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EDITED BY

Rakesh Bhardwaj,
Indian Council of Agricultural Research
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REVIEWED BY

Temin Payum,
Jawaharlal Nehru College, Pasighat, India
Hammyliende Talang,
The ICAR Research Complex for North
Eastern Hill Region (ICAR RC NEH),
Umiam, India

*CORRESPONDENCE

Hema Kesa

✉ hemak@uj.ac.za

Alex D. Tchuenchieu Kamgain

✉ kamgaina@uj.ac.za

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Availability and accessibility of indigenous foods in Gauteng region, South Africa

Hema Kesa^{1,2*}, Alex D. Tchuenchieu Kamgain^{1,3*},
Mthokozisi Kwazi Zuma^{2,4} and Xikombiso Mbhenyane²

¹Food Evolution Research Laboratory, School of Tourism and Hospitality, University of Johannesburg, Johannesburg, South Africa, ²Division of Human Nutrition, Department of Global Health, Faculty of Medicine and Health Science, University of Stellenbosch, Stellenbosch, South Africa, ³Centre for Food, Food Security and Nutrition Research, Institute of Medical Research and Medicinal Plants Studies, Yaoundé, Cameroon, ⁴Agricultural Research Council, Central Office, Smallholder Agricultural Development Unit, Pretoria, South Africa

While South Africa maintains national food security, food insecurity persists at the household level, with not all households having access to sufficient food. Proposals to address this include promoting the consumption of indigenous foods (IF). However, urbanization in the Gauteng region has sparked a nutrition transition, characterized by increased consumption of Western diets, resulting in rising rates of malnutrition and non-communicable diseases. This study sought to assess the availability and accessibility of indigenous foods in the region for residents. A quantitative cross-sectional research survey was conducted in the Gauteng region, involving 746 participants who provided insights into their ways of acquiring indigenous foods and rated their overall availability. Additionally, the survey gathered opinions on IF availability across different settings and collected suggestions for improving IF accessibility. Among a list of 18 South African indigenous foods, between 55.2 and 77.2% of participants did not know where they could be obtained. Acquisition through vendors, with a maximum of 14% of respondents, emerged as relatively more popular compared to food markets, spaza shops, supermarkets, and home gardens. The majority of surveyed participants (55%) perceived indigenous foods as unavailable in the region. Agreement rates for the availability of indigenous foods for sale or serving in various settings were 53.5% for supermarkets, 42% for schools, 44.2% for hospitals, and 37.5% for workplaces. Respondents suggested several strategies to enhance IF accessibility in the region, including marketing, home gardens, farms, supermarkets, education, elders, restaurants, and schools/universities. Overall, there is a need for increased education on the nutritional benefits of indigenous foods and the implementation of policies to improve their accessibility in urbanized provinces like Gauteng.

KEYWORDS

diet-related diseases, public health, indigenous foods, food consumption, Gauteng province

1 Introduction

As reported by *STATS-SA (2019)* and *van den Berg and Walsh (2023)*, there has been a decline in the percentage of households and individuals who had limited access to food in South Africa during the last decades. Although the country is food secure at a national level, South Africa is still food insecure at the household level as not all households have access to

adequate food. Almost 20% of South African households had inadequate or severely inadequate access to food in 2017 (STATS-SA, 2019). Just under a third (29.6%) of households that comprise more than three children reported that food access was inadequate. This proportion is almost twice the national average. The COVID-19 pandemic lockdowns have worsened the situation in South Africa (Manduna, 2023). As an example, the National Income Dynamics Study (NIDS) Coronavirus Rapid Mobile (CRAM) Wave 1 survey conducted in 2020 revealed that 47% of South Africans ran out of money to buy food at the beginning of the pandemic and 21% of participants reported that someone in the household went hungry (Wills et al., 2023).

The promotion of indigenous food consumption has been recommended as one of the solutions to this food insecurity matter. They are food crops that have their origin in South Africa. Added to these crops are those that were introduced into the country and are now recognised as naturalised or traditional crops (South African Department of Agriculture, Forestry and Fisheries, 2013). They are divided into three main categories: namely grains, vegetables, and fruits. They require low manipulation, are highly nutrient-dense, and generally resistant to drought and crop diseases as they are better adapted to thrive in their indigenous environments. Indigenous foods can be used as food substitutes for starch-enriched foods such as maize and rice, eaten as is or processed into jams or juices—to name but a few of their many uses (Agribook.digital, 2024). They are rich and inexpensive sources of proteins, carbohydrates, dietary fibre, minerals, and vitamins for millions of people in developed and LMIC countries and are some of the basic foods of the indigenous populations of Africa (Mbhenyane, 2017).

