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RESEARCH

Adherence of patients with type 2 diabetes mellitus with the SEMDSA lifestyle guidelines

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Background: Type 2 diabetes mellitus (T2DM) is considered to be the fastest growing chronic disease in the world and thus multi-sectoral, population-based strategies and approaches are needed to address the modifiable risk factors involved in the development and treatment of T2DM. Evidence-based nutrition principles and recommendations are summarised by the Society for Endocrinology, Metabolism and Diabetes in South Africa (SEMDSA) into guidelines for the management of T2DM. This study aimed to determine the adherence of patients with T2DM with the SEMDSA lifestyle guidelines.
Methods: A cross-sectional study was conducted in a private practice ($n = 50$), during which an interviewer-assisted questionnaire related to socio-demographics, diet and lifestyle was completed with each participant. Participants were also weighed and measured.
Results: 88% of participants were overweight (22%) or obese (66%). Diets consumed were generally high in total energy (TE) (median: 13 272 kJ), low in carbohydrates (CHO) (56% of participants consumed < 45% of CHO from TE), high in saturated fat (92% consumed ≥ 7% from TE) and high in sodium (74% of participants consumed ≥ 2 300 mg sodium daily). Exercise was not commonplace; 84% of participants did not meet the guideline for aerobic exercise and 92% did not meet the guideline for resistance training.
Conclusion: The adherence of participants to the SEMDSA guidelines was poor, thus increasing the risk of long-term complications and poor glycaemic control.

Keywords: diet, lifestyle, private practice, SEMDSA guidelines, Type 2 diabetes

Introduction

Chronic diseases related to lifestyle, such as type 2 diabetes (T2DM), have reached epidemic proportions over the last half century[1,2] and are having a major impact on the health of Africans and South Africans, urban and rural alike.[3,4] T2DM is classified as the fastest growing chronic disease in the world.[5–7] The prevalence of T2DM has almost doubled in the last two decades—rising from 4.7% in 1980 to 8.5% in 2014.[5] Africa, as a continent, has the lowest proportion of people diagnosed with T2DM—5.7% or 19.8 million people—but the highest percentage of persons with undiagnosed T2DM; it is estimated that 62% of T2DM cases remain undiagnosed in Africa.[6] T2DM is associated with a high degree of morbidity and premature mortality in many countries, including South Africa.[3]

T2DM places a significant financial burden on those with the condition, and their families, as well as on health-care systems and national and global economies, by affecting both the direct cost of care, as well as loss of work and wages.[5]

Despite the high prevalence, T2DM is largely preventable. Multi-sectoral, population-based strategies and approaches are needed to address the modifiable risk factors involved in the development of T2DM. These include addressing overweight and obesity, most often the result of an unhealthy diet and physical inactivity.[5,8]

Living well with T2DM is possible.

Many studies have linked lifestyle interventions to improved glycaemic control and delay of long-term complications in T2DM. Medical nutrition therapy plays a major role in controlling weight and blood glucose levels and preventing micro- and macro-vascular complications and diabetes-induced mortality.[9,10] Exercise improves glycaemic control by increasing insulin sensitivity and lowering blood glucose concentrations and by the important role that it plays in weight control.[11] Regular physical activity lowers HbA1c levels by an average of 0.6–0.8%.[12] This is significant, as lower HbA1c levels are associated with improved morbidity and mortality outcomes.[13]

Diabetes management can be strengthened through the use of evidence-based guidelines, standards and protocols.[5] National guidelines are thus critically important in directing T2DM care and preventing complications.[5]

In the South African setting, evidence-based nutrition principles and recommendations are continuously summarised by the Society for Endocrinology, Metabolism and Diabetes in South Africa (SEMDSA) into guidelines for the management of T2DM. These guidelines are intended to reduce the burden of T2DM, by managing modifiable risk factors, comorbidities, symptoms and complications of the disease effectively. Early intervention and adequate control of glycaemia, hypertension and dyslipidaemia in patients with T2DM is imperative in preventing or reducing T2DM associated morbidity and mortality.[7]

Comparing the modifiable risk factors involved in the development of T2DM (overweight and obesity, diet, alcohol consumption, smoking habits and physical activity patterns) with the guidelines suggested by SEMDSA can provide information regarding the degree to which these guidelines are applied by South Africans living with T2DM. Identifying these gaps can further contribute to the empowerment of dietitians,

diabetes educators and medical practitioners to target areas that need attention in patient education with the aim of optimising patient care and enhancing patient understanding.

