 | 0.0 | 29 | 23.8 | 15 | 12.3 |
| Chicken | 3 | 2.5 | 118 | 96.7 | 2 | 1.6 |
| White fish (hake) | 0 | 0.0 | 9 | 7.4 | 14 | 11.5 |
| Canned fish (pilchards, tuna) | 0 | 0.0 | 114 | 93.4 | 3 | 2.5 |
| Russians/polony/viennas | 0 | 0.0 | 71 | 58.2 | 7 | 5.7 |
| Offal | 0 | 0.0 | 25 | 20.5 | 6 | 4.9 |
| Soy milk | 1 | 0.8 | 0 | 0.0 | 0 | 0.0 |
| Texturised protein (*Imana*) | 0 | 0.0 | 4 | 3.3 | 0 | 0.0 |
| Eggs | 17 | 13.9 | 84 | 68.9 | 10 | 8.2 |
| Cheese | 1 | 0.8 | 7 | 5.7 | 5 | 4.1 |
| Peanut butter | 1 | 0.8 | 48 | 39.3 | 6 | 4.9 |
| **Fats/oils:** | | | | | | |
| Canola oil | 6 | 4.9 | 0 | 0.0 | 0 | 0.0 |
| Olive oil | 5 | 4.1 | 1 | 0.8 | 0 | 0.0 |
| Sunflower oil | 112 | 91.8 | 0 | 0.0 | 0 | 0.0 |
| Margarine | 5 | 4.1 | 13 | 10.7 | 1 | 0.8 |
| Butter | 0 | 0.0 | 2 | 1.6 | 1 | 0.8 |
| Mayonnaise | 0 | 0.0 | 21 | 17.2 | 5 | 4.1 |
| Nuts | 0 | 0.0 | 2 | 1.6 | 16 | 13.1 |
| Seeds | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Avocado | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Cream | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Bacon | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Non-dairy coffee creamer | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Lard | 0 | 0.0 | 1 | 0.8 | 0 | 0.0 |
| **Sugar/sweets:** | | | | | | |
| Sugar | 68 | 55.7 | 3 | 2.5 | 2 | 1.6 |
| Syrup | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Honey | 1 | 0.8 | 0 | 0.0 | 0 | 0.0 |
| Jam | 0 | 0.0 | 3 | 2.5 | 1 | 0.8 |
| Sweets | 2 | 1.6 | 1 | 0.8 | 1 | 0.8 |
| Chocolate | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Desserts | 0 | 0.0 | 1 | 0.8 | 0 | 0.0 |
| Biscuits | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| **Miscellaneous:** | | | | | | |
| Diabetic products | 1 | 0.8 | 0 | 0.0 | 0 | 0.0 |
| Spreads (cheese, fish) | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Vinegar | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Salt | 124 | 101.6 | 0 | 0.0 | 0 | 0.0 |
| Aromat | 8 | 6.6 | 45 | 36.9 | 1 | 0.8 |
| Spices | 15 | 12.3 | 64 | 52.5 | 0 | 0.0 |
| Stock cubes | 16 | 13.1 | 58 | 47.5 | 7 | 5.7 |
| Packet soups | 0 | 0.0 | 3 | 2.5 | 6 | 4.9 |
| Potato crisps ('*Simbas*') | 0 | 0.0 | 2 | 1.6 | 14 | 11.5 |

(*Continued*)

Table 3: Continued.

| Food type | Daily | | Weekly | | Monthly | |
|---|---|---|---|---|---|---|
| | *n* | % | *n* | % | *n* | % |
| Fast foods | 0 | 0.0 | 2 | 1.6 | 7 | 5.7 |
| Sweeteners | 6 | 4.9 | 0 | 0.0 | 0 | 0.0 |
| **Beverages:** | | | | | | |
| Soft drinks | 8 | 6.6 | 34 | 27.9 | 12 | 9.8 |
| Cordials | 3 | 2.5 | 11 | 9.0 | 1 | 0.8 |
| Fruit juice | 2 | 1.6 | 16 | 13.1 | 28 | 23.0 |
| Tea | 69 | 56.6 | 26 | 21.3 | 3 | 2.5 |
| Coffee | 0 | 0.0 | 1 | 0.8 | 1 | 0.8 |
| Hot chocolate | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Milo | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |

Table 4: Daily intakes of fruit, vegetables and dairy

| Intakes according to recommendations for metabolic health for adults | | Frequency/percentages | | | | | |
|---|---|---|---|---|---|---|---|
| | | Total group (*n* = 121) | | Females (*n* = 96) | | Males (*n* = 25) | |
| | | *n* | % | *n* | % | *n* | % |
| **Fruits:** | | | | | | | |
| Below | < 2 servings per day | 80 | 66.1 | 62 | 64.6 | 18 | 72.0 |
| Within | 2–4 servings per day | 38 | 31.4 | 33 | 34.4 | 5 | 20.0 |
| Above | > 4 servings per day | 3 | 2.5 | 1 | 1.0 | 2 | 8.0 |
| **Vegetables:** | | | | | | | |
| Below | < 3 servings per day | 95 | 78.5 | 77 | 80.2 | 18 | 72.0 |
| Within | 3–5 servings per day | 25 | 20.7 | 18 | 18.8 | 7 | 28.0 |
| Above | > 5 servings per day | 1 | 0.8 | 1 | 1.0 | 0 | 0.0 |
| **Dairy:** | | | | | | | |
| Below | < 2 servings per day | 113 | 93.4 | 92 | 95.8 | 21 | 84.0 |
| Within | 2–3 servings per day | 8 | 6.6 | 4 | 4.2 | 4 | 16.0 |
| Above | > 3 servings per day | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |

than an hour, 54.8% (*n* = 66) between one and two hours, and 5.7% (*n* = 7) longer than two hours. After seeing the doctor, 13.1% (*n* = 16) of participants reported waiting less than an hour to collect their medicines from the pharmacy, while the majority (75.4%; *n* = 92) reported waiting between one and two hours to collect their medication. Thus, the total time

Table 5: Physical activity, alcohol and smoking habits

| Variable | Frequency/percentages | | | | | |
|---|---|---|---|---|---|---|
| | Total group (*n* = 122) | | Females (*n* = 97) | | Males (*n* = 25) | |
| | *n* | % | *n* | % | *n* | % |
| **Physical activity level (assessed by IPAQ):** | | | | | | |
| Low | 2 | 1.6 | 1 | 1.0 | 1 | 4.0 |
| Moderate | 99 | 81.1 | 87 | 89.7 | 12 | 48.0 |
| High | 21 | 17.2 | 9 | 9.3 | 12 | 48.0 |
| **Alcohol consumption:** | *n* = 117 | | *n* = 92 | | *n* = 25 | |
| Non-users | 97 | 82.9 | 86 | 93.5 | 11 | 44.0 |
| Prudent users: ≤ 1 unit of alcohol/day for females; ≤ 2 units of alcohol per day for males | 2 | 1.7 | 1 | 1.1 | 1 | 4.0 |
| At-risk users: > 1 unit of alcohol/day for females; > 2 units of alcohol per day for males | 18 | 15.4 | 5 | 5.4 | 13 | 52.0 |
| **Tobacco use:** | | | | | | |
| Non-users | 109 | 89.3 | 87 | 89.7 | 22 | 88.0 |
| **Tobacco users:** | 10 | 8.2 | 10 | 10.1 | 3 | 12.0 |
| Cigarettes | 3 | 1.6 | 0 | 0.0 | 3 | 12.0 |
| Snuff | 10 | 8.1 | 10 | 10.1 | 0 | 0.0 |

**Table 6:** Cardio-metabolic and glycaemic control

| Variable | Frequency/percentages | | | | | |
|---|---|---|---|---|---|---|
| | Total group | | Females | | Males | |
| | *n* | % | *n* | % | *n* | % |
| **Blood pressure measured before the structured interview:** | *n* = 122 | | *n* = 97 | | *n* = 25 | |
| < 140/80 mmHg | 7 | 5.7 | 7 | 7.2 | 0 | 0.0 |
| ≥ 140/80 mmHg | 115 | 94.3 | 90 | 92.8 | 25 | 100.0 |
| **Fasting blood glucose measured prior to structured interview (capillary):** | *n* = 121 | | *n* = 96 | | *n* = 25 | |
| < 4 mmol/l | 5 | 4.1 | 3 | 3.1 | 2 | 8.0 |
| 4–7 mmol/l | 39 | 32.2 | 34 | 35.4 | 5 | 20.0 |
| > 7 mmol/l | 77 | 63.6 | 59 | 61.5 | 18 | 72.0 |
| **$HbA_{1c}$ levels:** | *n* = 94 | | *n* = 74 | | *n* = 20 | |
| < 7%: optimal | 38 | 40.4 | 33 | 44.6 | 5 | 20.0 |
| 7–8%: acceptable | 11 | 11.7 | 9 | 12.2 | 1 | 5.0 |
| > 8%: suboptimal | 45 | 47.9 | 32 | 43.2 | 13 | 65.0 |

spent at the clinic were between three and six hours; not surprisingly, most (76.2%; *n* = 93) of the participants indicated that the waiting times at the clinics were too long.

Overall, 95.9% (*n* = 117) of the participants felt that the doctors, specifically, did not spend adequate time with them to address their needs and few reported that they saw the same nurse (13.9%; *n* = 17) and doctor (36.1; *n* = 44) at follow-up visits. Also, 18.0% (*n* = 22) reported that, at times, the pharmacy did not have their required medication in stock. However, 98.4% (*n* = 120) were satisfied with the overall services rendered at the clinics. Only 22.6% (*n* = 28) knew about the Lesotho Diabetes Association, and only 1.7% (*n* = 2) were members.