Indigenous foods contain phytochemicals that are linked to protection against the development of non-communicable diseases such as cancer, diabetes, and hypertension. Some of these indigenous foods have been chemically analysed and contain active compounds such as organic sulphur, hypoglycaemic alkaloids, flavonoids, phytosterin glycosides, and polyacetylenes (Mbhenyane et al., 2013). Takaidza (2023) described the nutritional and healthy values of each of the 18 South African official indigenous food. It comprises grain crops such as pearl millet, grain sorghum, cowpea, bambara groundnuts, and mungbean; vegetables including *Cleome gynandra*, *Amaranthus*, Blackjack (*Bidens Pilosa*), Jew's mallow, cassava, and yam (*Amadumbe*); and fruits such as marula (*Sclerocarya birrea*), red milkwood, mobola (*Parinari curatellifolia*) plum, wild medlar, *num-num*, and Kei apple. The health benefits of indigenous foods in this respect are less known or promoted. Budreviciute et al. (2020) assert that traditional food in most countries including South Africa, is healthier and could play a key role in the prevention and management of non-communicable diseases (NCDs). Unfortunately, this diet has been replaced by unhealthy processed food that is rich in sugars and fats, animal-source foods also known as “modern diet” which is among the main causes of NCDs (Olatona et al., 2018; De Araújo et al., 2021; Lane et al., 2021; Alamnia et al., 2023). In 2016, non-communicable diseases (NCDs) accounted for up to 51% of all deaths in South Africa (WHO-World Health Organization, 2018). Given this alarming prevalence, concerns arise regarding the availability and accessibility of indigenous foods in urban areas, which are most affected by nutritional transition. Consequently, this study sought to evaluate the perspectives of residents in the Gauteng region, the

most urbanized area in South Africa, regarding these critical aspects.

2 Methodology

2.1 Study design

The study was carried out using a quantitative cross-sectional descriptive research survey. It was conducted in the Gauteng region which consists of the cities of Johannesburg, Pretoria, Ekurhuleni, Soweto, Krugersdorp, Benoni, Boksburg, Germiston, and Vereeniging and their surrounding metropolitan areas in the eastern part of the Witwatersrand region. It is a province that is largely urbanized and directly concerned with nutrition transition.

2.2 Sampling

Participants were randomly chosen from the Gauteng region. Inclusion criteria stipulated that participants must be at least 18 years old and have resided in Gauteng for a minimum of 2 years. The survey was conducted from August to November 2019 in the nine municipalities of the province. A total of 746 people participated in the study which is representative of the population. Indeed, the minimum calculated sample size was supposed to be 440. This was obtained using Slovin's formula and by considering that the 15.7 million people Gauteng residents minus 23.6% of children under 15 years considering Census 2011 data.

$$n = N / \left(1 + Ne^2 \right) \text{ people} = 11\,994\,800 / \left(1 + 11\,994\,800 \times 0.0025 \right) = 399.99$$

The minimal sample size was therefore 400 plus 10% to accommodate attrition, accruing 440.

2.3 Data collection

The survey utilized a self-administered questionnaire to gather information. It included closed-ended questions aimed at collecting data on various aspects, such as the sociodemographic profile of participants, their ways to acquire indigenous food (IF) crops, their opinion on how available indigenous foods is, and their interest to see IF availability and accessibility enhanced. Sociodemographic inquiries encompassed gender, race, age, education level, household size, monthly income, residential area, and corresponding settlement. Respondents were prompted to indicate how they acquire each listed IF (options included “Food markets,” “Spaza shops,” “Supermarket,” “Grow in garden,” “Vendors,” or “Do not know”). They also expressed their overall perception of indigenous food availability by selecting from options like “Very poor,” “Poor,” “Average,” “Good,” or “Excellent.” Furthermore, their opinions on IF being sold or served in schools, hospitals, supermarkets, and workplaces were gauged using responses like “yes,” “maybe,” or “no.” Finally, respondents were invited to provide suggestions on enhancing IF accessibility in the region through an open-ended

question “How can indigenous foods be made more accessible to Gauteng residents?”

The questionnaire was written in English, and a pilot study conducted on a diverse group of participants consisting of 15 people from different areas in Gauteng was completed to assess its validity and reliability. Field workers recruited for the study were able to communicate in all the official languages of South Africa. This was helpful to ensure that the questionnaire was correctly completed. Data collection took place in public venues such as malls, churches, and community centres across the six municipalities and three metropolitan areas in Gauteng.

2.4 Ethical consideration

This study was carried out under the ethics clearance numbers 2019STH012 and X20/11/040 of the University of Johannesburg and Stellenbosch University, respectively. Informed consent was obtained from each participant after the objectives of the study had been explained. Privacy and confidentiality were thoroughly maintained.

