UTILISATION OF TRADITIONAL AND INDIGENOUS FOODS IN THE NORTH WEST PROVINCE OF SOUTH AFRICA

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DEDICATIONS

This thesis is dedicated to:

My beloved parents, Johnson Matenge and Tsholofelo Matenge who taught me how to persevere and always have hope for better outcomes in the unpredictable future. Thanks again for your guidance and patience. I love you so much. To my children, Tapiwa and Tawanda, leaving you at a time when you needed me the most was the hardest thing that I had to do in my life, but I thank the omnipresent God who is watching over you and because of him you coped reasonably well. My son Panashe, has given me sincere love and support, has endured well the tough life in Potchefstroom and has been doing a good job at school. Just one look in his eyes gave me hope.

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SUMMARY

BACKGROUND

In South Africa and Africa as a whole malnutrition and poverty often co-exist with urbanisation, which is associated with significant dietary changes mostly due to neglect of indigenous foods and loss of indigenous knowledge (IK). Consumption of traditional leafy vegetables (TLV), legumes and fruits is the most sustainable way of reducing micronutrient deficiencies in resource-poor communities as they are often easier to grow, resistant to pests and diseases and acceptable to local tastes.

AIM AND OBJECTIVES

The main aim of this thesis was to explore the possibilities of promoting the cultivation, utilisation and consumption of indigenous and traditional plant foods (ITPF) among urban and rural communities in the North West Province of South Africa that could possibly lead to increased IK and dietary diversity. The objectives were the following:

- Assess consumption of TLV in the rural and urban communities.
- Compare nutritional status of consumers and non-consumers of TLV using data obtained from the Prospective Urban and Rural Epidemiology (PURE-SA) study.
- Assess the availability, cultivation and consumption patterns of ITPF.
- Assess indigenous knowledge (IK) within the rural and urban communities.
- Assess consumers' views of ITPF in the rural and urban communities.
- Assess consumers' acceptance of, preference for and consumption intent of dishes made from cowpea leaves.

- To compile recipes for the most important ITPF commonly consumed in the study areas in order to promote the cultivation and consumption of ITPF (see Addendum D).

STUDY DESIGN

Health profile study: For the health profile study, a comparative study was conducted on the baseline data of the population that participated in the PURE-SA study (1004 urban and 1006 rural participants) which follows the health transition in urban and rural subjects over a 12 year period. The baseline data for the North West Province of South Africa were collected from October to December 2005.

Utilisation of ITPF study: The study on the utilisation of ITPF used a sequential explanatory study design which involved the collection of quantitative and qualitative data and analyses. The consumer acceptance study consisted of an explorative and experimental phase. Participants were male and female, aged older than 20, residing in the selected communities and knowledgeable on the indigenous and traditional foods of the area.

METHODS

A variety of quantitative and qualitative research techniques were used. Data were generated through questionnaires, focus groups and individual - and group interviews.

Health profile study: Demographic characteristics and frequency of consumption of TLV data were collected by the researcher from 396 randomly selected subjects from participating subjects in the PURE-SA study. An extensive nutritional profile of these subjects was compiled including blood samples, blood pressure, anthropometric measurements and total dietary intake by means of a quantitative food frequency questionnaire.

Utilisation of ITPF study: A comparative study was conducted in rural and urban populations of the North West Province. Data were collected by the researcher using a questionnaire (n=396 households), key informant interviews (n=4), and four focus groups.

Consumer study: Four focus groups were conducted by the researcher, two in rural and two in urban communities, to investigate consumers' views about ITPF. Eighty-seven participants were recruited based on a specific purpose rather than randomly. Consumers' acceptance of, preference for and intended consumption of products made with cowpea leaves were assessed. A 5-point hedonic scale and a 7-point food action rating scale were used for sensory evaluation.