While all the participants believed that a healthy diet could control their blood glucose levels (Table 7), only about half of the participants indicated that they had received some form of education from healthcare providers concerning healthy eating habits. Only one in five (26.2%) stated that they had received any written instructions or education from a dietitian or nutritionist. Participants noted financial constraints (64.8%) and poor self-control (90.2%) as the main barriers to adhering to a 'healthy' diet, while 33.6% reported that it was difficult to follow a 'different' diet from the rest of the family. All but one participant believed that moderate physical activity has a role in the management of T2DM, but none of the participants reported that they had ever received any written instructions from a healthcare worker regarding an exercise programme. Most (52.1%) perceived gardening as their main exercise, followed by walking (24.8%) and housework (14.8%). Only 8.1% reported going to the gym or taking part in aerobic exercise or jogging. Participants noted lack of time (87.7%) and workloads (70.5%) as the main reasons for not exercising. Overall, 84.7% of participants reported having no idea regarding the recommended limits for alcohol intake. All of the participants (100%) thought that patients with diabetes should not use tobacco, but 8.2% were using snuff or smoking cigarettes at the time of the study (see Table 5).

As summarised in Table 8, participants were familiar with the symptoms of hyperglycaemia, as well as some of the long-term consequences, and knew that they can prevent these consequences. Most (98.4%) of the participants reported that they adhered to their prescribed medications and only one reported not having confidence in the benefits of the medications. Most reported that they had received education on their prescribed medications, but 8.1% reported that they had not. Although all of the participants thought that it was important to 'regularly test your blood sugar', 94.3% had their blood glucose levels tested (by finger prick) only every third month during their follow-up appointments at the clinics. Moreover, most participants did not know the normal reference range for fasting blood glucose, with more than a third admitting that they have no idea what it should be.

When asked to pick the causes of T2DM from a list, none believed that witchcraft or punishment from God caused diabetes, while only 2.5% (*n* = 3) believed that it was the result of supernatural forces (these all constitute opinions reported in a Zimbabwe study).[24] Of the 121 who answered the question, most believed that it was inherited (99.2%; *n* = 120), caused by overweight (82.6%; *n* = 100) and by 'wrong' diet (83.5%; *n* = 101). Overall, 32.2% (*n* = 16) reported using traditional medicines, namely *lekhala* (aloe), *hloenya*, *haelale* and *sehalahala sa,* which are all indigenous plants of Lesotho. Overall, 11.6% (*n* = 14) reported using popular herbal 'home remedies', which included cinnamon, garlic, ginger and green tea, while 22.3% (*n* = 27) used nutritional supplements, including omega-3, antioxidants, vitamin B complex, calcium (used by only 3.3%) and a product containing lipids and sterols, called *Tre-en-en*. Overall, 85.1% (*n* = 103) reported that, even if they took traditional medicines, herbs, and nutritional supplements, they continued with their prescribed medications (concurring with the confidence they expressed in their medical treatments); 14.9% (*n* = 18), however, indicated that while using these substances they stopped taking their medicines.

## Discussion

This study, which included mostly middle-aged participants, who had been diagnosed with T2DM for longer than five years, and who were being managed as out patients in two PPHC clinics in Maseru, Lesotho, found extremely high levels of overweight and obesity, poor dietary and lifestyle habits, ignorance regarding blood glucose targets, and the virtual absence of monitoring for complications of diabetes.

Table 7: Knowledge, attitudes, perceptions and practices of participants regarding the role of diet and lifestyle in the self-management of their diabetes

| Questions | Options (choose one) | *n* | % |
|---|---|---|---|
| Do you believe that good dietary habits could help control your blood sugar? | Yes | 122 | 100.0 |
| | No | 0 | 0.0 |
| Have you received any education from a healthcare provider about healthy eating habits? | Yes | 65 | 53.3 |
| | No | 57 | 46.7 |
| Have you ever received detailed written instructions regarding dietary intake from a dietitian/nutritionist? | Yes | 9 | 26.2 |
| | No | 90 | 73.7 |
| What usually prevents you from following a healthy diet? | | | |
| i) Often eat out | Yes | 13 | 10.7 |
| | No | 109 | 89.3 |
| ii) Financial constraints | Yes | 79 | 64.8 |
| | No | 43 | 34.7 |
| iii) Poor self-control | Yes | 110 | 90.2 |
| | No | 12 | 9.8 |
| iv) The difficulty of following a different diet from the rest of the family | Yes | 41 | 33.6 |
| | No | 81 | 66.4 |
| v) Travel a lot | Yes | 4 | 3.3 |
| | No | 118 | 96.7 |
| vi) Attend many social gatherings | Yes | 1 | 0.8 |
| | No | 121 | 99.2 |
| Do you believe that moderate physical activity (exercise) helps to manage T2DM? | Yes | 121 | 99.2 |
| | No | 1 | 0.8 |
| What physical activities (exercises) do you do? (report the types) (researcher listed the self-reported types) | Walking | 30 | 24.8 |
| | Housework | 18 | 14.9 |
| | Gym/jogging | 10 | 8.3 |
| | Gardening | 63 | 52.1 |
| What usually prevents you from doing physical activity (exercise)? (the researcher summarised the self-reported reasons) | | | |
| i) Unwillingness | Yes | 1 | 0.8 |
| | No | 121 | 99.2 |
| ii) Lack of time to exercise | Yes | 107 | 87.7 |
| | No | 15 | 12.3 |
| iii) Workload | Yes | 86 | 70.5 |
| | No | 36 | 29.5 |
| iv) Lack of advice given by healthcare provider | Yes | 2 | 1.6 |
| | No | 120 | 98.4 |
| v) Coexisting diseases such as osteoarthritis (joint pains) | Yes | 25 | 20.5 |
| | No | 97 | 79.5 |
| vi) Stressful environment | Yes | 2 | 1.6 |
| | No | 120 | 98.4 |
| Have you ever received detailed written instructions or an exercise programme from a healthcare provider? | Yes | 0 | 0.0 |
| | No | 122 | 100.0 |
| How much alcohol are you allowed to use (per day or at a time?) One portion = one beer, one shot of liquor or 1 small glass of wine | One portion | 7 | 5.7 |
| | Two portions | 8 | 6.6 |
| | Three portions | 4 | 3.3 |
| | Don't know | 103 | 84.4 |
| 18. Should people with diabetes be using any form of tobacco (cigarette or snuff)? | Yes | 0 | 0.0 |
| | No | 122 | 100.0 |

