Medicinal ethnobotanical knowledge across urban cultural groups: A case study in a South African township

Kara-Lee Prinsloo, Riana Kleynhans and Raymond Jansen

Correspondence

Kara-Lee Prinsloo[1*]**, Riana Kleynhans**[1] **and Raymond Jansen**[2]

[1*]Department of Horticulture, Tshwane University of Technology, Pretoria, South Africa
[2]Department of Environmental, Water and Earth Sciences, Tshwane University of Technology, Pretoria, South Africa

[*]Corresponding Author: PrinslooKL@tut.ac.za

Ethnobotany Research and Applications 26:27 (2023) - http://dx.doi.org/10.32859/era.27.5.1-10
Manuscript received: 23/03/2023 – Revised manuscript received: 30/08/2023 - Published: 31/08/2023

Research

Abstract

Background: The use of medicinal plants for primary health care is still prevalent in southern Africa, but the decline in indigenous traditional knowledge is cause for concern as this could lead to a loss of valuable indigenous cultural knowledge. Many ethnobotanical studies have been conducted amongst rural communities, however limited information is available on the indigenous cultural knowledge amongst mixed tribal urban communities

Methods: This study was conducted in the diverse urban township of Tembisa, located in the eastern parts of Gauteng Province in South Africa. Through the use of structured questionnaires (n=2724), the Zulu, Tsonga, and Pedi ethnic groups' knowledge of 17 regularly used medicinal herbs was assessed.

Results: Our findings indicated that indigenous traditional knowledge is still prevalent in this urban setting, although the extent of this knowledge was significantly influenced by cultural group, participant age, residency period and age of migration into this urban environment. Two plant species *Artemisia afra* and *Helichrysum odoratissimum*, were particularly well known amongst all cultural groups, but knowledge on other plants varied. Generally, the younger generation had less knowledge than the elders with the exception for the Tsonga people.

Conclusion: Although it was refreshing to find that cultural knowledge about medicinal plants still exists in an urban environment, the perceived lack of knowledge among the younger generation can be viewed as a risk to the continued existence of this knowledge, especiaaly if the opportunities to relay this knowledge becomes less, as influenced by modern urban living.

Keywords: ethnobotany**,** medicinal plants, cultural knowledge, urban environment

Background

Throughout history, societies around the world have learnt which plants to use to treat specific medical ailments and to maintain health. These readily available and culturally important traditional remedies form the basis of an accessible and affordable health-care regime and are regarded as an important component in the livelihood of indigenous and rural communities. Medicinally important plants do not only play a large role as a primary healthcare resource, but also in many cultures for religious and spiritual purposes (Rehan *et al*, 2021). According to the World Health Organization (WHO 2022),

approximately 80% of people in Africa depend on traditional medical systems and indigenous knowledge to address their health care needs. Besides the health benefits, research has also shown that natural resources contribute to the well-being and in certain circumstances, survival of millions of poor people across the world (Chu & Karr, 2017). Here, indigenous knowledge is defined as the unique, traditional, local knowledge existing within and developed around the specific conditions of women and men indigenous to a particular area (Ezeanya-Esiobu,2019).

Different cultural groups have been recognized as having varied traditional or indigenous knowledge on the use of medicinal plants. Most of these cultural groups pass down traditional knowledge from generation to generation through oral and visual displays, with little or no documentation. It is further believed that the majority of these cultures possess a huge store of this undocumented traditional knowledge and how these traditional remedies are applied for the treatment of specific diseases (Gakuya *et al*.2020). As such, much of this information is under threat of being lost, as traditional social patterns are disturbed and many young people migrate to cities, thereby breaking the cycle of oral and visual transfer of this specialized knowledge (Gakuya *et al*.2020). South Africa has witnessed increasing levels of migration from traditional rural villages and towns into cities, with Gauteng Province receiving the majority of migrants despite being the smallest but most industrialized province in the country (Statistics South Africa 2016). The influence of urbanization and the adoption of a more westernized way of life may hasten the loss of this knowledge where medicinal plants form a large component (Arjona – Garcia *et al*., 2021).

The primary objective of this study was to identify the cultural differences in selected medicinal plant knowledge amongst the three dominant cultural groups (Pedi, Tsonga and Zulu) as well as to determine knowledge gaps within and between these ethnic groups in a large urban settlement in Gauteng Province, South Africa.

Materials and Methods

Study area

The study was conducted in Tembisa, an urban township in the Ekurhuleni Metropolitan area of Gauteng Province, South Africa. Tembisa township is approximately 42.80 km² in size and is located between latitudes 26º1’0”S and longitude 28º14’0”E. The township is extremely overpopulated with an estimated population of 463 109 people in an overcrowded area (Statistics South Africa 2016). Tembisa is home to all 11 officially recognized languages, however the three predominant cultural groupings are Pedi (33.1%), Zulu (21.7%) and Tsonga (13.3%).

Data collection

A structured questionnaire was used to collect demographic data (cultural group and age) and information of selected plants from participants in Tembisa's three majority cultural groups (Pedi, Zulu, and Tsonga) between March and June 2015. Questionnaires were translated into the local languages. Besides the actual age of participants, data were also collected on how long they had lived in Tembisa and at what age they migrated to Tembisa. Enumerators (fluent in the local language of each cultural group) were used to collect data, enabling the participation of illiterate people as well. Enumerators were trained prior to data collection to ensure consistency.