2.5 Data analysis

The collected data underwent analysis using Statistical Package for Social Sciences (SPSS) version 27 (IBM SPSS Statistics, Chicago, IL, United States). Descriptive analysis was conducted for closed-ended questions, while thematic analysis was employed for open-ended questions.

3 Results

3.1 Sociodemographic characteristics of the studied population

Table 1 illustrates the participant characteristics ($n = 746$). The cohort comprised females (59.8%) and males (40.1%), with the majority falling within the 18–55 age bracket (93%) and representing various racial groups as classified by South Africa (Black, Coloured, Indian, White), with Asians constituting a minority. Educational attainment was predominantly at either secondary (35.8%) or tertiary (61.9%) levels, and participants were primarily located in urban (65.8%) and peri-urban areas (24.8%). The housing types varied from single to family dwellings, and monthly incomes spanned a range from low to high. For international conversion, the exchange rate was ZAR 1 = EUR 0.049 = USD 0.054.

3.2 Ways to acquire indigenous foods

Figures 1–3 depict the different ways of obtaining indigenous grain crops, vegetables, and fruits. Participants were allowed to choose more than one way to acquire indigenous foods which were food markets, *spaza* shops, supermarkets, home gardens, and vendors, and were given the choice to choose “Do not know.”

TABLE 1 Demographic profile of participants ($N=746$).

Demographic variables		Frequency (N)	Percentage (%)
Gender	Male	299	40.1
	Female	447	59.9
Race	Black	206	27.6
	Coloured	152	20.4
	Indian	142	19
	White	223	29.9
	Asian	21	2.8
	Other	2	0.3
Age group	18–25	207	27.7
	26–35	215	28.8
	36–45	171	22.9
	46–55	101	13.5
	56–65	37	5
	66+	14	1.9
	Missing	1	0.1
Highest education level	Grade 0–7	17	2.3
	Grade 8–12	267	35.8
	Tertiary Education	462	61.9
Household size	1–2	145	19.4
	3–5	441	59.1
	6 or more	160	21.4
Household income per month after tax	Less than R500	16	2.1
	R500–R999	13	1.7
	R1,000–R1,999	20	2.7
	R2,000–R2,999	39	5.2
	R3,000–R4,999	84	11.3
	R5,000–R9,999	94	12.6
	R10,000–R14,999	123	16.5
	R15,000–R24,999	117	15.7
	R25,000–R34,999	82	11
	R35,000–R44,999	67	9
	R45 000–R54 999	47	6.3
R55 000+	44	5.9	
Area of residence	Urban	491	65.8
	Peri-urban	185	24.8
	Rural	69	9.2
	Missing	1	0.1
Corresponding settlement of urban/peri-urban area	Informal settlement	60	8
	Former border or homeland towns	11	1.5
	Township (Kasi)	189	25.3
	Suburb / Edge city	416	55.8
	Missing	70	9.4

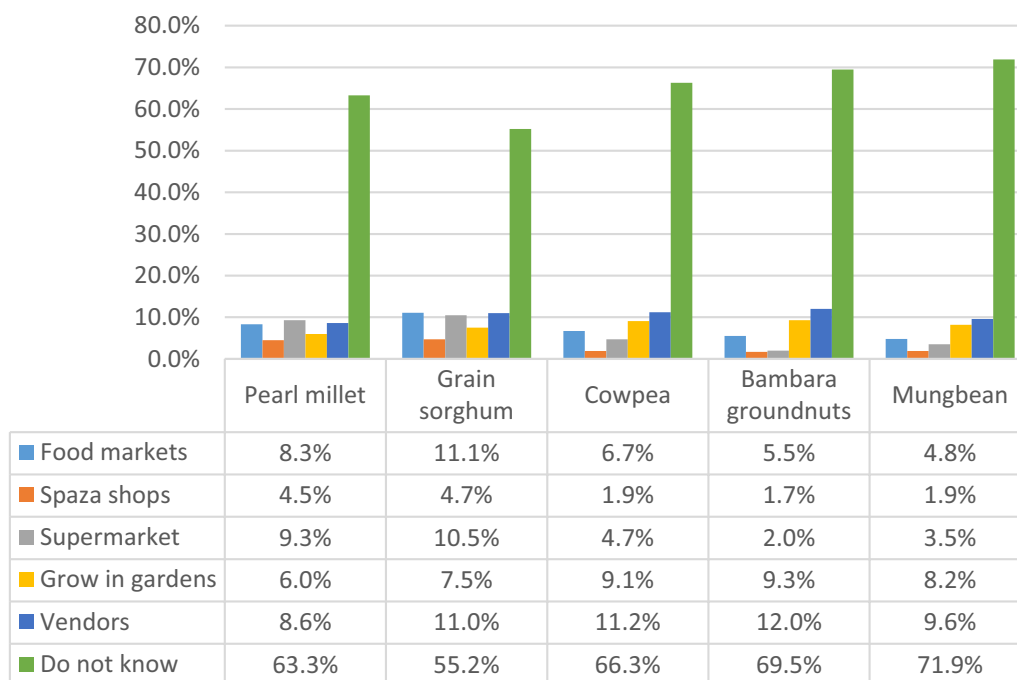


FIGURE 1 Ways in which indigenous grain crops are acquired. Gauteng province, South Africa, 2019.