The participants in this study, though recruited via random convenience sampling, were predominantly female (4:1 ratio to males). Though this is not the typical gender pattern for T2DM reported in higher income countries,[12] it is consistent with the findings of other studies on T2DM in Lesotho[25–27] and neighbouring South Africa.[28–30] This may be explained by the fact that, in sub-Saharan Africa and other developing regions, the most prominent risk factor, which is obesity, is more common in women than in men,[12] as is also evident in the current study. The exact aetiology of this gender disparity is not fully understood, and has been attributed to a more significant impact of the nutrition transition on the physical activity levels of women, cultural views that favour female obesity, gender differences in carbohydrate metabolism that cause a more pronounced increase in triglyceride levels in women, as well as income disparities.[12,31] According to the Lesotho Human Development Report, men earn

Table 8: Knowledge, attitudes, perceptions and practices of participants regarding the medical components of diabetes self-management

| Questions | Options (choose one) | *n* | % |
|---|---|---|---|
| Please tick the symptoms of high blood sugar: | | | |
| i) Drinking a lot of water | | 122 | 100.0 |
| ii) Passing a lot of urine | | 122 | 100.0 |
| iii) Feeling weak and tired | | 121 | 99.2 |
| Please tick the consequences of high blood sugar over a long time: (all 124 answered the question): | | | |
| i) Blindness | | 122 | 100.0 |
| ii) Foot ulcers | | 111 | 91.0 |
| iii) Kidney problems | | 106 | 86.9 |
| Do you think diabetes complications can be prevented? | Yes | 120 | 98.4 |
| | No | 2 | 1.6 |
| Do you take your medicines as prescribed? | Yes | 120 | 98.4 |
| | No | 2 | 1.6 |
| Did you receive any education about the use of your medicines? | Yes | 112 | 91.8 |
| | No | 10 | 8.1 |
| Are you confident that your medicines work? | Yes | 123 | 99.2 |
| | No | 1 | 0.8 |
| Do you think it is important to test your blood sugar regularly? | Yes | 122 | 100.0 |
| How often do you test? (report) | Once/month | 7 | 5.7 |
| | Every third month | 115 | 94.3 |
| What is a normal fasting blood sugar? (pick one) | 4.0–7.0 mmol/l | 12 | 9.8 |
| | 7.0–8.0 mmol/l | 13 | 10.7 |
| | 8.0–10.0 mmol/l | 27 | 21.1 |
| | 10.0–12.0 mmol/l | 25 | 20.5 |
| | Don't know | 45 | 36.9 |
| How often are the following checked for you (open question for self-reporting) | | | |
| i) Eyesight (eye test) | Never | 122 | 100.0 |
| ii) Kidney function (urine test) | Never | 122 | 100.0 |
| iii) Blood pressure | Three-monthly | 122 | 100.0 |
| iv) Feet | Never | 122 | 100.0 |

1.5 times more than women,[32] and this income disparity is also evident in the current study with more females earning incomes at the lower end of the range than males, despite also having more dependants than the males. Evidence also suggests that, unlike men, women who are food insecure are more likely to be overweight and obese than women who are not food insecure.[32] Therefore, it is suggested that obesity prevention programmes and policies may be more effective if they are conveyed in a gender-specific manner.[25]

Only 1 in 10 participants in the current study had a normal BMI, with obesity occurring among two-thirds of females. Even more disconcerting, especially keeping in mind that the sample was explicitly drawn from patients already diagnosed with T2DM, is the fact that, based on WC and WHtR, almost the entire sample was at high risk for cardio-metabolic complications due to central obesity,[20] even though more than 80% knew that overweight is a cause of T2DM. The higher level of obesity amongst women is further significant as women with diabetes have higher increases in cardiovascular risk, myocardial infarction and stroke mortality than men, compared with subjects without diabetes.[33]