Quota sampling was used to identify the residency areas that mainly consisted of Zulu, Tsonga and Pedi people and convenience sampling was then implemented in the selected sampling regions within Tembisa. A population of 1000 participants for each cultural group was targeted, accounting for approximately 1% of the total population. Out of the 3000 targeted participants, a total of 2724 participants (1000 Pedi, 1000 Tsonga and 724 Zulu) completed the structured questionnaire in their native language. Plant knowledge was determined by asking participants if they knew or were familiar with 17 different selected medicinal plants by displaying photographs and vernacular names. The images used were of plants in their natural state. Plants were selected based on the most widely used species in cultural medical practice as determined from the literature (Prinsloo *et al*., 2023, Mashiane *et al*., 2018)).

Data analyses

Respondents were divided into six age groups: <20, 20-29, 30-39, 40-49, 50-59 and >60. Residence time for Respondents’ residence duration was categorized as: <10, 10-14, 15-19, 20-24, 25-29, 30-39, and >40 years, while their migration age into Tembisa was classified as: born, 1-4, 5-9, 10-14, 20-24, 25-29 and >30. ANOVA was performed on quantitative data on the number of plants known per age group and cultural group using SAS version 9.3 statistical software (SAS 1999).The general linear model (GLM) calculation was performed, and means were separated using a *t*-test with least significant difference (LSD) at $p<0.05$ (Snedecor & Cochrane 1967). Chi–square tests ($p<0.05$) were used to test whether demographic proportions varied significantly between groups (Rayner 1969).

Results

The Zulu participants' average age (23 years) was significantly (chi-square p=0.001) younger than both the Pedi (37 years) and Tsonga (35 years). The younger average age in the Zulu was due to the large (39%) number of participants under the age of 20, compared to only 13% and 5% of participants under the age of 20 in the Tsonga and Pedi, respectively (Table 1). In addition, the Zulu had less participants in the older age classes compared to the Tsonga and Pedi (Table 1).

Table 1. Distribution of participants from the three cultural groups per age group (chi-square Pr= 0.001)

Cultural group	<20	20-29	30-39	40-49	50-59	>60
Pedi	5	35	25	16	11	8
Tsonga	13	37	16	14	10	10
Zulu	39	35	13	8	3	2

Ethnobotanical knowledge as measured by number of medicinal plants known, was significantly (p<0.001) associated with age in cultural groups. The medicinal plant knowledge of the Zulu increased significantly with each higher age group (Fig. 1). The knowledge of the Pedi also increased with increasing age, but not significantly from age group to age group where the two youngest and two oldest age groups were concerned. The Tsonga however, had very similar medicinal plant knowledge across all age groups. For the over 60 age group, the Zulu had significantly more knowledge than the Pedi and the Tsonga. In the two youngest age groups, the Zulu had significantly less medicinal plant knowledge than the Tsonga and Pedi participants (Fig. 1).

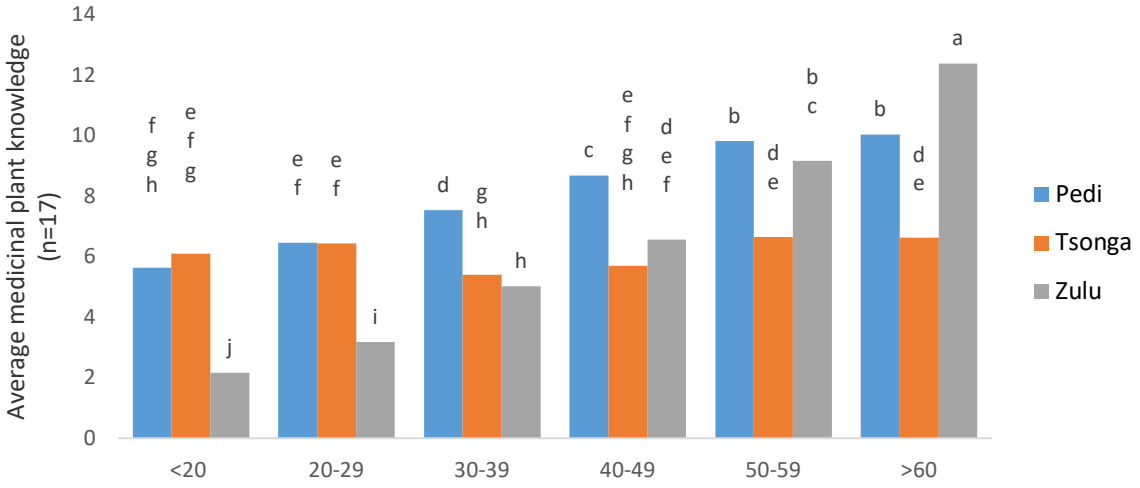

Figure 1. Average number of medicinal plants known per age group (LSD=0.9857)

Ethno-botanical knowledge as measured by number of medicinal plants known was also significantly (p.<0.001) influenced by residency period (total time lived) in Tembisa (Fig. 2) and the age at which participants migrated to the township (Fig. 3). The Pedi cultural group knew more medicinal plants compared to the Tsonga and Zulu regardless of how long they had been in Tembisa (Fig. 2) with the exception of the Zulu, who had lived in Tembisa for more than 40 years. Within the Tsonga cultural group, there was a slight increase in medicinal plant knowledge for participants who had been in the township for 20 and 30 years, but overall knowledge was fairly similar regardless of how long they have lived in the township. Participants of the Zulu cultural group that had been in the township for less than 20 years had much less knowledge than all other groups. A considerable increase in medicinal plant knowledge was observed amongst the Zulu participants who had lived in the Township for more than 20 years. The Zulu participants that had been in the township the longest had the highest medicinal plant knowledge.