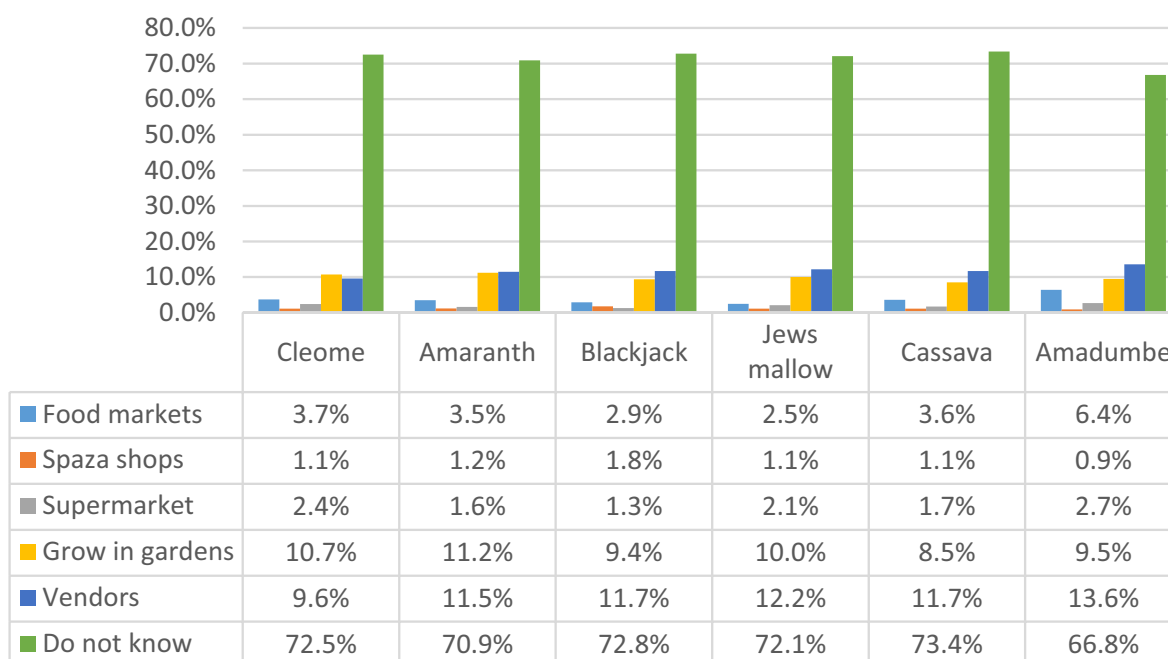
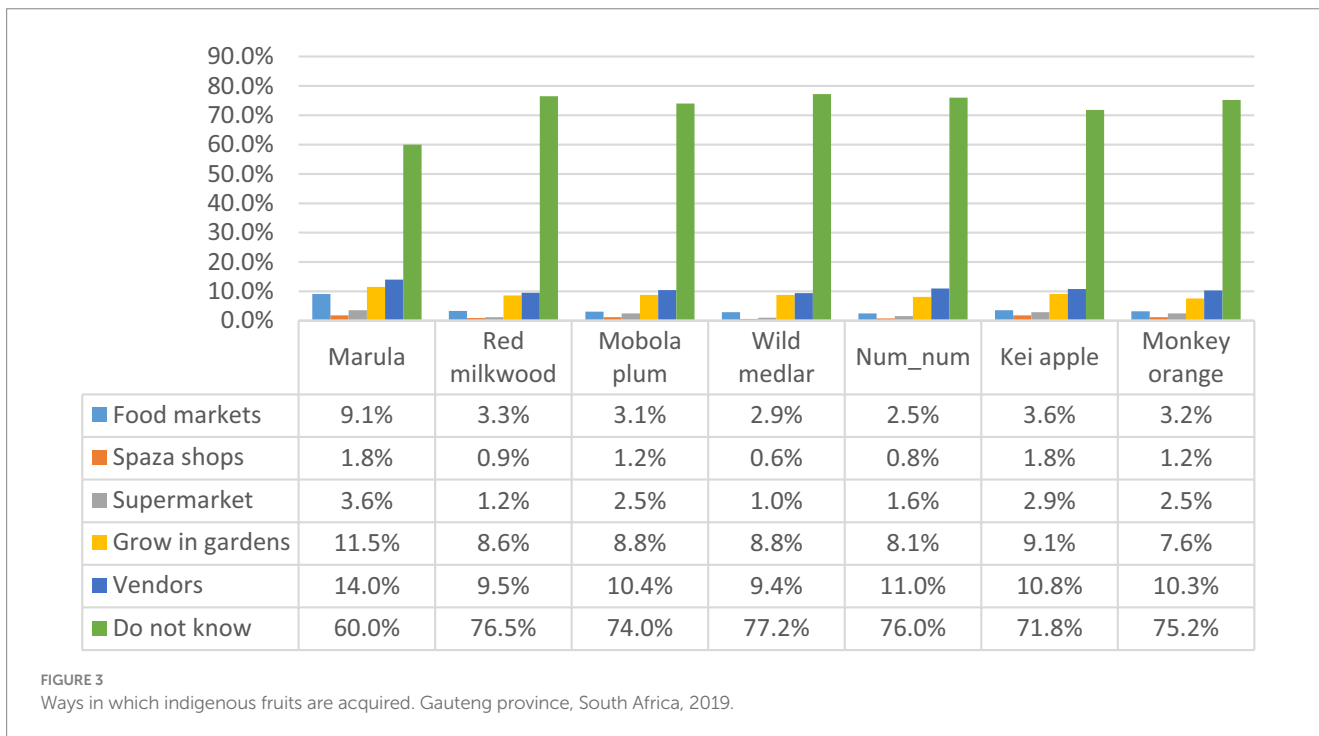


