

A plant-based dietary approach to the management of type 2 diabetes mellitus in South Africa: short communication of a multiple-case study

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Objective: The aim of this study was to explore how participants and physicians experienced a plant-based dietary approach to type 2 diabetes mellitus (T2DM) in South Africa.

Design: A multiple-case study was undertaken.

Setting: The pilot 'Diabetes Reversal Challenge' was initiated and led by UBUNTU Wellness Institute. Participants with T2DM consume a whole-food plant-based diet for 21 days and are assigned to private physicians for clinical monitoring of health outcomes.

Subjects: South African adults with T2DM ($n = 10$) and physicians ($n = 4$) participated in the challenge between April 2021 and May 2022.

Outcome measures: Participants' health outcomes and contextual factors influencing how participants and physicians experienced the plant-based dietary approach in South Africa were the measures used.

Results: The plant-based dietary approach resulted in positive health outcomes for South African adults with T2DM, such as improved glycaemic control, weight loss, reduced need for medication and psychological benefits. Multiple layers of contextual factors influenced the plant-based dietary approach to T2DM in South Africa, mapped into a socio-ecological framework that includes (1) individual, (2) interpersonal, (3) organisational, (4) community and (5) healthcare system factors.

Conclusions: These results encourage healthcare systems to explore plant-based dietary approaches as an option in the management of T2DM in South Africa.

Keywords: plant-based diet, plant-based nutrition, type 2 diabetes, South Africa

Introduction

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder characterised by persistent hyperglycaemia and peripheral insulin resistance, accounting for the vast majority of diabetes cases.¹ Between 2015 and 2017, diabetes remained the second leading cause of death among South Africans, but the proportion of deaths have increased from 5.4% to 5.7%.² In 2021, it was calculated that a significant proportion, 15.25%, of South Africans have T2DM.³

Alarming, the International Diabetes Federation estimates that 45.4% of South Africans living with diabetes remain undiagnosed.⁴ T2DM can be diagnosed with plasma glucose testing, and early detection and treatment prevents future diabetes-related micro- and macrovascular complications. Long-term glycaemic control is measured using glycated haemoglobin (HbA1c), and a glycaemic target of below 7% is recommended for most people living with T2DM.^{1,5}

Lifestyle changes such as adopting healthy dietary patterns can effectively prevent and manage T2DM. Dietitians, experts in medical nutrition therapy (MNT), guide patients to enjoy a variety of nutrient-dense foods with a low to moderate glycaemic index in appropriate portion sizes. This approach promotes quality dietary intake and the equal distribution of carbohydrates to attain glycaemic control, prevent diabetes-related complications and contribute to overall cardiometabolic health. MNT can achieve a HbA1c reduction of 0.5–2%^{1,6} in

T2DM cases, and can also reduce diabetes-related healthcare costs.⁷

Plant-based dietary approaches in alignment with MNT are protective against T2DM, but the role of vegetarian and vegan diets for T2DM is not well understood among South African health professionals.⁸ The reversibility of T2DM using a low-fat vegan diet was first demonstrated in 2009 during a 74-week clinical trial. After controlling for medication changes, the plant-based diet improved glycaemia and plasma lipids more than a conventional diabetes diet in an American population.⁹ In 2021, a systematic review concluded that vegan diets were associated with improved glycaemic control and a lower prevalence of T2DM.¹⁰ Despite the concept advancing globally, plant-based dietary approaches to T2DM have not yet been applied in a South African context.

Methods

The study design was a multiple-case study.¹¹ The case studies deliberately explore the pilot intervention within its broader context to understand factors associated with healthy plant-based eating behaviour in South Africa. The data were collected retrospectively, including information gathered from interviews and clinical records. The results are sorted into the contextual themes of the socio-ecological model.

The study protocol was approved by the North-West University Ethics Review Board (NWU-00298-21-A1) and researchers obtained gatekeeper permission from the initiators of the challenge.