The aim of this study was to examine the diet and lifestyles of patients with T2DM in accordance with the SEMDSA guidelines.

Methods

Although the 2017 SEMDSA guidelines have recently been published,[14] this study was undertaken during 2016 when the 2012 SEMDSA guidelines were still applicable.[7]

Study design and participants

A cross-sectional study design was applied in a convenient sample (n = 50) to determine the adherence of patients with T2DM with the 2012 SEMDSA lifestyle guidelines. Participants were over 18 years of age and being treated for T2DM at a physician's private practice in Bloemfontein. Patients with T2DM with impaired cognition and pregnant women were excluded.

Ethics

The study was approved by the Health Sciences Research Ethics Committee of the Faculty of Health Sciences at the University of the Free State (ECUFS 89/2015) and all participants signed written informed consent.

Study variables and techniques

Socio-demographic, diet and lifestyle information was collected by the researcher in a structured interview with each participant.

For the purpose of this study, socio-demographic factors referred to age, gender, marital status, home language, highest level of education and current employment status (Table 1).

Diet and lifestyle

The 2012 SEMDSA dietary guidelines recommended the following:

- Carbohydrates should make up 45–60% of total energy intake.
- Fructose intake should be limited to < 60 g daily.
- A sucrose intake of 10% of total energy is acceptable.
- Soluble and insoluble fibre intake should be increased to 25–50 g daily.
- Daily protein intake should be 15–20% of total energy.
- Restrict fat intake to < 35% of total energy intake.
- Saturated fat should be < 7% of TE.
- Polyunsaturated fat < 10% TE.
- Consume two or more portions of fish per week to provide the recommended omega 3 polyunsaturated fatty acids.
- Reduce sodium intake to < 2 300 mg daily.

To best capture habitual dietary intake of macro- and micronutrients (including types of foods consumed, frequency and amounts) a quantitative food frequency questionnaire (QFFQ) developed for the Transition, Health & Urbanisation in South Africa (THUSA) study was used.[15] This QFFQ was selected as it has been validated for the Tswana-speaking population of South Africa and therefore includes both Western and traditionally consumed foods.

Standard household measuring equipment was used to measure quantities of foods and beverages consumed. Grams of foods and beverages consumed were determined from volume by using the Food Quantities Manual.[16] These amounts were then entered into the Medical Research Council's (MRC) Food Finder 3 (FF3) programme for analysis.[17] Actual intake of sodium (grams per day) as well as percentages of protein, carbohydrates, fat, sucrose and fructose of total energy were determined.

Table 1: Participant profile

Variable	Frequency (*n*)	Percent (%)
Gender:		
Male	24	48
Female	26	52
Marital status:		
Married	37	74.0
Divorced	4	8.0
Never married	3	6.0
Widow/er	6	12.0
Home language:		
English	5	10.0
Afrikaans	26	52.0
Sotho	14	28.0
Tswana	3	6.0
Xhosa	2	4.0
Zulu	0	0.0
Other	0	0.0
Highest level of education:		
None	0	0.0
Primary school	0	0.0
Grade 8–10	1	2.0
Grade 11–12	27	54.0
Tertiary education	22	44.0
Employment status:		
Housewife by choice	2	4.0
Unemployed	5	10.0
Self-employed	4	8.0
Full-time wage earner (receives a salary)	27	54.0
Other (part-time, piece-job etc.)	12	24.0

Alcohol consumption and smoking habits were determined using a questionnaire developed by the researcher as a measure of adherence to the SEMSDA 2012 guidelines.

Alcohol consumption was categorised as low, moderate or high (Table 2).[7]

One unit of alcohol was measured as 10 g of pure alcohol, also known as the "standard drink".[18] This equates to:

- 330 ml beer;
- 100 ml wine;
- 30 ml spirits.

The lifestyle questionnaire measured frequency and units of alcohol consumed while the type and amount of alcohol consumed was determined using the QFFQ.

Table 2: Categories of alcohol consumption

Alcohol consumption (units)	Low	Moderate	High
Men	< 2	2	> 2
Women	< 1	1	> 1

The 2012 SEMSDA guidelines recommend smoking cessation.[7] Smoking habits were categorised as:

- never smoked;
- current smoker (number of cigarettes smoked daily);
- quit smoking (how long ago).