FIGURE 2 Ways in which indigenous vegetable crops are acquired. Gauteng province, South Africa, 2019.

According to Figure 1, most participants were unaware of where to acquire various indigenous grain crops, including pearl millet (63.3%), grain sorghum (55.2%), cowpea (66.3%), bambara groundnuts (69.5%), and Mungbean (71.9%). Only a minority reported obtaining these crops from sources such as food markets,

spaza shops, supermarkets, home gardens, and vendors. Among these, acquisition through vendors was relatively more common, yet overall accessibility to indigenous food crops was limited.

A similar pattern emerged concerning indigenous vegetable crops, as depicted in Figure 2. The majority of respondents [72.5% for

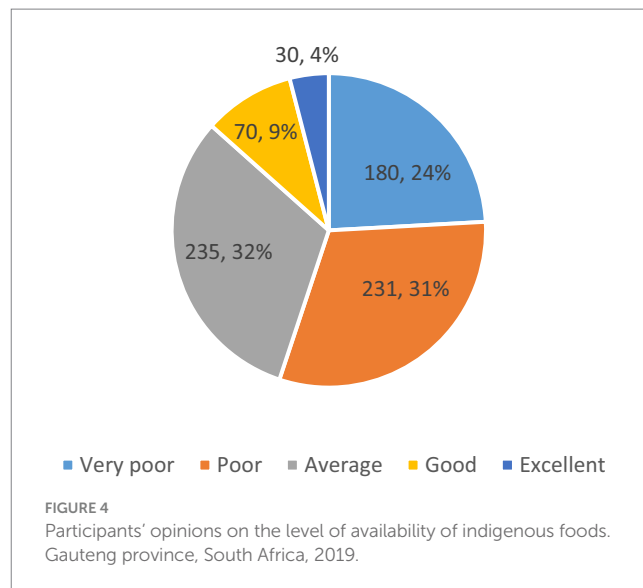


Cleome gynandra, 70.9% for *Amaranthus*, 72.8% for Blackjack (*Bidens Pilosa*), 72.1% for Jew’s mallow, 73.4% for cassava, and 66.8% for yam (*Amadumbe*) were uncertain about where to acquire them. Some participants did manage to obtain these indigenous vegetables from various sources such as food markets, spaza shops, supermarkets, home gardens, and vendors. Vendors were notably more popular, yet a minority of participants (11.2% for *Amaranthus*, 10.7% for *Cleome gynandra*, 10.0% for Jew’s mallow, 9.4% for Blackjack, and 8.5% for cassava) reported growing these vegetables in their gardens. Despite some availability, indigenous vegetable crops remained relatively inaccessible to the participants.

Regarding indigenous fruits (as shown in Figure 3), the proportion of participants who were unsure of where to obtain them ranged from 60 to 77.2%. Specifically, uncertainty levels were 60.0% for marula (*Sclerocarya birrea*), 76.5% for red milkwood, 74.0% for mobola (*Parinari curatellifolia*) plum, 77.2% for wild medlar, 76.0% for num-num, and 71.8% for Kei apple. Only a small number of respondents mentioned acquiring these fruits from various sources such as food markets, spaza shops, supermarkets, home gardens, and vendors, with vendors being the preferred choice. Marula appeared as the most commonly cultivated fruit in participants’ gardens (11.5%). Despite the possibility of obtaining some indigenous fruits, they were generally not easily accessible to the participants.