Table 1: Participant demographics

Case (participant [PT])	Gender	Assigned physician (doctor [DR])	Residence	Province
1	Male	1	Cape Town	Western Cape
2	Female	1	Nyanga	Western Cape
3	Male	3	Sandton	Gauteng
4	Female	3	Kempton Park	Gauteng
5	Female	1	Bonteheuwel	Western Cape
6	Female	2	Hammanskraal	Gauteng
7	Female	1	Napier	Mpumalanga
8	Male	4	Cape Town	Western Cape
9	Female	1	Imizamo Yethu	Western Cape
10	Male	1	Springs	Gauteng

Case description: 21-Day 'Diabetes Reversal Challenge'

In 2021, UBUNTU Wellness Institute (UWI) developed and initiated their 21-Day 'Diabetes Reversal Challenge', a plant-based dietary approach to T2DM. UWI invited South African adults living with T2DM to take the challenge, and private physicians to monitor the clinical progress of participants. There were no restrictions placed on participants with T2DM, such as their duration of diagnosis or presence of comorbidities, and the physicians were general practitioners. Between April 2021 and March 2022, 10 participants were collectively assigned to 4 physicians. Their residential areas spanned three South African provinces: Western Cape, Gauteng and Mpumalanga, as seen in Table 1.

The Diabetes Reversal Challenge was led by a director, project manager, nutritionist and local chefs from UWI in Cape Town, Western Cape. When participants accepted the challenge, they were provided with resources to follow a plant-based dietary approach from their own homes. The Diabetes Reversal Challenge consisted of:

1. Participants with T2DM eat a whole-food plant-based diet for 21 days.
2. Their meals are guided by a locally developed, no-oil, whole-food plant-based recipe book.¹²
3. A grocery sponsorship of R1000.
4. A WhatsApp group for communication between all participants and UWI.
5. At least one appointment with a physician to assess their clinical outcomes during the challenge.

Adherence to the diet was self-reported and not assessed. Once the 21 days were complete, participants were encouraged to continue the plant-based diet.

Data collection

Retrospective data collection took place between May and June 2022. All participants with T2DM ($n = 10$) and physicians ($n = 4$) who had taken part in the Diabetes Reversal Challenge at that time were included in the research. UWI mediated the recruitment and informed consent procedures. After written informed consent was obtained, semi-structured one-on-one interviews were conducted online or in-person with all participants.

The participants with T2DM were interviewed first, where additional consent was provided to discuss their case with their physician. Clinical records were requested, including

written and laboratory tests, for during and directly before and after the challenge. The participants attended appointments based on availability and accessibility, and the numbers of appointments during the challenge varied.

The physicians were not provided with a standardised tool to assess participants. Audits of clinical records were based on a reflexive data-capturing form, including age, sex, presence of comorbidities, medication changes, weight, abdominal circumference and biochemistry.

Glycaemic control during the challenge was assessed by self-monitoring of blood glucose, HbA1c and average estimated glucose trends (eAG). The researchers present the HbA1c and eAG trends in the results section. Other quantitative measures included weight, abdominal circumference and lipid profiles but were only available for a small portion of the sample.

Data analysis and synthesis

Qualitative data were analysed using thematic analysis guided by the socio-ecological model. The socio-ecological model explores the interplay between various social determinants of health from the individual to the family, the community and society at large.^{13,14} These factors influence healthcare and promotion interventions, and the model has been applied to explore previous T2DM interventions in Africa.¹⁵

The thematic analysis followed a six-step framework:¹⁶ familiarisation with the data, generation of initial codes, theme development, reviewing themes, defining themes and producing the report. The following themes associated with the socio-ecological model emerged when analysing the qualitative data: individual, interpersonal, organisational, community and healthcare system. Themes and descriptions are provided in Table 2.