Despite all of the participants believing that a healthy diet could control blood glucose levels (Table 7) and that a 'wrong' diet may contribute to T2DM, their overall dietary pattern was typical of the nutrition transition.[34] The staples were maize porridge, made from fortified but refined maize meal, and brown bread, while sunflower oil, tea and sugar were also consumed daily and cheap, processed meats that have been identified as risk factors for cardio-metabolic disease and insulin resistance[22] were consumed weekly. Overall consumption of fruit, vegetables and dairy was below the recommendations for cardio-metabolic health,[22] which concurs with the findings of a recent study among outpatients with T2DM attending public healthcare facilities in the five districts of the neighbouring Free State province of South Africa.[29]

A large body of evidence supports the protective effects of fruit and vegetable consumption against the risks for insulin resistance and hypertension, in part due to the potassium and fibre contributions of these foods,[22] making it a vital component of the diet in the treatment of T2DM. Causes of the low intakes of these foods were not assessed in the current study, but may be related to poverty, seasonality or inaccessibility of fresh fruits and vegetables. Spinach and indigenous green leafy vegetables, which are rich sources of potassium, calcium and a variety of other protective minerals and vitamins,[22] were, however, consumed every week. These are fast-growing, high-yielding crops and communities could be encouraged to grow these using grey water from the household, and to include them as part of the daily diet (notably, half of the participants listed gardening as a form of regular physical activity).

Studies also suggest that an inverse relationship exists between dairy product intake and insulin resistance syndrome, T2DM and cardiovascular disease, and this is mostly attributed to the calcium contribution of dairy, as well as to milk peptides that are formed during the digestion and during fermentation of milk.[35] Notably, in the current sample, almost all participants suffered from hypertension despite being on anti-hypertensive medications.

The dietary pattern of the current participants did include some cardio-metabolic protective aspects that should be encouraged, such as regular use of legumes, soy and tinned fish (a source of cardio-metabolic protective omega-3 fatty acids).[22] Also, besides recognising the importance of physical activity for managing diabetes, most participants (mainly women) reported being moderately to highly active (although they may have been over-reporting the amount of walking that they were doing). Their reported activities were, however, work and household related, with less than 10% reporting planned exercise. Targeted interventions are therefore needed in this study population to promote the value of aerobic and resistance exercise to improve cardio-metabolic control.[8]

Tobacco and excessive alcohol intake are well-recognised cardio-metabolic risk factors.[22] Although the participants all acknowledged that they should not be using tobacco products (Table 7), 1 in 10 were using these. Participants were less sure about the effects of alcohol on diabetes and were ignorant regarding the amount of alcohol that constitutes excessive drinking (Table 7). Overall, half of the male participants reported levels of alcohol intakes that would contribute to hypertension and increase their overall cardio-metabolic risk.[22] These findings are similar to those of another, older study among patients with T2DM in Lesotho.[36] More specific interventions on tobacco and alcohol use are thus needed in these populations.

Being aware that weight control, diet, exercise and prudent lifestyle are beneficial to glycaemic control and the prevention of complications did not translate to good practices in this study population. The fact that only half of the participants had ever received instructions regarding diet from a healthcare worker, and only around 25% received it from a dietitian or nutritionist, may have been contributing factors. When asked what prevented them from following a healthy diet, participants noted perceptions that they should be following a special diet that is more expensive and different from what the rest of the family was eating (Table 7), which is not necessarily accurate and points to lack of knowledge and skills. Similarly, participants in the current study indicated that they had never received detailed instructions on exercise. Dietitians and nutritionists are uniquely qualified to translate dietary and lifestyle guidelines to the individual preferences and sociodemographic circumstances of patients in the context of their families and communities.[37] Moreover, they are also trained in counselling individuals to motivate behaviour change.[37] A recent meta-analysis concluded that behaviour change techniques are vital to change the dietary patterns of patients with T2DM.[38] Strong evidence suggests that a coordinated referral system by which each patient with T2DM consults a dietitian or nutritionist on diagnosis, and at regular intervals during the life cycle, improves dietary and lifestyle compliance, improves overall cardio-metabolic control and is cost-effective.[37] Diabetes associations like the Lesotho Diabetes Association (LDA) are another potential source of information and support; however, few participants knew about the LDA, while only two were members, indicating a need for healthcare workers to disseminate the information on available resources to patients.