RESULTS

Health profile study: As expected, rural inhabitants were more likely to consume TLV. However, no household reported to consume TLV more than ten times a month. Factors such as price (affordability) and availability and easy-to-get-to points of purchase were found to be major constraints in the consumption of TLV, especially in urban communities. Urban respondents had significantly higher macronutrient intakes than rural subjects. There was no significant difference between the selected micronutrient intakes between consumers and non-consumers of TLV. Non-consumers of TLV had higher blood lipid levels than consumers from both the rural and urban areas. In the urban subjects the relative risk to develop high blood pressure was higher in non-consumers of TLV than in the consumers. However, the risk ratios of raised serum cholesterol and triglycerides were not significantly different.

Utilisation of ITPF study: More plant foods were available and consumed in the rural area than the urban area. However, fewer species were available than expected due to insufficient rainfall, poor soil quality, deforestation and over harvesting. Consumption of indigenous foods was influenced by price, culture,

seasonality/availability, accessibility and diversity in markets. A lack of markets for indigenous crops, insufficient rainfall and diseases and pests were cited as the major cultivation problems, followed by a lack of capital to buy farming implements, veld fires and poor soil quality.

Consumer study: Based on the qualitative focus group discussions, factors that influence the consumption of ITPF were identified. These factors included benefits and barriers of ITPF consumption. Ways to increase ITFP consumption were also identified. Health and nutrition; tradition and culture; and food safety emerged as drivers for ITPF consumption. A lack of knowledge and skills of food preparation and negative images and unfamiliarity of ITPF acted as barriers. Differences in views existed between older and younger consumers. In general younger consumers found ITF rather revolting and undesirable, humiliating to consume.

Sensory evaluation of food samples for the pooled data of the total study population showed that significant differences existed between the acceptability of all attributes, overall acceptance and consumption intent. Socio-demographic backgrounds such as place of residence (urban or rural), levels of education and age were shown to influence the acceptability of food samples and consumption intent. There was no positive association between acceptability of food and gender.

CONCLUSIONS

Health profile study: This study showed the possibility of beneficial effects of rural diets, however, the lack of knowledge concerning the bioavailability of nutrients from TLV and lack of information on food consumption database, of these vegetables constitute main barriers to obtaining information on nutrient intake. The low frequency of consumption of TLV is of concern. Taking into consideration safe agricultural practices, the promotion of TLV might be a solution towards healthier diets and combating poverty. More research is needed to investigate the health effects of these vegetables.

Utilisation of ITPF study: It is evident that there was a limited number of ITPF species cultivated and consumed. Consumers, especially older people, were found to possess extensive knowledge regarding the availability of ITPF species, their habitat and uses, seasonality and potential health benefits. There is a need to intensify education on conservation of natural resources and more studies should be undertaken to document and disseminate traditional food systems. In addition, there is a need to integrate existing health and nutrition interventions with traditional food promotion.

Consumer study: The results highlighted the importance of making use of a mixed method approach which made it possible not only to identify factors that influence the consumption of ITPF but also to understand the dynamics thereof from focus group discussions and how they influence acceptability, preference and consumption intent. Important benefits (drivers) of and barriers to ITPF consumption as well as suggestions on how to increase ITPF consumption were identified. Barriers to ITPF consumption and low scores of acceptability provided by younger participants can be connected to misconceptions about ITPF and lack of familiarity with the products. Therefore, a combination of strategies aimed at enhancing individual awareness of the health benefits of ITPF, decreasing barriers and conducting more acceptability studies may have a positive impact on the younger segment of the population.

KEYWORDS: consumers, consumers' views, consumption intent, cowpea leaves, cultivation, indigenous knowledge, indigenous and traditional plant foods, non-consumers, nutrient intake, traditional leafy vegetables, preference and product acceptance

AGTERGROND

In Suid-Afrika en Afrika as geheel kom wanvoeding en armoede dikwels saam met verstedeliking voor, wat met betekenisvolle dieetveranderinge geassosieer word, dikwles as gevolg van verwaarlosing van inheemse voedsels en verlies van inheemse kennis (IK). Inname van tradisionele blaargroentes (TBG), peulgroente en vrugte is die mees volhoubare manier om mikronutriëntte kekorte in hulpbron-arme gemeenskappe te verminder, omdat dit dikwels makliker groei, weerstand bied teen plae en siektes en aanvaarbaar is vir plaaslike smake.