Table 2: Theme descriptions of the plant-based dietary approach

Individual factors	What were the attitudes and health outcomes of participants?
Interpersonal factors	How did it impact close relationships of the participants?
Organisational factors	How did the participants and physicians experience the implementation?
Community factors	How did it fit into the South African sociocultural context?
Health system factors	How did it fit into the South African public health system?

Clinical records were examined to validate the described health outcomes. Using the interview data and clinical records, a cross-case synthesis was applied to explore the Diabetes Reversal Challenge, a plant-based dietary approach to T2DM in South Africa.

Results

Individual factors

Participants were motivated to make lifestyle changes, and their motivations to heal were strengthened by experiencing health benefits.

It started with the motivator being: I want to get off my medicine, or I want to get off as much of my medicine as possible to live a longer, better life ... that excitement was infectious ... how excited they were about the positive results. (DR1)

Improved glycaemic control, seen in Table 3, allowed the physicians to reduce medication dosages in a number of participants. In interviews, it was described that participants reduced their medication dosages and also stopped medication during the challenge.

On the 17th day, I was off my medication. (PT2)

Additional described health benefits of the challenge included weight loss and reduced abdominal circumference.

When I was on my diet I wasn't doing any serious exercise, but my weight came down nicely. And that was a very good benefit. (PT3)

They had lost kilograms, they lost centimetres. (DR1)

Table 3: Participants' glycated Hb (HbA1c) and estimated average glucose (eAG) trends before, during and after the 21-day Diabetes Reversal Challenge

Case	Day of challenge	HbA1c (%)	eAG (mmol/l)
1	-3	6.3	7.4
	13	6.2	7.3
2	1	8.7	11.2
	20	7.1	8.7
3	10	9.7	12.8
	27	9.1	11.9
	35	8.9	11.6
4	-1	10.1	8.3
	12	10	13.3
	26	9.4	12.4
	77	8.2	10.4
5	0	6.2	7.3
	13	6.1	7.1
	21	6.1	7.1
8	-1	11.7	16
	13	10.7	14.4
	21	10.9	14.7
9	1	13	18.1
	12	11.6	15.9
	21	10.7	14.4

The participants with T2DM also experienced increased energy levels, positive psychological changes, improved confidence and elevated mood.

Before starting the [21-day] programme, I used to be tired, always drowsy and wanted to sleep, and I didn't have any energy ... I could run, I could perform well, even mentally, physically, emotionally, there was a lot of improvement. (PT10)

Interpersonal factors

Family acceptance of the plant-based diet, or lack thereof, acted as a facilitator or barrier to adoption among participants. Meal-times are often shared in the family unit, and preparing separate meals was described as challenging to some. In other cases, family members joined the challenge and provided valuable support.

At this point, his partner also went on the diet as well. So that is definitely another positive outcome. (DR4)

Organisational factors

This was the pilot of the Diabetes Reversal Challenge and the implementation team provided continuous support and communication between participants. The physicians also regularly engaged in WhatsApp conversations. The role of the chef was appreciated by one participant, who received an individual session on no-oil cooking.

As soon as you know how to do it, it's like, wow! So that was really great to have some of these chefs come along. (PT1)

Before commencing the challenge, all participants ate an omnivorous diet and most were not well informed on the benefits of plant-based eating or its practical application. For this reason, participants expressed that they would have benefited from introductory educational materials. Starting the challenge, and its first week, was consistently the most challenging period for the participants.

A few of them said the first two or three days they experienced some headaches, a little bit of irritability, but all of them said from day three to four onwards, they started feeling better. (DR1)

The physicians did not receive strict guidelines for clinical monitoring. Physician feedback on implementation included increasing the duration of the intervention, regular clinical monitoring and scheduling follow-up evaluations.

Collective knowledge gaps existed on the need for vitamin B12 supplementation with a plant-based diet, although some participants were already supplementing vitamin B12 alongside metformin treatment.