In evaluating the availability of indigenous foods (as shown in Figure 4), 32% of participants ($n = 235$) rated it as average, 31% ($n = 231$) as poor, 24% ($n = 180$) as very poor, 9% ($n = 70$) as good, and 4% ($n = 30$) as excellent. These findings indicate that participants generally did not perceive indigenous foods to be easily accessible or readily available.

As shown by Figure 5, a larger percentage of respondents expressed agreement with the idea of indigenous foods being available for sale or served in various settings such as schools, hospitals, supermarkets, and workplaces. Specifically, agreement rates were 53.5% for supermarkets ($n = 399$), 42% for schools ($n = 320$), 44.2%



for hospitals ($n = 330$), and 37.5% for workplaces ($n = 280$). A portion of participants remained uncertain, responding with “maybe” (31.5–37.8%). Conversely, a minority disagreed with the notion of indigenous foods being sold or served in schools (23.9%, $n = 178$), hospitals (20.9%, $n = 156$), supermarkets (15.0%, $n = 112$), and workplaces (24.7%, $n = 184$). These findings suggest that participants generally desire increased accessibility and availability of indigenous foods for purchase and consumption.

Table 2 displays the insights provided by participants regarding possible strategies to enhance the accessibility of indigenous foods for Gauteng residents. The following nine themes were established: marketing; home gardens; farms and land; supermarkets including grocery stores/local shops, street vendors/food markets; retailers; education and awareness; elders; restaurants offering indigenous foods; and schools and universities.

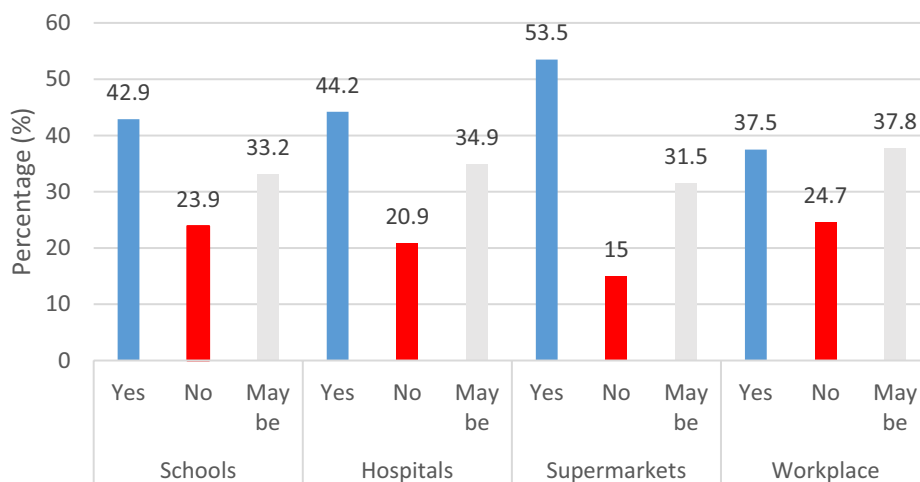


FIGURE 5

Participants' views on how the availability of indigenous foods could be increased. Gauteng province, South Africa, 2019.

4 Discussion

This study reveals that a significant portion of Gauteng residents lacked knowledge about where to acquire indigenous grain crops. Within the surveyed population, Black individuals exhibited greater familiarity with and consumption of indigenous foods compared to individuals from other racial groups, likely influenced by cultural factors (Kesa et al., 2023). Participants sourced indigenous grain crops from various outlets such as food markets, spaza shops, supermarkets, home gardens, and vendors, emphasizing the significance of supply-side factors in the indigenous foods discourse. Informal markets play a crucial role in the distribution of indigenous foods, as observed in the Tshakhuma and Khumbe markets in Limpopo province, where a substantial portion of trading revolves around indigenous foods (Nesamvuni et al., 2005). However, formal food markets in South Africa typically overlook indigenous foods, limiting access for informal traders. Smallholder farmers, who are major producers of indigenous foods, often market their produce through fresh produce markets, informal markets, and supermarket chains. Efforts to enhance integration with large fresh produce markets, such as the Johannesburg Fresh Produce Market (JFPM), are underway, including initiatives like building decentralised packing houses and grading point facilities to reduce transport costs and improve product quality (Aliber and Hart, 2009; Baiphethi and Jacobs, 2009; Jennings et al., 2015; Gutierrez et al., 2023).

Some of the participants cultivated indigenous crops in their gardens. It is often presented that in poorer countries urban food production is usually a survivalist or subsistence strategy but in more developed and affluent countries it acquires more recreational, health, or social undertones (Taylor and Lovell, 2012; Battersby and Marshak, 2013; Eigenbrod and Gruda, 2015). In the context of Gauteng, it is postulated that those who produced their indigenous foods in their gardens did so for sustenance and to ensure availability. Although some indigenous fruits could be obtained, they were not very accessible to the participants. A similar trend was noted in a study conducted by Matenge (2011) in the Northwest province in South Africa: urban communities mainly sourced their

indigenous foods from informal markets, home gardens, and rural communities.