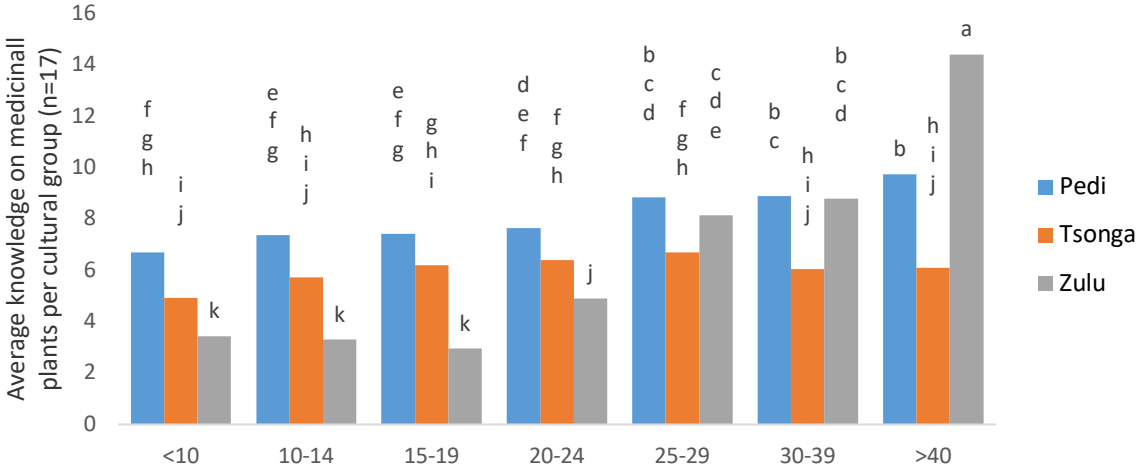

Figure 2. Average number of medicinal plants known as influenced by length of stay in Tembisa (LSD=1.2907)

Pedi participants that migrated to Tembisa after the age of 30 had similar medicinal plant knowledge as those who were born in there. The medicinal plant knowledge of the Tsonga cultural groups differed little depending on whether they were born in Tembisa or migrated at a later age (Fig. 3). The medicinal plant knowledge of the Zulu cultural groups was much lower when they were born in Tembisa, but increased significantly when they were older than 20 and migrated. The Zulu participants who migrated when they were over 30 years old possessed the most medicinal plant knowledge of all. Although substantial differences were observed when comparing the number of plants known to the age at which participants migrated to Tembisa, as well as the amount of time spent in Tembisa, these interactions were primarily due to the actual age of the participant. Participants who had been in Tembisa for a longer period were similarly older, and the same can be said of the migration age effects.

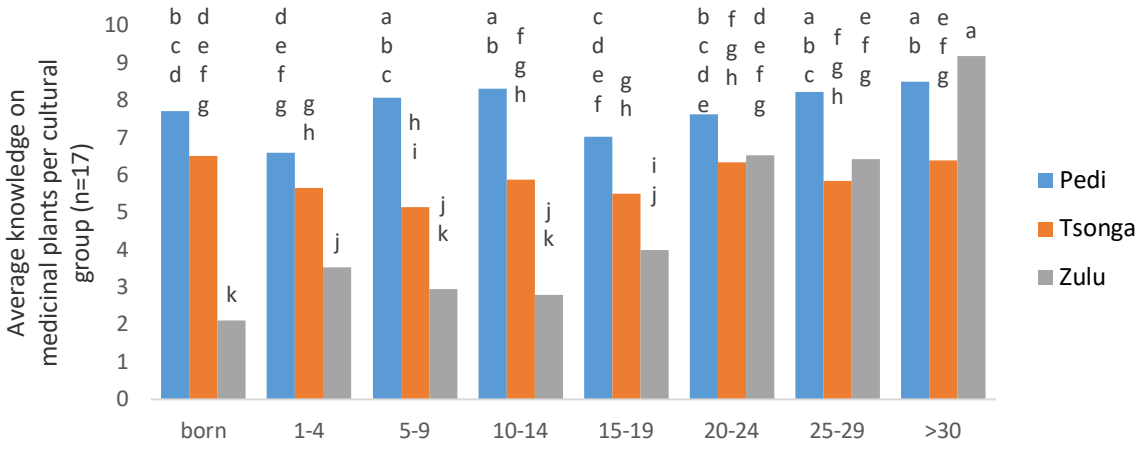

Figure 3. Association between the average number of medicinal plants known and migration age of participants to Tembisa (LSD=1.2363)

Artemisia afra Jacq. Ex Wild and *Helichrysum odoratissimum* (L.) Sweet were the most well-known plants amongst all three cultural groups (Table 2). The familiarity of other selected medicinal plants, on the other hand, varied between cultural groups (Table 2), with some species being more familiar than others. There were a few medicinal plants that stood out in terms of the variation in knowledge between cultural groups, such as *Alepidia amatymbica* Eckl. and Zeyh, which had a knowledge spectrum of 75% among the Pedi cultural group, far higher than the Tsonga and Zulus.