The vitamin B12 ... that was something I've never been enlightened [about] during the process. (PT9)

Community factors

Meat consumption patterns have increased in South Africa, as recently as within one generation. The consumption of animal products is now embedded in South African culture, and eating a plant-based diet challenges this. Social events, special religious events and birthdays triggered non-adherence.

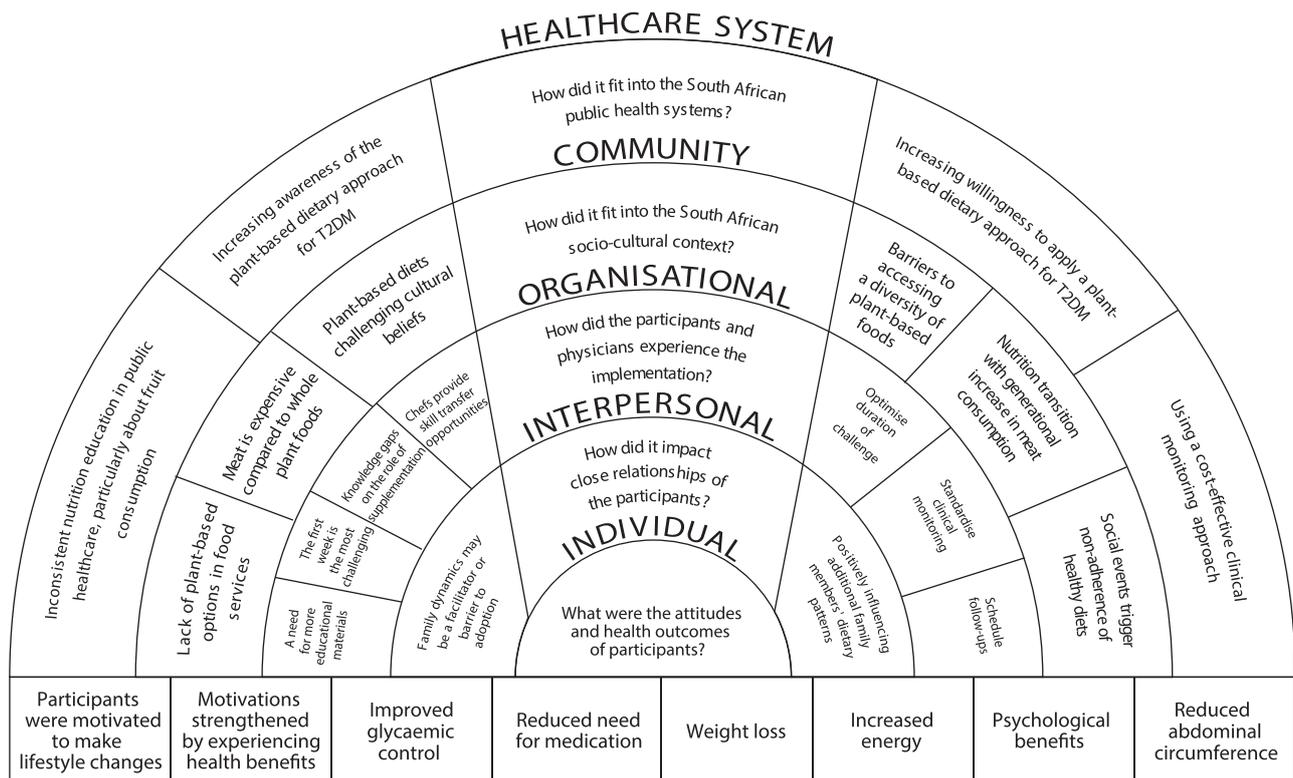


Figure 1: A socio-ecological model of a plant-based dietary approach for the management of type 2 diabetes mellitus in South Africa

Participants explained that rejecting animal-based food at these events could be viewed as disrespectful or rude.