The SEMDSA physical activity guidelines include aerobic and resistance training:

Aerobic

- 150 (minimum) minutes per week of moderate activity (50–70% of max heart rate) (small increase in breathing or heart rate); **OR**
- 75 (minimum) minutes per week of vigorous activity (> 70% of max heart rate) (large increases in breathing or heart rate); **OR**
- equivalent combination of moderate and vigorous aerobic exercise.

Physical activity intensity and duration was calculated using the Global Physical Activity Questionnaire (GPAQ) developed by the WHO.[19] This tool collects physical activity information in three settings—travel to and from work/other places, activity at work and recreational activities, as well as sedentary behaviour. Self-reported increases in breathing and heart rate were used to differentiate moderate (a small increase in breathing or heart rate) from vigorous (a large increase in breathing or heart rate) aerobic activity and sedentary behaviour was measured by number of hours spent sitting per day.

Resistance

For the purpose of this study, resistance exercise was determined by frequency (number of times per week), regardless of sets or reps (SEMDSA recommends 2–3 times per week).

Other variables

Weight, height and waist circumference were measured by the trained researcher according to standardised techniques,[20] to determine BMI, waist circumference and waist–height ratio (Tables 3 and 4).

BMI (weight divided by height squared) was categorised according to the WHO cut-off points.[21] The WHO Stepwise Approach to Surveillance (STEPS) protocol was used to measure waist circumference[22] and categorised according to the Europid cut-off points (< 80 cm women; < 94 cm men).[7,23] Waist–height ratio was calculated by dividing waist circumference by height. Waist circumference should be half height.[24]

Participants were weighed and measured without shoes and in light clothing. All measurements were taken twice to the nearest 0.01 cm/0.1 kg.

Table 3: Body mass index (BMI)

Weight status	BMI (kg/m^2)	Frequency (*n*)	Percent (%)
Underweight	< 18.5	1	2.0
Normal weight	18.5–24.9	5	10.0
Overweight	25–29.9	11	22.0
Obese	> 30	33	66.0

Table 4: Waist circumference and waist–height ratio

Variable	Frequency (*n*)	Percent (%)
Waist circumference:		
Male		
< 94 cm	4	16.7
≥ 94 cm	20	83.3
Female		
< 80 cm	1	3.8
≥ 80 cm	25	96.2
Waist–height ratio:		
≤0.5	4	8.0
>0.5	46	92.0

Statistical analysis

FF3, a dietary analysis software program developed by the Nutritional Intervention Research Unit and the Biomedical Informatics Research Division of the South African Medical Research Council in collaboration with WAMTechnology cc, Stellenbosch, was employed to analyse dietary intake.[17] Statistical analysis was performed by the Department of Biostatistics at the UFS. Descriptive statistics including percentages, frequencies, means, standard deviations, medians and percentiles were employed to describe categorical and continuous data.

The comparison with the 2012 SEMDSA guidelines entailed noting the percentage of participants that were correctly applying what is stipulated by the guidelines in terms of diet, alcohol consumption, smoking habits and physical activity.

Results

The median age of participants was 57.9 years old, ranging from 21.1 to 82.6 years. The time since T2DM had been diagnosed ranged from 1 month to 30 years, with a median of 7 years.

The diets of participants were generally high in total energy (TE) (median: 13 272 kJ), low in carbohydrates (CHO) (56% of participants consumed < 45% of CHO from TE), high in saturated fat (92% consumed ≥ 7% from TE) and high in sodium (74% of participants consumed ≥ 2 300 mg sodium daily) (Table 5).

TE intake of participants ranged from 3 912 kJ to 28 849 kJ daily (mean: 14 304 kJ; median: 13 272 kJ).

The Daily Recommended Intake (DRI) for active individuals 19–70 years old is 10 093 kJ.[25] Participants in this study thus consumed 142% of the DRI.

A large number of participants (42%) never consumed alcohol and 64% reported never smoking (Table 6).