DOEL EN DOELWITTE

Die hoofdoel van hierdie proefskrif was om ondersoek in te stel na die moontlikhede van bevordering van die verbouing, verbruik en inname van inheemse en tradisionele plantvoedsels (ITPV) deur stedelike en landelike gemeenskappe in die Noordwes Provinsie van Suid-Afrika wat moontlik verhoogde IK en dieetdiversiteit tot gevolg kon hê. Die doelwitte was die volgende:

- Bepaal die inname van TBG in die landelike.
- stedelike areas en vergelyk die voedingstatus van gebruikers en nie-gebruikers van TBG deur data verkry van die Prospektiewe Stedelike en Landelike Epidemiologiese studie (PURE-SA).
- Bepaal die beskikbaarheid, verbouing en verbruikpatrone van ITPV en IK in die landelike en stedelike gemeenskappe.
- Bepaal die opinies van verbruikers van ITPV in die landelike en stedelike gemeenskappe.
- Bepaal die aanvaarding van, voorkeur vir en inname-voorneme van geregte gemaak van die blare van swartbekboontjies.

- Om resepte van die belangrikste ITPV algemeen gebruik in die studie-areas saam te stel (kyk Bylae 9).

STUDIE-ONTWERP

Vir die gesondheidsprofielstudie is ‘n vergelykende studie uitgevoer op die basislyndata van die populasie in die PURE-SA studie (1000 stedelike en 1000 landelike deelnemers) wat die gesondheidsoorgang in stedelike en landelike respondente oor ‘n 12-jaar-periode volg. Die basislyndata vir die Noordwes Provinsie van Suid-Afrika is van Oktober tot Desember 2005 versamel.

Die ITPV-studie het ‘n sekwensiële verklarende studie-ontwerp gebruik wat die versameling van kwantitatiewe en kwalitatiewe data en analises ingesluit het. Die verbruikersaanvaardingstudie het uit ‘n verkennende en eksperimentele fase bestaan. Deelnemers was manlik en vroulik, ouer as 20, woonagtig in die gekose gemeenskappe en bekend met die inheemse en tradisionele voedsels van die area.

METODES

‘n Veskeidenheid van kwantitatiewe en kwalitatiewe navorsingstegnieke is gebruik. Data is gegenereer deur vraelyste, fokusgroepe en individuele- en groep-onderhoude.

Gesondheidsprofielstudie: Demografiese eienskappe en frekwensie van inname van TBG is versamel van 396 ewekansigverkose proefpersone van die deelnemers aan die PURE-SA-studie. ‘n Uitgebreide gesondheidsprofiel van hierdie proefpersone is gedoen, insluitend bloedmonsters, bloeddruk, antropometriese afmetings en totale dieetinname met behulp van ‘n kwantitatiewe voedselfrekwensievraelys.

Verbruik van ITPV-studie: ‘n Vergelykende studie is uitgevoer in landelike en stedelike populasies van die Noordwes Provinsie. Data is versamel deur gebruik te

maak van ‘n vraelys (n=396 huishoudings), sleutelinformantonderhoude (n=4) en vier fokusgroroepe.

Verbruikerstudie: Vier fokusgroepe, twee in landelike en twee in stedelike gemeenskappe, is gelei om verbruikers se opinie omtrent ITPV te ondersoek. Sewe-en-tagtig deelnemers, gebaseer op ‘n spesifieke doel eerder as ewekansig, is gewerf. Verbruikers se aanvaarding van, voorkeur vir en voorneme om blare van swartbekboontjies in te neem is bepaal. ‘n 5-punt hedoniese skaal en ‘n 7-punt voedselaksie beoordelingskaal is gebruik vir sintuiglike evaluering.