The lack of referral is further evident in the fact that there was very little evidence that participants were being monitored for any complications. Moreover, even though participants were knowledgeable regarding the long-term complications of diabetes, it is disconcerting that around 10% did not know that uncontrolled diabetes can lead to foot ulcers and kidney damage. A recent review exploring the gaps in diabetes care in sub-Saharan Africa notes that, before the rapid nutrition and lifestyle transition, diabetes was a historically unknown disease in the region. Thus, 'emphasis and focus on training health care providers about diabetes was often sacrificed in the interest of promoting education for heavily funded diseases including TB, HIV, and malaria'.[3]

Although almost all the participants thought that it was important to have blood glucose levels tested regularly, and most knew the symptoms of hyperglycaemia (Table 8), none of the participants was performing self-monitoring of blood glucose, due to not having access to the necessary equipment. Thus, all of them had their blood glucose levels tested, along with their blood pressure, only once in three months during the visit to the clinic, a situation that has been documented throughout the sub-Saharan region.[3] Ideally, patients should be self-monitoring blood glucose and blood pressure, which improves their self-awareness, empowers them to take control and facilitates discussion with clinicians.[39–41] Not surprisingly, in the current study, 9 out of 10 participants had no idea what normal blood glucose levels should be, and poor control was evident in most of them by elevated fasting blood glucose and $HBA_{1c}$ levels, while most suffered from uncontrolled hypertension. It is hoped that technological advances in the foreseeable future will bring self-monitoring within reach of patients who utilise the public health systems in developing countries. Notably, whereas $HBA_{1c}$ levels $< 7\%$ are associated with decreased cardio-metabolic complications in patients with diabetes, there were several participants in the current study with quite low $HbA_{1c}$ levels (14% had HbA1c levels < 5%). Very low levels of $HbA_{1c}$ have recently been linked to increased mortality in older individuals with diabetes, probably because in these settings it may be a marker of malnutrition.[42]

The main concern for the participants was the long hours of waiting to be serviced at the clinics. As most were employed (Table 1), time at the clinic meant time away from work. Participants reported that they were seldom seen by the same health care professional at follow-up visits, while they felt that clinicians did not spend enough time with them to address all their concerns; thus, they did not report a sense of patient-centred care.[43] One in five had experienced their medications being out of stock at the clinic pharmacy, which is a recurring problem in public health settings in the sub-Saharan region.[3] Overall, the participants expressed faith in the efficiency of the prescribed medications and reported compliance. While most had received counselling regarding their medications, it is disconcerting that 14% said that they had not. Although almost all of the participants indicated that they were satisfied with the services rendered to them at the clinics, the overall situation at the clinics in this study falls short of the patient-centred approach recommended for diabetes care.[43]

Contrary to some communities in Africa,[24] participants did not believe that supernatural forces such as witchcraft or punishment from God caused diabetes. However, a third used some forms of traditional medications and 14% indicating that they stopped taking their regular medications when using these medicinal plants. Although some of these plants have been tentatively studied as natural remedies that may aid in blood glucose control, convincing evidence for their efficacy is still lacking, and drug interactions of these substances have not been adequately studied.[44] Healthcare workers should be aware of these practices and should counsel patients on the potential dangers.

## Limitations

The fact that the current study was performed at only two public healthcare facilities may limit the generalisation of the findings. The findings are, however, very similar to those recorded for out-patients with T2DM who rely on the public health sector in Lesotho,[27,36] as well as in other parts of the sub-Saharan region.[3]

## Conclusions

Patients with T2DM included in the current study were predominantly older and female, with extremely high levels of overweight and obesity and poor dietary and lifestyle habits that may be related to the nutrition transition which they were evidently undergoing, as well as poor dissemination of information regarding diet and lifestyle by the public healthcare system that they were relying on. These patients were ignorant of blood glucose targets, had uncontrolled hypertension despite being on treatment, and were not being monitored for complications of diabetes, overall rendering their three-monthly visits to the clinics a revolving door. A holistic approach to the management of these patients is therefore advocated. Healthcare providers should receive ongoing training in updated diabetes care, and effective referral systems that include dietitians or nutritionists as valuable and proven resources for improving patient self-management in cost-effective ways[37] should be implemented. The Ministry of Health should encourage the supply of pamphlets to health facilities as a method of information dissemination using the local language, as most patients in the current study indicated a lack of written instructions on diet and exercise. Radio and television are also valuable platforms with significant societal reach for spreading health information, as has been shown with HIV campaigns.[45] Studies that include a broader scope of patients in both urban and rural areas, as well as in the private and public healthcare settings, are required to investigate further barriers to implementing guidelines on diabetes care in Lesotho.

## Disclosure statement

No potential conflict of interest was reported by the authors.