Table 5: Dietary intake compared with the SEMDSA guidelines

Variable	Frequency (*n*)	Percent (%)
Carbohydrate % of TE:		
< 45	28	56.0
45–60	22	44.0
Fructose (g)		
< 60	50	100.0
Sucrose % of TE:		
≤ 10	46	92.0
> 10	4	8.0
Total dietary fibre (g):		
< 25	13	26.0
25–50	28	56.0
> 50	9	18.0
Total fat % of TE:		
≥ 35	25	50.0
< 35	25	50.0
Saturated fat % of TE:		
< 7	4	8.0
≥ 7	46	92.0
PUFA % TE:		
< 10	38	76.0
≥ 10	12	24.0
Recommended Omega 3 intake		
≥ 2 portions/week	5	10.0
< 2 portions/week	45	90.0
Protein % of TE:		
< 15	22	44.0
15–20	21	42.0
> 20	7	14.0

Table 6: Alcohol consumption and smoking habits

Variable	Frequency (*n*)	Percent (%)
Alcohol consumption frequency:		
Never	21	42.0
Every day	1	2.0
Most days	2	4.0
Only over weekends	8	16.0
Special occasions	18	36.0
Alcohol consumption categories:		
Low (< 2 units daily)	1	2.0
Moderate (2 units daily)	0	0.0
High (> 2 units daily)	2	4.0
Smoking habits:		
Never smoked	32	64.0
Current smoker	5	10.0
Quit smoking	13	26.0

Exercise was not commonplace among participants and the guidelines were poorly adhered to. Most participants did not meet the guideline for aerobic (84%) or resistance exercise (92%) (Table 7).

Table 7: Aerobic and resistance exercise compared to the SEMDSA guidelines

Variable	Frequency (*n*)	Percent (%)
Aerobic exercise:		
Guideline attained	8	16.0
Guideline not attained	42	84.0
Resistance exercise:		
Guideline attained	4	8.0
Guideline not attained	46	92.0

Discussion

The median age of participants in the present study was 57.9 years. Peer *et al.*[26] conducted a study on the rising prevalence of diabetes among urban-dwelling South Africans and found that there was an increase in diabetes from 45 years old, that peaked (38.6% increase) in 65–74-year-olds. Bradshaw *et al.*[27] have also reported that T2DM was more common in older (≥ 60 years) South Africans.

Overweight and obesity have been extensively documented in the literature as a major factor in the development of T2DM.[5,28–30] In the present study, 88% of participants were overweight (22%) or obese (66%). The occurrence of overweight and obesity in the current study was more or less similar to that reported in the Diet of Diabetic Patients in Spain study.[31] In that study, 39.9% of participants were overweight and 47.1% were obese. Another study by Stewart *et al.*,[32] conducted by general practitioners in their respective private practices included participants from nine countries in Latin America, also reported similar results. Of the 3 592 participants with T2DM interviewed by the 377 general practitioners, 79% were overweight or obese.

One of the strongest risk factors for T2DM is excess body fat.[5] Abdominal obesity, most often expressed as an increased waist circumference, is an independent predictor of T2DM regardless of BMI, and is a stronger risk factor in women than in men.[33] Therefore one would expect higher rates of abdominal obesity in the diabetic population, and this was the case in our study, where 90% of participants with T2DM (96.2% of women and 83.3% of men) had a waist circumference above the high-risk cut-off points. Results from Spain were similar, though not quite as high, with 71.4% of Spanish participants having abdominal obesity. However, higher cut-off points were used (male ≥ 102 cm; female ≥ 88 cm), indicating that the percentage of participants with a high waist circumference might be even higher if lower cut-off points were applied.

Compared with BMI, waist circumference and waist-hip ratio, Xu *et al.*[34] have suggested that waist–height ratio (> 0.5) may be a better indicator to use to identify risk for T2DM.

In our study 92% of participants had a waist–height ratio above 0.5 and the percentage of participants presenting with higher than normal values was highest for the waist–height indicator at 92% (compared with waist circumference at 90% and BMI at 88%). Waist–height ratio may thus be a better predictor of T2DM than other anthropometric indicators.

Studies from Europe (Italy and Spain),[31,35] America (Look Ahead Trial),[36] the Far East (Japan)[37] and the Middle East (Saudi Arabia)[38] have assessed dietary intake of patients with T2DM. In these studies dietary intakes have been determined using food

frequency questionnaires (Look Ahead Trial, Japan and Saudi Arabia), food diaries (Italy) and dietary history (Spain) and comparing their findings with country-specific dietary guidelines for patients with T2DM.

Despite small differences, dietary guidelines are fairly standard across countries and most recommendations were similar to those included in the 2012 SEMDSA guidelines.