Data from the General Household Survey of 2018 by STATS SA indicated low levels of agricultural engagement among South African households, particularly in urban areas like Gauteng (Official Guide to South Africa, 2019). Participants did not find indigenous foods easily available or accessible in Gauteng. When asked where they would like to see indigenous foods become more available and accessible, the participants globally agreed to indigenous foods being sold or served in schools, hospitals, supermarkets, and workplaces. However, 31.5 to 37.8% of respondents reported “Maybe.” This represents a high percentage. As noticed in a previous paper (Kesa et al., 2023), this surveyed urban population had a weak knowledge and consumption of indigenous foods. Akinola et al. (2020) had already pointed out the fact that people in Africa do not value indigenous foods and their potential benefits are thus neglected. Their awareness of the nutritional and health values of those indigenous foods can therefore be questioned. Despite this, there is a growing consensus among the studied participants for indigenous foods to be made more available and accessible, particularly in settings such as schools, hospitals, supermarkets, and workplaces.

As also suggest by respondents, addressing this demand requires a multifaceted approach, encompassing marketing strategies, promoting home gardens and farms, enhancing education and awareness, and engaging various stakeholders like elders, retailers, and restaurants (Shackleton et al., 2009). Urban agriculture presents an opportunity to mitigate malnutrition and food insecurity, utilizing vacant spaces in cities and peri-urban areas for agriculture (Eigenbrod and Gruda, 2015). Moreover, the production and incorporation of indigenous vegetables into the food chain hold economic promise for reducing poverty and unemployment, particularly in developing countries (Schreinemachers et al., 2018). Nutrition education is essential to promote the consumption of indigenous foods across all household members, including as complementary foods (Mushaphi et al., 2017).

Expanding the scope of research to include rural and peri-urban areas is essential for a comprehensive understanding, as the current survey predominantly focused on urban areas where individuals from various regions converge for shopping and entertainment.

TABLE 2 Responses on how indigenous foods can be more accessible in Gauteng (n=746).

Theme	Responses (verbatim)	Researchers' interpretation
Marketing (Advertising/Branding/Price)	<p><i>There should be public promotions about indigenous foods.</i></p> <p><i>Online Mix cultures Food shows</i></p> <p><i>Advertise more and offer deliveries.</i></p> <p><i>Higher availability in mainstream stores as well as for marketing (e.g., featured in cooking shows, in-store recipes, local recipe books or web pages) would help create awareness.</i></p> <p><i>Indigenous foods must be branded and made available in food market with reasonable prices.</i></p>	<p>In order to increase the consumption, of indigenous foods, it needs to be marketed to consumers. Participants provided examples of marketing, i.e., food shows, promotions, branding, recipe books (food preparation). The general public/consumers must be made aware of the benefits of indigenous foods.</p>
Home gardens	<p><i>We should grow them in our gardens.</i></p> <p><i>We should be thought how to grow them.</i></p> <p><i>Self-gardening, vending distribution.</i></p> <p><i>Residents should grow them.</i></p> <p><i>Must be grown more in informal or even formal areas.</i></p>	<p>Participants are receptive to indigenous crops being grown in their own gardens. To do that, they need to be trained/educated. Home gardens (indigenous crops) should be encouraged in urban and rural areas.</p>
Farms/land	<p><i>Farmers must produce more indigenous food.</i></p> <p><i>If farmers can produce more of it and transport them to Supermarkets in cities (JHB) then the residents could have access to the foods.</i></p> <p><i>By supplying land for people to promote the availability of plants.</i></p> <p><i>By giving people land to plough.</i></p> <p><i>Offer land to plant.</i></p> <p><i>Space to plant.</i></p> <p><i>Allocate land and opportunity to grow in JHB.</i></p> <p><i>Farmers around Johannesburg should start farming indigenous food.</i></p> <p><i>Johannesburg municipality can even promote and plant more of the same indigenous foods.</i></p>	<p>More land needs to be made available for the growth of indigenous crops. Farmers need to be educated on how to grow and harvest indigenous crops.</p> <p>Urban farming i.e., in Johannesburg is also encouraged.</p>
Supermarkets, grocery stores, local shops, street vendors, food markets	<p><i>Arrange to sell them at local Supermarkets.</i></p> <p><i>By bringing them from the farms into Supermarket areas. This practice is already done but there is more demand.</i></p> <p><i>Grocery stores, Vendors, fruit shop & veg shops.</i></p> <p><i>Make it more available in supermarkets in order for us to reach out to them.</i></p> <p><i>Very healthy but they sell in Supermarket's people know about it they will definitely buy it.</i></p> <p><i>Supermarkets, home grown, Vendors.</i></p> <p><i>Supermarket should promote them more than western foods.</i></p> <p><i>I believe by making indigenous foods more available in such stores would make indigenous foods more readily accessible.</i></p> <p><i>Many of us south Africans are not educated on these indigenous foods and if these foods can be sold at Supermarkets or grocery stores or even get Vendors to sell them to us at our doorsteps.</i></p> <p><i>Selling them on the street corners</i></p> <p><i>Be made available in Food market.</i></p> <p><i>Food market in Johannesburg</i></p> <p><i>It should be made readily available in Food market.</i></p>	<p>The majority of the participants who completed the question, responded that indigenous foods could be sold in all supermarkets (formal and informal). This will ensure the availability and accessibility of indigenous foods and will encourage consumption.</p> <p>Other suggestions were vendors, local stores and food markets (in urban and rural areas)</p>
Retailers: Spar, Woolworths, Shoprite, Pick n Pay, etc.	<p><i>Put indigenous food in markets like Shoprite.</i></p> <p><i>Through retail saturation on shelves</i></p> <p><i>Sell at speciality stores – fruit & veg shops – pharmacies (Dischem and others.).</i></p> <p><i>Indigenous foods can be made accessible to residents in Johannesburg.</i></p> <p><i>They should be marketed and sold at Supermarkets like Shoprite, pick-'-pay and Woolworths.</i></p> <p><i>They are available at food lovers' markets with instructions on how to cook and enjoy them.</i></p> <p><i>Being more available in Spar retail shops</i></p>	<p>Retailers need to source indigenous foods and it should be sold in "big" supermarkets such as Spar, Woolworths, Shoprite and Pick n Pay. This will allow for increase availability and accessibility of indigenous foods.</p>