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## References

1. International Diabetes Federation. IDF Diabetes Atlas, Eighth edition [Internet]. 2017. Available from: https://www.idf.org/e-library/epidemiology-research/diabetes-atlas/134-idf-diabetes-atlas-8th-edition.html
2. Cho NH, Shaw JE, Karuranga S, Huang Y, Rocha JD, Ohlrogge AW, et al. IDF diabetes Atlas: global estimates of diabetes prevalence for 2017 and projections for 2045. Diabetes Res Clin Pract. 2018;138:271–81. Available from: https://doi.org/10.1016/j.diabres.2018.02.023
3. Pastakia S, Pekny C, Manyara SM, Fischer L. Diabetes in sub-Saharan Africa – from policy to practice to progress: targeting the existing gaps for future care for diabetes. Diabetes Metab Syndr Obes Targets Ther. 2017;10:247–63.
4. Mutyambizi C, Pavlova M, Chola L, Hongoro C, Groot W. Cost of diabetes mellitus in Africa: a systematic review of existing literature. Global Health. 2018;14(3):1–13.
5. Jamison DT, Summers LH, Alleyne G, Arrow KJ, Berkley S, Binagwaho A, et al. Global health 2035: a world converging within a generation. Lancet. 2014;382(9908):1898–955. Available from: http://dx.doi.org/10.1016/S0140-6736(13)62105-4
6. Zheng Y, Ley SH, Hu FB. Global aetiology and epidemiology of type 2 diabetes mellitus and its complications. Nat Publ Gr. 2017;14(2):88–98. Available from: http://dx.doi.org/10.1038/nrendo.2017.151
7. Franz MJ, MacLeod J, Evert A, Brown C, Gradwell E, Handu D, et al. Academy of nutrition and dietetics nutrition practice guideline for type 1 and type 2 diabetes in adults: systematic review of evidence for medical nutrition therapy effectiveness and recommendations for integration into the nutrition care process. J Acad Nutr Diet. 2017;117(10):1659–79. Available from: http://linkinghub.elsevier.com/retrieve/pii/S2212267217303325
8. The Society for Endocrinology Metabolism and Diabetes of South Africa Type 2 Diabetes Guidelines Expert Committee. 2017 SEMDSA Guideline for the management of Type 2 diabetes mellitus. JEMDSA. 2017;22(Supplement 1):S1–S196.
9. Geller K, Lippke S, Nigg CR. Future directions of multiple behavior change research. J Behav Med. 2017;40(1):194–202.
10. International Diabetes Federation. IDF Africa members: Lesotho [Internet]. 2019 [cited 2019 Jan 23]. Available from: https://www.idf.org/our-network/regions-members/africa/members/14-lesotho.html
11. World Health Organisation. Global report on diabetes [Internet]. Geneva; 2016. Available from: http://www.who.int
12. Wu F, Guo Y, Chatterji S, Zheng Y, Naidoo N, Jiang Y, et al. Global gender disparities in obesity: a review. Int J Behav Nutr Phys Act. 2015;4(1):1–16. Available from: http://www.ijbnpa.org/content/9/1/32
13. Stewart A, Marfell-Jones M, Olds T, de Ridder H. International standards for anthropometric assessment. 3rd ed. Lower Hutt, New Zealand: The International Society for the Advancement of Kinanthropometry; 2011.
14. Ma WY, Yang CY, Shih SR, Hsieh HJ, Hung CS, Chiu FC, et al. Measurement of waist circumference: midabdominal or iliac crest? Diabetes Care. 2013;36(6):1660–6.
15. U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2015 – 2020 Dietary guidelines for Americans (8th edition) [Internet]. 2013. Available from: http://health.gov/dietaryguidelines/2015/guidelines/
16. International Physical Activity Questionnaire [Internet]. [cited 2018 Dec 4]. Available from: https://sites.google.com/site/theipaq/
17. Wanner M, Probst-Hensch N, Kriemler S, Meier F, Autenrieth C, Martin BW. Validation of the long international physical activity questionnaire: influence of age and language region. Prev Med Reports. 2016;3:250–6. Available from: http://dx.doi.org/10.1016/j.pmedr.2016.03.003
18. World Health Organization. Obesity: preventing and managing the global epidemic. World Health Organization - Technical Report Series 894. Geneva; 2000.
19. Eckel RH, Alberti KGMM, Grundy SM, Zimmet PZ. The metabolic syndrome. Lancet. 2010;375(9710):181–3.
20. Ashwell M, Gibson S. Waist-to-height ratio as an indicator of 'early health risk': simpler and more predictive than using a 'matrix' based on BMI and waist circumference. BMJ Open. 2016;6(3):e010159.
21. Guidelines for data processing and analysis of the International Physical Activity Questionnaire (IPAQ) – Short and Long Forms [Internet]. 2005. Available from: https://sites.google.com/site/theipaq/scoring-protocol
22. Mozaffarian D. Dietary and policy priorities for cardiovascular disease, diabetes, and obesity. Circulation. 2016;133(2):187–225.
23. IPAQ scoring protocol - International Physical Activity Questionnaire [Internet]. [cited 2019 Apr 23]. Available from: https://sites.google.com/site/theipaq/scoring-protocol
24. Hjelm K, Mufunda E. Zimbabwean diabetics' beliefs about health and illness: an interview study. BMC Int Health Hum Rights. 2010;10(1):7. [cited 2019 Apr 25]. Available from: https://bmcinthealthhumrights.biomedcentral.com/articles/10.1186/1472-698X-10-7
25. Adebayo F. Dietary habits and prevalence of obesity among type 2 diabetes patients seen at Scott Hospital, Morija, Lesotho [Internet]. University of Limpopo (Medunsa Campus), South Africa; 2010. Available from: http://ulspace.ul.ac.za/handle/10386/260