In the present study, most participants (56%) consumed less than 45% TE from carbohydrates. These results are similar to the Spanish and American studies where most participants consumed less than 45% of TE from CHO—a mean of 41.1% and 44% respectively. In Spain, only 25.5% of the study population met the guideline for carbohydrate consumption, while in the American Look Ahead Trial, very few participants met the recommendations for carbohydrate-containing foods. These included only 7% for grains, 36% for fruit and 38% for vegetables (they did not report on total carbohydrate intake as a percentage of TE).

Vitolins *et al*.[36] hypothesise that people with T2DM may purposely be avoiding carbohydrates due to the belief that restricting carbohydrates will help to control blood glucose levels.[36] The same trends have recently been noted in South Africa, with the media often promoting very low carbohydrate diets to control blood glucose.[39]

In Italy, Japan and Saudi Arabia, the mean percentage of carbohydrates consumed was more likely to be within the guidelines (49, 53.6 and 56.9% of TE respectively) with most participants meeting the guideline (Italy, 72%; Japan, 58% and Saudi Arabia, 61.4%).

All participants in the present study met the SEMDSA guideline for fructose intake. In the five comparison studies discussed, none assessed fructose intake individually, although added fructose is a principle driver of T2DM and its consequences.[40] The relatively low intake of fructose is not surprising, as fructose (or high fructose corn syrup) is not routinely used in South Africa as a sweetener.

Sucrose, on the other hand, is widely used as a sweetener in South Africa. According to the SEMDSA guideline, 10% of TE can come from sucrose. Surprisingly, 92% of participants met this guideline with only 8% consuming more than 10% of TE from sucrose. Most diabetic patients are under the impression that limiting added sugar intake is the most important dietary goal[36] and this may be the reason why most limited their intake of sugar.

Dietary fibre is essential in all diets but particularly in one for those with T2DM as it helps slow the release of sugar into the bloodstream, thus helping to control blood glucose levels.[38] More than half of participants in this study reported fibre intakes between the recommended 25 g to 50 g daily (56%). Some 18% reported that they consumed more than 50 g of fibre daily and only about one-quarter (26%) consumed less than 25 g a day.

Protein consumption was generally lower than the SEMDSA guidelines with 44% of participants consuming < 15% TE from protein, 42% meeting the guideline and 14% consuming > 20% of TE from protein. This did not differ significantly among participants in comparison studies, with Italians consuming the lowest mean percentage of TE from protein (15.7%) and Japanese participants the most (19%).[35,37] Participants in the Look Ahead Trial and those from Saudi Arabia consumed 17% and 17.3% of TE from protein.[36,38]

In the present study, half of participants met the SEMDSA recommendation for total fat intake and half exceeded the recommendation. In comparison studies, those from Saudi Arabia and Spain used the same fat-intake recommendations as SEMDSA. Results showed that 54.4% of Saudi Arabians consumed less than 35% of TE from fat (mean consumption 31.2% TE) but only 38.3% of Spanish participants met the recommendation (mean consumption 36.7% TE).[31, 38]

The Look Ahead Trial used a recommendation of < 30% TE for total fat and 93% of participants in that study exceeded this recommendation, with a mean of 40% of TE coming from fat.[36] Italy's recommendation of 24–35% of TE from fat was met by 62% of participants, with a mean intake of 32% TE from fat.[35] Japan had a far stricter fat recommendation at < 25% of TE. Not surprisingly, only 30% of Japanese participants met this recommendation. Despite this, Japan had the lowest mean fat consumption at 27.6% of TE, while American participants had the highest (40% of TE).[36,37]

The vast majority of participants in the current study (92%) exceeded the SEMDSA guideline for saturated fat intake. Short-term studies have shown that the intake of saturated fats by overweight or obese participants can induce insulin resistance.[41] Insulin resistance has been linked to increased levels of free fatty acids and pro-inflammatory cytokines in plasma, resulting in less glucose being transported into skeletal muscle cells, hepatic glucose production increasing and increased lipolysis.[42] Dyslipidaemia is a known risk factor for cardiovascular disease in patients with T2DM[43] and a major accelerator to macrovascular complications and atherosclerosis.[7] Atherosclerosis is the main cause of macrovascular complications in T2DM[44] and is associated with a worsening prognosis, more rapid progression and earlier onset than general atherosclerosis.[45]