(Continued)

TABLE 2 (Continued)

Theme	Responses (verbatim)	Researchers' interpretation
Education and awareness	<p><i>Be made more aware of the different types that are produced.</i></p> <p><i>By educating people.</i></p> <p><i>Educate more people about indigenous foods.</i></p> <p><i>Educate people and show them how to cook it.</i></p> <p><i>Educate people more on these foods and their benefits.</i></p> <p><i>Educate the middle class on indigenous foods.</i></p> <p><i>More awareness & information about these foods,</i></p> <p><i>Teach us how and where to grow them.</i></p> <p><i>Teach people about its nutritional value.</i></p> <p><i>Knowledge first – market them to people.</i></p> <p><i>Workshops on where, when and how to grow them.</i></p> <p><i>Having workshops in schools and community centres; have shops in malls.</i></p>	Consumers want to be educated on how to obtain indigenous crops/seeds, when to grow it, how to grow it and the nutritional benefits. Workshops should be offered by the agricultural department to urban, peri-urban and rural communities.
Elders	<p><i>By elders.</i></p> <p><i>If elderly people can pass on the knowledge to the youth about indigenous food, and the youth market it.</i></p>	Indigenous knowledge is very important and if passed on from generation to generation, there will always be an awareness. Elders play a big role in knowledge about indigenous foods (growth, harvesting and preparation of indigenous foods) and it is important for them to pass their knowledge onto the youth in order to encourage them about the benefits.
Restaurants offering indigenous foods	<p><i>Create more restaurants that sells these kinds of foods.</i></p> <p><i>Someone must open an African restaurant where they will sell indigenous foods only.</i></p>	More restaurants selling indigenous foods should be opened, incorporating indigenous foods into their menus.
Schools and universities	<p><i>Sell them at schools and universities.</i></p> <p><i>Sold at schools.</i></p> <p><i>Sell them at university.</i></p> <p><i>Educate school about indigenous foods.</i></p>	If they're sold at schools and universities, the youth can get more exposed to these foods. Schools can grow indigenous crops in their gardens and the crops can be incorporated in the school menus.

Gauteng province, South Africa, 2019.

5 Conclusion

Accessing various indigenous foods in the Gauteng Region poses significant challenges for the population. It is imperative to undertake efforts to enhance their availability and accessibility, especially considering the residents' willingness to consume them more frequently.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

This study was carried out under the ethics clearance numbers 2019STH012 and X20/11/040 of the University of Johannesburg and Stellenbosch University, respectively. Informed consent was obtained from each participant after the objectives of the study had been explained. Privacy and confidentiality were thoroughly maintained.

Author contributions

HK: Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Writing – original

draft, Writing – review & editing. AT: Conceptualization, Data curation, Funding acquisition, Investigation, Methodology, Writing – original draft, Writing – review & editing. MZ: Writing – review & editing. XM: Supervision, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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