26. Chiwungwe F. Diabetes-related knowledge, attitudes and practices [KAP] of adult patients with type 2 diabetes in Maseru, Lesotho [Internet]. University of the Free State; 2017. Available from: http://scholar.ufs.ac.za:8080/xmlui/bitstream/handle/11660/6452/ChiwungweF.pdf?sequence=1&isAllowed=y
27. Makwero MT, Mollentze WF, Joubert G, Steinberg WJ. Anthropometric profile and complications in patients with diabetes mellitus seen at Maluti Adventist Hospital, Lesotho. South African Fam Pract. 2018;60(3):97–102. Available from: http://doi.org/10.1080/20786190.2018.1426901
28. Klisiewicz AM, Raal F. Sub-optimal management of type 2 diabetes mellitus: a local audit. J Endocrinol Metab Diabetes S Afr. 2009;14 (1):13–6.
29. Roux M, Walsh C, Reid M, Raubenheimer J. Diabetes-related knowledge, attitude and practices (KAP) of adult patients with type 2 diabetes mellitus in the Free State province, South Africa. S Afr J Clin Nutr [Internet]. 2018;0(0):1–8. Available from: https://doi.org/10.1080/16070658.2018.1468536
30. Shilubane H, Netshikweta L, Ralineba T. Beliefs and practices of diabetic patients in Vhembe district of Limpopo province. Afr J Prim Heal Care Fam Med. 2016;8(2):a949.
31. Wells JCK, Marphatia AA, Cole TJ, McCoy D. Associations of economic and gender inequality with global obesity prevalence: understanding the female excess. Soc Sci Med. 2012;75(3):482–90. [cited 2019 Apr 24]. Available from: https://www.sciencedirect.com/science/article/abs/pii/S0277953612002961
32. Lesotho Country Office and Government of Lesotho (Ministry of Gender and Youth Sports and Recreation) on Empowerment for Youth Development (2012- 2014). Lesotho National Human Development Report [Internet]. 2015. Available from: http://hdr.undp.org/en/content/lesotho-national-human-development-report-2016
33. Kautzky-Willer A, Harreiter J, Pacini G. Sex and gender differences in risk, pathophysiology and complications of type 2 diabetes mellitus. Endocr Rev. 2016;37(3):278–316.
34. Steyn NP, Mchiza ZJ. Obesity and the nutrition transition in sub-Saharan Africa. Ann N Y Acad Sci. 2014;1311:88–101.
35. Omar M, Nouh F, Younis M, Younis M, Nabil N, Saleh S, et al. Role of dietary calcium in hypertension. Int Blood Res Rev. 2019;9(1):1–14.
36. Makinga PN, Beke A. A cross-sectional survey on the lifestyle and healthseeking behaviour of Basotho patients with diabetes. S Afr Fam Pract. 2013;55(2):190–5.
37. Briggs Early K, Stanley K. Position of the academy of nutrition and dietetics: the role of medical nutrition therapy and registered dietitian nutritionists in the prevention and treatment of prediabetes and type 2 diabetes. J Acad Nutr Diet. 2018;118(2):343–53.
38. Finucane FM, Mckay R, Quinlan LR, Ginis KAM, Gainforth HL. Diet behavior change techniques in type 2 diabetes: a systematic review and meta-analysis. Diabetes Care. 2017;40(December):1800–10.
39. Zhu H, Zhu Y, Leung SW. Is self-monitoring of blood glucose effective in improving glycaemic control in type 2 diabetes without insulin treatment: a meta-analysis of randomised controlled trials. BMJ Open. 2016;6(9):1–9.
40. Fletcher BR, Hinton L, Hartmann-boyce J, Roberts NW, Bobrovitz N, Mcmanus RJ. Self-monitoring blood pressure in hypertension, patient and provider perspectives: a systematic review and thematic synthesis. Patient Educ Couns. 2016;99(2):210–9. Available from: http://dx.doi.org/10.1016/j.pec.2015.08.026
41. Hu Z, Zhang K, Huang Y, Zhu S. Compliance to self-monitoring of blood glucose among patients with type 2 diabetes mellitus and its influential factors: a real-world cross-sectional study based on the Tencent TDF-I blood glucose monitoring platform. mHealth. 2017;3(25):1–6.
42. Abdelhafiz A, Sinclair A. Low HbA1c and increased mortality risk: is frailty a confounding factor? Aging Dis. 2015;6(4):262.
43. Young-Hyman D, Groot MD, Hill-briggs F, Gonzalez JS. Psychosocial care for people with diabetes: a position statement of the American Diabetes Association. Diabetes Care. 2016;39(12):2126–40.
44. Balogun FO, Tshabalala NT, Ashafa AOT. Antidiabetic medicinal plants used by the Basotho tribe of Eastern Free State: a review. J Diabetes Res. 2016;2016:1–12. [cited 2019 Apr 25]. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4942634/
45. Schroeder K. Radio as a tool of health education: what makes for an effective HIV / AIDS radio campaign in sub-Saharan Africa? Intersect. 2016;9(3):1–16.

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