Most comparison studies used the same guidelines as SEMDSA for saturated fat, except for the Look Ahead Trial and Italy where ≤ 10% (instead of ≤ 7%) of TE was used. Spanish results were the most similar to our study, with 92% of participants exceeding recommended guidelines—a mean saturated fat intake of 11.2% of TE was reported.[31] In the Look Ahead Trial, the highest (mean) percentage of saturated fat was consumed (13% of TE) and 85% of participants exceeded the ≤ 10% of TE guideline.[36] Italians and Saudi Arabians had fairly similar results with most participants meeting the guideline at 57% and 51.7% respectively, although, different cut-off points were used: < 10% of TE in Italy and < 7% of TE in Saudi Arabia.[35,38] Again Japan had the lowest mean intake of saturated fat at 7.9% of TE, with 73% of participants meeting the < 7% of TE guideline.[37]

Just 10% of our participants met the guidelines for omega 3 consumption, a finding that was quite different from the 69.1% of Spanish participants who met the same guideline.[31]

Almost three-quarters (74%) of participants exceeded the SEMDSA guideline for sodium intake. These results do not account for added sodium, therefore the actual percentage of participants who consumed excess amounts of sodium is possibly much higher.

Only three comparison studies assessed sodium intake and all used different cut-off points, making comparisons almost impossible. In the Look Ahead Trial, 92% of participants exceeded the far stricter guideline of ≤ 1 500 mg daily.[36] Japan had the most lenient guideline at ≤ 3 900 mg daily and this was exceeded by 51.5% of participants (mean sodium intake was as high as 4 200 mg daily).[37] In Spain a mean of 3 100 mg of sodium was consumed.[31] Most Spanish participants (55.4%) met the < 3 000 mg daily guideline (double the amount of sodium recommended in the Look Ahead Trial).

In another trial that included 296 diabetic participants, the Enhancing Adherence in Type 2 Diabetes Trial (an American study), two cut-off points were used and 20.3% consumed < 2 300 mg and only 2.4% < 1 500 mg sodium daily,[46] with a mean intake of 3 214 mg. The first cut-off point is the same as the South African one, indicating that the percentage of South African participants who exceeded the guideline was much higher than that for the American participants (74% vs. 20%).

Sodium intake was alarmingly high in all studies reviewed. This is a dangerous lifestyle habit in patients with T2DM, as they are at a higher risk of hypertension, cardiovascular disease and chronic kidney disease,[46] all of which are affected by sodium intake.

Many studies have documented the importance of aerobic exercise and resistance training in controlling and preventing T2DM.[2,3,12,47,48]

We found that most participants (54%) were completely sedentary and the vast majority did not meet the SEMDSA guidelines for aerobic activity (84%) or resistance training (92%). These results are similar to those reported by the Latin American private practice general practitioners (GPs), where 71% of the participants with T2DM were found to be sedentary.[38]

Another study undertaken in 48 private practices in the Auvergne region of France looked at barriers to physical activity in diabetes.[12] In this study, 63.1% of (369) patients did not take part in regular physical activity, although 83.2% reported that their GPs had recommended that they exercise regularly. Fear of suffering a heart attack, their poor physical health status and low levels of fitness were cited as the main reasons for not exercising.

Despite an overwhelming body of evidence regarding the benefits of regular physical activity and clear guidelines on the type and duration of physical activity for managing and preventing T2DM, most patients do not perform sufficient physical activity.[2]

Limitations of this study included the relatively small number of participants and the fact that all participants were members of private medical practices, which may have introduced an element of possible bias as these patients may not be representative of all patients with T2DM in Bloemfontein. The inclusion of newly diagnosed patients (≤ one month) may too be viewed as a limitation as it can be argued that these patients may not have had time to make the required changes to their diets. In this study four participants were newly diagnosed with T2DM. It is also possible that patients with poorly controlled T2DM may have been less likely to participate. Barriers to adherence were not addressed in this study.

In conclusion, the adherence of participants to the SEMDSA guidelines was poor, thus increasing their risk of long-term complications and poor glycaemic control. This was characterised by following a diet that, although low in carbohydrates, was high in fat (especially saturated fat) and sodium, and leading a predominantly sedentary lifestyle. Complying with the SEMDSA guidelines can assist in maintaining a healthy weight, consuming a healthy diet and performing regular exercise.

In view of the poor compliance of patients with T2DM with the SEMDSA lifestyle guidelines that was identified in the present study, research regarding barriers to compliance with dietary and exercise guidelines in South African patients with T2DM is warranted.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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