Other species with significantly higher familiarity in the Pedi included *Siphonchilus aethiopicus* (Schweif.) B.L. Burt (65%) and *Aloe ferox* Mill (92%). In contrast to this, knowledge of *Bulbine latifolia* var. *latifolia* Roem. Et Schult (15%), *Leonotis leonurus* (L.) R. Br. (30%) and *Hypoxis hemerocallidea* Fisch. C.A. Meyand Ave-Lall (18%) was far less amongst the Zulu cultural group compared to the Pedi and Tsonga cultural groups.

Table 2. Familiarity of participants on selected medicinal plants within each cultural group

Botanical name	Vernacular name	Pedi	Tsonga	Zulu	χ^2
*Alepidia amatymbica*Eckl.&Zeyh	Ikhatazo (Zulu)	75%	52%	30%	<.0001
Aloe ferox Mill.	Umhlaba (Zulu and Pedi)	92%	6%	24%	<.0001
Artemisia afra Jacq. Ex Wild	Umhlonyane (Zulu), Lengana (Pedi)	64%	65%	61%	0.0002
Boophane disticha (L.f) Herb.	Incwadi (Zulu)	24%	48%	36%	<.0001
Bulbine latifolia var. *latifolia* Roem. Et Schult	Ibhuchu (Zulu)	85%	60%	15%	<.0001
Dicoma anomala Sond.	Umuna (Zulu), Hloenya (Pedi)	4%	10%	19%	<.0001
Elephantorrhiza elephantina (Burch.(Skeels	Intolwane (Zulu)	1%	14%	28%	<.0001
Eucomis autumnalis (Mill.) Chitt	Umathunga (Zulu)	48%	14%	30%	<.0001
Helichrysum odoratissimum (L.) Sweet	Imphepho (Zulu)	86%	92%	74%	<.0001
Hypoxis hemerocallidea Fisch. C.A. Mey& Ave-Lall	Lotsane (Sotho), Inkomfe (Zulu)	77%	84%	18%	<.0001
Leonotis leonurus (L.) R.Br.	Lebake (Pedi), Umunyane (Zulu)	99%	81%	30%	<.0001
Merwilla plumbea (Lindl.) Speta	Inguduza (Zulu)	1%	3%	14%	<.0001
Moringa oleifera J. Lamarck	Moringa	49%	44%	17%	<.0001
Siphonochilus aethiopicus (Scwif.) B.L. Burt	Serokole (Pedi) Indungolo (Zulu)	65%	6%	15%	<.0001
Sutherlandia frutescens R.Br.ex W.T.Aiton	Unwele	7%	3%	18%	<.0001
Warburgia salutaris (Bertol.F.) Chiov.	Isibhaha (Zulu), Shibaha (Tsonga), Molaka (Pedi)	0%	21%	25%	<.0001
Xysmalobium undulatum (L.) Aitonf.var	Ishongwe (Zulu), Leshoka (Pedi)	1%	3%	15%	<.0001

Age had an influence with regards to medicinal plant knowledge, specifically where the Pedi and Zulu cultural groups were concerned. If the average medicinal plant knowledge over the total age distribution is considered, there were certain species that stood out with a significantly higher amount of familiarity than others. For example, *Hypoxis hemerocallidea* had an average knowledge amongst all age groups of 76%, with knowledge increasing from younger than 20 to older than 60-year-old participants (Table 3). Other species with high recognition across age groups included *Leonotis leonurus* (82% average) and *Helichrysum odoratissimum* (87% average). In contrast, plants such as *Merwilla plumbea* (Lindl.) Speta (8% average), *Xysmalobium undulatum* (L.) Aiton f. var (9% average) and *Sutherlandia frutescens* R.Br. ex W.T. Aiton (11% average) were less well-known (Table 3). Except for *Boophone disticha* (L.f.) Herb*., Elephantorrhiza elephantina* (Burch.) Skeels*, Dicoma anomala* Sond*., Merwilla plumbea, Sutherlandia frutescens, Warburgia salutaris* (Bertol. F.) Chiov. and *Xysmalobium undulatum*, all species showed an increase in familiarity with older age groups. In these species, a decline in familiarity was observed from younger than 20-year-old participants to older participants, followed by a rise again in the 50 to 59 and/or older than 60 age groups (Table 3). Although the younger than 20 age groups in general had the lowest medicinal plant knowledge, this group displayed the most familiarity with *Merwilla plumbea* and *Xysmalobium undulatum.*

Discussion

Traditional or cultural knowledge especially plant knowledge, can be affected by many factors such as culture (Mncwango *et al*., 2020, Onuminya *et al*., 2018, Ontila *et al*., 2016), age (Prinsloo *et al*., 2020 Nkhabutane *et al*., 2019, Kansiime *et al*., 2018), modernization (Arjona – Garcia *et al*., 2021)), urbanization (Arjona – Garcia *et al*., 2021, Prinsloo *et al.*, 2020)), migration (Medeiros et al., 2016) and education (Ouma, 2022, Prinsloo *et al*., 2020). South Africa not only contains a rich diversity of plants, but also cultures and the cultural use of these plants. Ethno-botanical knowledge has been investigated in many areas and amongst a number of cultural groups in South Africa, but these studies mostly focused on rural areas (Rankoana, 2022, Mashiane 2018). Many studies (both local and international) found that age has an effect on knowledge with older individuals having more knowledge (Ogar *et al*., 2020, Prinsloo *et al*., 2020). This is, however, the first study to

focus on participants in a large urban context in South Africa. The primary objective was to investigate whether knowledge of certain plant species known to be used in African culture is still prevalent amongst cultural groups in an urban setting, and if there is evidence to suggest a loss of this knowledge, particularly in the youth.