Even in rural areas, the colonised diet has permeated and is now regarded as the standard diet. My dad tells me always that we never used to have meat as often as we do nowadays. (PT3)

Our church celebrated lots of events ... where they slaughter animals. (PT2)

Compared with whole-plant foods, meat is expensive so the plant-based diet was more affordable than their regular diet. In lower-income settings, difficulty in accessing a diversity of fresh fruit and vegetables was described. In some cases, participants travelled to access a variety of plant-based food, adding additional costs to the healthy diet. Barriers to access also existed in restaurants, hotels and airlines.

Just to say to someone when you book an airline ticket that, 'I'm a diabetic, I want a diabetic meal'. I promise you they have got no clue what to deliver to you as a diabetic. (PT1)

Health system factors

The participants with T2DM expressed dissatisfaction with the nutrition education received upon diagnosis. A participant reported receiving inconsistent nutrition advice upon diagnosis, particularly regarding fruit consumption.

That evening, I read the three pieces of paper that I was given. They contradict each other! So, the one said fruit juice is a good thing. And the other said it's a bad thing. (PT1)

After the Diabetes Reversal Challenge, the physicians demonstrated acceptance of the plant-based dietary approach to T2DM management. One physician was skilled in plant-based nutrition, but for the remaining three, this intervention was their first clinical exposure to plant-based nutrition for T2DM management.

It's been sort of a novel learning experience in terms of what a plant-based programme can be ... seeing what it can do in terms of chronic disease management, this was very powerful. (DR1)

When participants returned to their public healthcare clinics with positive outcomes, it sparked interest among other healthcare professionals, particularly nurses.

It was so exciting to see that even the doctors wanted to know more ... the doctor suggested I must take a video of myself to share my experience with others and to tell them about my journey. At the clinic was a nurse whose husband is also diabetic; she was very interested. (PT9)

Physicians advised that if the intervention were to be applied within the South African public healthcare system, clinical monitoring should be standardised and resource efficient.

Socio-ecological model

The thematic analysis revealed multiple factors influencing the plant-based dietary intervention in South Africa at each level of the socio-ecological model: (1) individual, (2) interpersonal, (3) community, (4) organisational and (5) healthcare system. Themes and sub-themes are mapped out in the socio-ecological model pictured in Figure 1.

Discussion

The evidence presented in this multiple-case study is a real-life representation of a plant-based dietary approach to T2DM in South Africa. Dietary approaches are contextual and influenced by a number of factors at each level of the socio-ecological model. Considering these perspectives can significantly increase the outcomes of the interventions. This paper contributes to an understanding of the broader factors influencing healthy plant-based dietary approaches, particularly for T2DM, in South Africa.

The Diabetes Reversal Challenge was not a controlled study, and there are limitations in interpreting the clinical outcomes of participants. The limitations include a small sample size, lack of standardisation and the outcomes of adherence. Nevertheless, participants with T2DM and physicians described positive health outcomes, including reducing drug dosages, improved glycaemic control, weight loss and psychological benefits. These results should encourage South African physicians, dietitians and diabetes educators to further explore plant-based dietary approaches as an option in the management of T2DM.

In the title of the challenge, the term 'reversal' refers to remission of T2DM. According to a consensus statement, remission of T2DM is described as the maintenance of HbA1c levels persisting below 6.5% for at least three months without concurrent use of glucose-lowering drugs.¹⁷ Despite the challenge having positive outcomes such as reduced drug dosages and downward trends of HbA1c, extended clinical monitoring with appropriate recording of medication dosages would be required to claim remission of T2DM. This definition is vital for the organisers of the challenge to consider, particularly when managing expectations among prospective participants.

South Africa's diverse cultural, health and sociopolitical influences pose a unique lens through which to view healthy plant-based eating behaviour. Meat consumption proves to be a significant part of South African social and religious events. The lack of diversity of plant-based food options in supermarkets and food services poses a barrier to adopting a healthy plant-based diet. Our findings indicate that plant-based dietary approaches for diabetes management require the support of family, the community and health systems.

Conclusion

This study suggests that plant-based dietary approaches may be valuable in managing T2DM in South Africa.

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