Table 3. Overall knowledge of medicinal plants per age class of respondents in Tembisa

Botanical name	<20	20-29	30-39	40-49	50-59	>60	Ave %
Alepidia amatymbica Eckl. & Zeyh	50%	62%	59%	68%	75%	81%	**66%**
Aloe ferox Mill.	28%	47%	57%	56%	53%	45%	**48%**
Artemisia afra Jacq. Ex Wild	53%	57%	61%	74%	84%	88%	**70%**
Boophane disticha (L.f) Herb	44%	38%	26%	27%	41%	52%	**38%**
Bulbine latifolia var. latifolia Roem. Et Schult	48%	68%	69%	69%	74%	57%	**64%**
Dicoma anomala Sond.	18%	9%	12%	16%	20%	27%	**17%**
Elephantorrhiza elephantine (Burch.) Skeels	17%	7%	10%	15%	17%	25%	**15%**
Eucomis autumnalis (Mill.) Chitt	20%	21%	35%	47%	56%	56%	**39%**
Helichrysum odoratissimum (L.) Sweet	73%	83%	88%	88%	94%	93%	**87%**
Hypoxis hemerocallidea Fisch. C.A. Mey & Ave-Lall	58%	75%	77%	79%	84%	82%	**76%**
Leonotis leonurus (L.) R.Br.	60%	84%	84%	84%	89%	90%	**82%**
Merwilla plumbea (Lindli.)Speta	14%	4%	4%	9%	7%	10%	**8%**
Moringa oleifera J. Lamarck	32%	34%	38%	47%	52%	64%	**45%**
Siphonochilus aethiopicus (Schweif.) B.L. Burt	19%	22%	45%	56%	56%	53%	**42%**
Sutherlandia frutescens R.Rr.ex W.T Aiton	14%	5%	8%	11%	14%	16%	**11%**
Warburgia salutaris (Bertol F.)Chiov.	17%	8%	15%	18%	22%	16%	**16%**
Xysmalobium undulatum (L.) Aiton f. var	14%	5%	6%	8%	8%	10%	**9%**
Average	**34%**	**37%**	**41%**	**45%**	**46%**	**50%**	**50%**

Plant knowledge and its relationship to cultural group and age

This study demonstrated the existence of plant knowledge amongst people in a large African urban area, although the extent of this knowledge is considerably influenced by cultural group and participant age. Participants over the age of 40 had much higher plant knowledge than younger participants. Rankoana (2022) found that elderly people in the Mantheding community in Limpopo Province, South Africa had more knowledge of plants than younger people. According to Rankoana research, the knowledge gap was caused by factors related to modernization and globalization that are perceived to raise people's living standards at the expense of traditional cultural practices by removing them from the cultural utilization of natural resources. With the change in living standards, came the loss of traditional knowledge, particularly in the youth. As the youth grew up in urban areas, they would lose the possibilities and exposure to plants gained while harvesting and cultivating crops in the wild

Age is naturally associated with knowledge acquisition so even if people moved away from their rural areas and or culture, individuals still have access to local knowledge because their parents and or grandparents are still available to access the local knowledge when visits occur (Nkhabutane *et al*., 2019, Kansiime *et al*., 2018). The Pedi cultural group moved to Tembisa when they were older (average 21 years of age compared to average of 17 and 13 years for the Tsonga and Zulu respectively) and still regularly visit their family staying in rural areas (Prinsloo *et al*., 2020).. This could explain why they had more knowledge than the Zulu participants. The younger Zulus do not return to their homelands as most of their parents also stay with them in Tembisa (Prinsloo *et al*, 2020). The elders interviewed in this study might be more knowledgeable as they grow older and were exposed to more traditional knowledge. Migration and urbanization are reported to have a direct negative impact on the dissemination of traditional knowledge (Arjona – Garcia *et al*., 2021, Prinsloo *et al.*, 2020) and could lead to a lack of indigenous knowledge and traditional cultural practices. However, this study found that differences in knowledge were more closely related to age than the migration period as older participants born in Tembisa also had a good knowledge of plants. Age dependence on plant knowledge could be due to cultural erosion (Mashiane *et al*, 2018) or because older

people are expected to have substantially more knowledge than younger people (Prinsloo *et al.*, 2020), which was clearly the case in this study.

Seventy percent of the participants moved to Tembisa township mainly for secondary activities such as employment (demographic data not shown), explaining the loss or lack of knowledge in the township's younger residents. Tembisa is a so-called 'new township' with an urban lifestyle approach and forms part of the highly urbanized Ekurhuleni Municipality. Adaptation to this urban lifestyle could partly explain the low knowledge among the younger Zulu participants as these Zulus would rather visit the local clinic or medical doctors to treat their ailments than making use of traditional plant products (Prinsloo, 2020). Younger Zulus are modernized, have a less cultural lifestyle, and prefer city life, which in return, results in fewer visits to traditional rural areas and thus influencing the amount of knowledge transferred between generations (Prinsloo *et al*., 2020.). According to Seile *et al*., (2022) most of the indigenous knowledge in the region of Mpumalanga Province was acquired before the age of 30. In our study, an increase in knowledge was still observed for age groups above 30, especially in the Zulu group. Globalization and the introduction of the internet and the impact of social media amongst the participants in the urban landscape could have influenced their behavior and attitudes towards traditional practices. Older people were born in an era before computers and social media and traditional practices were accepted widely as the norm, whereas a more westernized way of life is now considered more acceptable (Seile *et al*., 2022, Ogar *et al*, 2020)).

An increase in formal education is often strongly associated with a low degree of indigenous knowledge. Da Silva *et al*., (2023) ascribed the loss of traditional knowledge amongst younger participants in the study amongst countries in Africa, South America and Asia to the time they spent in school. Formal education thus encourages a more urban lifestyle and promotes disinterest in the natural environment and lack of knowledge could be a direct result of this. Currently, traditional practices and plant knowledge is not part of the school curriculum in South Africa and the majority of younger participants in this study were born in Tembisa or migrated to Tembisa when they were very young (data not shown). The schooling and exposure to modernized technology and western culture in urban areas could thus further contribute to the lower plant knowledge in the younger generation in this township.

Differentiation in plant species knowledge as affected by cultural group and age

Some intriguing results were obtained when knowledge of specific plant species was compared between cultures and age groups.. Two plant species (*Artemisia afra* and *Helichrysum oddoratissimum*) were commonly known by all three cultural groups in Tembisa. Both plants are usually stocked in bulk by traditional medicinal shops as prospective clients often request it by name (Prinsloo, 2017). Both of these plants are widely used and well known (Nigam *et al*., 2019), however participants in Tembisa were unfamiliar with *Xysmalobium undulatum* and *Sutherlandia frutescens*. The dearth of knowledge about *S. frutescens* can be linked to the natural distribution of the species as it is absent in large regions of the country and is not found in Limpopo, Mpumalanga and KwaZulu-Natal Provinces where the Pedi, Tsonga and Zulu originate from. The natural distribution ranges of *Artemisia afra*, *Helichrysum oddoratissimum* and *Xysmalobium undulatum,* however, coincide with the traditional homelands of all three cultural groups but they were unfamiliar with *X. undulatum*. It is possible that the visuals shown to participants for this species did not include the underground parts of the plant as these are the parts actually used in cultural practices. It is also probable that there is not always a close correlation between the natural distribution of plant species and the area of residence of cultural groups.

Cultural groups may use different plant species for different reasons, which could explain the differences observed between groups. Both *Artemisia* sp. and *Helichrysum* sp. are widely used for ritual purposes, explaining the general familiarity of the plants across age and cultural groups. Plants solely used for medicinal purposes are generally not as well known by the community as it may be protected knowledge limited, for example, to traditional healers. Medicinal plants are often sourced and harvested from the wild and re-cultivated in a specific area by traditional healers (Nigam *et al*., 2019). These areas are mostly on private property to which the general public do not have access and people are thus not exposed to these plants - explaining a lower or lack of familiarity to them. In many instances, young people grow up learning about medicinal plants from their parents or other elders, but this knowledge can vary from cultural group to cultural group, which could explain further differences between the three cultural groups in Tembisa (Prinsloo, 2017).

Furthermore, clear cultural differences in specific plant knowledge were observed. Three medicinal plants (*Bulbine frutescens Hypoxis hemerocallidea* and *Leonotis leonorus*) were well known amongst both the Pedi and Tsonga groups, with limited familiarity in the Zulu cultural group. This can, to a limited extent, be ascribed to age as a large number of the Zulu participants were younger than 20 years old and, generally, the younger Zulu participants had less plant knowledge, although individual participants in this age group with extensive knowledge were also present amongst the Zulu (individual data not

shown). The Pedi and Tsonga people have very strong ties with their families residing in the rural areas leading to the transmission of knowledge as they visit often. However, this is not the case with younger Zulu participants. In addition, the Zulu people tend to be far more protective with regards to sharing indigenous plant knowledge and this may result in reducing general plant knowledge in the youth. Through extensive literature and communications Prinsloo *et al* (2020) acknowledged that the Zulu people use indigenous plants for recreational purposes such as cooking and fragrance, but the medicinal knowledge lies mainly with the traditional healers and elders in the community, whilst the Pedi and Tsonga do not.

Alepidia amatymbica has a high knowledge spectrum amongst the Pedi group, but a much lower knowledge value amongst the other two groups. *Siphonochilus aethiopicus* was another medicinal herb popular among the Pedi people. This species originates from Limpopo and Mpumalanga Provinces, the primary settlement for these people. Although *Siphonochilus* is thought to be locally extinct in KwaZulu-Natal and upper north of South Africa however, *Siphonochilus* has been used by the Zulu people for millennia (Dugmore & Van Wyk, 2008). This could explain why the Tsonga had such little knowledge of the species as its natural distribution falls outside of their traditional settlement areas. It's worth noting that *Hypoxis hemerocallidea*, commonly referred to as the 'African potato' had an average knowledge of 76% amongst all participants and this could be attributed to being one of the most well-known medicinal plant species, receiving a great deal of media attention in the past.

There were a few noticeable medicinal plants for which knowledge was notably low (less than 30%) amongst all the cultural groups and in all the age classes (Table 2 and 3) which includes *Dicoma anomola, Elephantorrhiza elephantina, Merwilla plumbea Sutherlandia frutescens, Warburgia salutaris* and *Xysmalobium undulatum*. These species (except *Xysmalobium undulatum* and *Merwilla plumbea*) are not found naturally near Tembisa and are not available in markets (M.L. Phosoko, pers. comm.). Many Tembisa residents are primarily poor, have limited access to resources, travel infrequently and limited access to what was previously well-known plant species. Other interesting cultural differences include the extensive familiarity of the Pedi with *Aloe ferox* and *Siphonochilus aethiopicus* compared to the Tsonga and Zulu's relatively limited knowledge on these plant species. Once again, the natural range of these species is not necessarily linked to the natural distribution of the Pedi people.

A different trend was observed with regard to participant age for seven plant species (*Boophone distica, Dicoma anamola, Elephantorrhiza, Merwilla, Sutherlandia, Warburgia* and *Xysmalobium*). With these species, younger participants had a higher proportion of knowledge, while older participants had a lower percentage of knowledge and a larger percentage of familiarity. When compared to the Pedi and Tsonga, the Zulu had the highest knowledge of all these species (with the exception of *Boophone*),Generally, the Zulu participants were the youngest in this study and, as a result, had the least overall knowledge; yet some individual participants (younger than 20 years) amongst the Zulu had surprisingly good plant knowledge. Prinsloo (2017) observed that the younger people have access to social media and written material than older people and this may influence the trend observed in these seven plant species.

Conclusions

Traditional knowledge is still prevalent in the urban township of Tembisa although the extent of this knowledge is strongly influenced by age and cultural group. The younger participants in this study generally had significantly less knowledge than the older participants. The influence of age on plant knowledge was however less pronounced with the Tsonga. These different knowledge patterns likely link to intrinsic cultural differences when sharing information. The data collected displayed a collective of knowledge on medicinal plants where the Tsonga are concerned, indicative of a general sharing of knowledge within this cultural group. The clear differences observed in age where medicinal plants are concerned, does not necessarily display a lack of sharing, but could also be linked to the protection of this knowledge by the traditional health practitioners (THP's). There is a clear need to document the current traditional knowledge on medicinal plants that are known to different cultural groups, as it is evident that this knowledge could be lost if the transfer of the knowledge to the youth is disrupted. Cultural knowledge has a long history, is often unique and may hold merit in promoting certain plant species as medical remedies. In addition to documenting this knowledge, there may be merit in introducing the value and importance of indigenous knowledge into the education curriculum in schools as it would contribute to provision of cultural values, promote people's heritage, and stress the importance of natural ecosystems and the role these systems may have in local communities. Indeed, there were differences in knowledge between various cultural groups in Tembisa township and there was no evidence to suggest that these groups shared their knowledge or attempted to promote this knowledge in the younger generations of people and the reality of losing this cultural knowledge is highly evident.

Declarations

Ethics Approval: This study was reviewed and approved by the Faculty Committee for Research Ethics at Tshwane University of Technology (Ref no: 2015/02/003(2)).

Data Availability: Supporting data available in the article and generated data is available upon request.

Funding: Funding was not provided or granted by any outside organization or party.

Author contributions: KP, RK and RJ conceptualized the study. KP carried out and managed the fieldwork and data collected. KP, RK and RJ all assisted in data and statistical analyses. KP, RK and RJ contributed to drafting and revising the manuscript. All the authors read and approved the final manuscript.

Acknowledgements

The authors are very grateful to the enumerators who assisted in the data collection and the local inhabitants of Tembisa township for sharing their valuable knowledge with us.

Literature cited

Arjona-García C, Blancas J, Beltrán-Rodríguez L, López Binnqüist C, Colín Bahena H, Moreno-Calles AI, Sierra-Huelsz JA, López-Medellín X. 2021. How does urbanization affect perceptions and traditional knowledge of medicinal plants? Journal Ethnobiology Ethnomedicine 17(1):48**.**

Chu EW, Karr JR. 2017. Environmental Impact: Concept, Consequences, Measurement. Reference Module in Life Sciences. B978-0-12-809633-8.02380-3. doi: 10.1016/B978-0-12-809633-8.02380-3. Epub 2016 Oct 31. PMCID: PMC7157458.

Da Silva C, Pereira F. Amorim JP.2023. The integration of indigenous knowledge in school: a systematic review. Open access, Taylor and Francis group. Creative compare.

De Oliveira Abreu DB, Santoro FR, De Albuquerque UP, Ladio A, De Meiros PM. 2015. Medicinal plant knowledge in a context of cultural pluralism: A case study in Northeastern Brazil. Journal of Ethnopharmacology 175:124-130.

Dugmore H, Van Wyk BE. 2008. Muthi and myths from the African bush. Briza publications, Pretoria South Africa.

Ezeanya-Esiobu, C. 2019. Indigenous Knowledge and Curriculum in Africa. In: Indigenous Knowledge and Education in Africa. Frontiers in African Business Research. Springer, Singapore.

Gakuya, DW, Okumu, MO, Kiama, SG, Mbaria, JM, Gathumbi, PK, Mathiu, PM, Nguta, JM. 2020. Tradtional medicine Kenya: Past and current status, challnges, and the way forward. Scientific African, 8.

Kansiime, M.K., Ochieng, S., Karanja, D., Romney, D. Afari-Sefa, V. 2018. Changing knowledge and perceptions of African indigenous vegetables: the role of community based nutritional outreach. Development in Practice, 28(4): 480–493.

Magwede K, Tshisikhawe MP, Luseba D, Bhat RB. 2014. Ethnobotanical survey of medicinal plants used in treatment of ticks. International Journal of Experimental Botany 83(1):155-165.

Mahwasane ST, Middleton L, Boaduo N. 2013. An ethnobotanical survey of indigenous knowledge on medicinal plants used by traditional healers of Lwamondo area, Limpopo Province, South Africa. South African Journal of Botany 88:69-75.

Martinez-Balleste A, Martorel C, Caballero J. 2006. The effect of Maya traditional harvesting on the leaf production, and demographic parameters, of Sabal palm in the Yucatan Peninsula, Mexico. Forest and Ecology Management 256(6):1320-1324.

Mashiane, P.,Prinsloo,K., Slabbert, MM. 2018. An investigation on the knowledge and use of medicinal plants amongst different cultural and age groups in the Bronkhorstspruit area. MSc dissertation, Tshwane University of Technology.

Medeiros, P, Abrea, DBO, de Albuquerque, UP. 2016. Plant knowledge and use in the context of migration. In the book: Introduction to Ethnobiology.

Mncwango, N.C., Mavengahama, S., Ntuli, N.R., Van Jaarsveld, C.M. 2020. Diversity, consumption dynamics and ethnomedicinal claims of traditional leafy vegetables consumed by a rural community in the KwaMbonambi area, Northern KwaZulu-Natal, South Africa. *Biodiversitas*, 21: 1201–1207.

Monteiro JM, Albuquerque UP, Lins-Neto EMF, Araju EL, Amorim ELC. 2006. Use patterns and knowledge of medicinal species among two rural communities in Brazil semi-arid northeastern region. Journal of Ethnopharmacology 105(1-2):173-186.

Nigam M, Atanassova M, Mishra AP2019 l. Bioactive Compounds and Health Benefits of Artemisia Species. Natural Product Communications. ;14(7).

Nkhabutlane, P., De Cock, H.L. Du Rand, G.E. 2019. Culinary practices, preparation techniques and consumption of Basotho cereal breads in Lesotho. Journal of Ethnobotanical Foods, 6(12): 1–11.

Ogar, E. Pecl, G. Mustonen, T. 2020.Science must embrace traditional and indigenous knowledge to solve our biodiversity crisis. One Earth 3(2)162-165.

Ontila, E.G., Onyango, C.M., Onwanga, R.N., Nyamongo, D. 2016. Indigenous knowledge on the uses of African nightshade (*Solanum nigram* L.) species among three Kenyan communities. Economics and Sociology, 14(3): 1–8.

Onuminya, T.O., Shodiya, O.E. Ehinju, P.B. 2018. Ethnobotanical survey and genetic conservation of underutilized leafy vegetables in Lagos, Nigeria. International Journal of Biological Chemistry Science, 12: 689–702.

Ouma, A. 2022. Intergenerational learning processes of traditional medicinal knowledge and socio-spatial transformation dynamics. Frontiers in Sociology 7:661992

Prinsloo, K. Mashiane, P, Slabbert, R. 2023. The use and availability of medicinal plants in a semi urban region amongst different cultural groups, Bronkhorstspruit, South Africa. Acta Horticulture 1358.

Prinsloo, K, Kleynhans, R, Jansen, R. 2020. Demographic variation in an urban community assessed for traditional ecological knowledge. Acta Horticulture. 1279.

Prinsloo, K. 2017. Urban migration and the loss of traditional ecological plant knowledge: A case study in South Africa. PhD dissertation. Tshwane University of Technology.

Rankoana, SA.2022.Ethnobotanical study of indigenous plants used by the members of Mantheding community in Limpopo Province, South Africa. E-Jornal of Humanities, Arts and Social Sciences 3(7) 269-278.

Rayner, A.A. 1969. A first course in Biometry for agriculture students. University of Natal Press, Pietermaritzburg.

Rehman, R, Kalsoom, M, Adnan, M, Fazeli-Nasab, B, Naz, N, Ilahi, H, Fraz Ali, M, Ilys, A, Yousaf, G, Danish Toor, M, Ali, Z. 2021. Importance of medicinal plants in human and plant pathology: A Review. International Journal of Pharmacy and Biomedical research 8(2),1-11.

Seile, BP, Bareetseng, S. Koitswe, MT, Aremu, AO.2022.Indigenous knowledge on the uses sustainability and conservation of African ginger (*Siphoncillus aethiopicus*) among two communities in Mpumalanga Province, South Africa.

Snedecor GW, Cochrane, WG. 1967. Statistical Methods, 6th edition. USA: The Iowa State University press pp. 11-12.

Statistical Analysis System (SAS). 1999. SAS. SAS/STAT Users guide, version 9.4, 1st printing, Volume 2.

Statistics South Africa. 2016. Community survey 2016. http://cs2016.statssa.gov.za/wp-content/uploads/2016/07/NT-30-06-2016-RELEASE-for-CS-2016-_Statistical-releas_1-July-2016.pdf (accessed 20/09/2017).

World Health Organization (WHO). 2022. Traditional medicine. https://www.afro.who.int/regional-director/speeches-messages/african-traditional-medicine-day-2022