RESULTATE

Gesondheidsprofielstudie: Soos verwag was landelike inwoners meer geneig om TBG in te neem. Geen huishouding het egter meer as tien keer per maand TBG ingeneem nie. Faktore soos prys (bekostigbaarheid), beskikbaarheid en maklik-om-te-bereik punte van aankoop is gevind as die hoofbeperkings van die inname van TBG, veral in stedelike gemeenskappe. Stedelike gemeenskappe het betekenisvol meer makronutriënte as landelike gemeenskappe ingeneem. Daar was egter geen verskil tussen die geselekteerde mikronutriëntinnames tussen verbruikers en nie-verbruikers van TBG nie. Nie-verbruikers het hoër bloedlipiedvlakke as verbruikers in beide landelike en stedelike areas vertoon. In stedelike deelnemers was die relatiewe risiko om verhoogde bloeddruk te ontwikkel hoër in nie-verbruikers as verbruikers van TBG. Die risikoverhoudings van verhoogde serumcholesterol- en trigliseriedvlakke was egter nie betekenisvol verskillend nie.

Verbruik van ITPV-studie: Meer plantvoedsels was in die landelike as die stedelike areas beskikbaar en verbruik. Minder spesies was egter beskikbaar as wat verwag was as gevolg van onvoldoende reënval, swak grondkwaliteit, ontbossing en te veel oeste. Inname van inheemse voedsels was beïnvloed deur prys, kultuur, seisoenaliteit/beskikbaarheid, toeganklikheid en diversiteit in markete. ‘n Gebrek aan markte vir inheemse oeste, onvoldoende reënval en siektes en plae is genoem as die

hoofprobleme met verbouing, gevolg deur ‘n gebrek aan kapitaal om plaasimplemente te koop, veldvure en swak grondkwaliteit.

Verbruikerstudie: Gebaseer op die kwalitatiewe fokusgroepbesprekings is faktore geïdentifiseer wat die verbruik van ITPV beïnvloed. Hierdie faktore het voordele en knelpunte van ITPV-verbruik ingesluit. Voorstelle om ITPV-verbruik te verhoog is ook geïdentifiseer. Gesondheid en voedingstatus; tradisie en kultuur; en voedselveiligheid het as drywers van ITPV na vore gekom. ‘n Gebrek aan kennis en vaardighede in verband met voedselvoorbereiding en negatiewe beeld en onbekendheid met ITPV was knelpunte. Verskille van opinies het tussen ouer en jonger verbruikers bestaan. Oor die algemeen het jonger verbruikers ITPV nogal walglik en onwenslik gevind, vernederend om te eet.

Sintuiglike evaluering van voedselmonsters vir die gesamentlike data van die totale studiepopulasie het getoon dat betekenisvolle verskille bestaan het tussen die aanvaarbaarheid van al die attribute/eienskappe, algehele aanvaarbaarheid en voorneme van verbruik. Sosio-demografiese agtergronde soos verblyfplek (stedelik of landelik), vlakke van opvoeding/onderrig en ouderdom het die aanvaarbaarheid van voedselmonsters en voorneme om te verbruik beïnvloed. Daar was geen verband tussen voedselaanvaarbaarheid en geslag nie.

GEVOLGTREKKINGS

Gesondheidsprofielstudie: Hierdie studie het die moontlikheid van voordelige effekte van landelike diëte gewys, maar die gebrek aan kennis in verband met die biobeskikbaarheid van nutriënte van TBG en inligting oor die nutriëntsamestelling van hierdie groente is belangrike knelpunte in die insameling van inligting oor nutrëintinname. Die lae frekwensie van inname van TBG is kommerwekkend. Met inagneming van veilige landboukundige praktyke mag die bevordering van TBG ‘n oplossing in die rigting van gesonder diëte en bestryding van armoede wees. Meer navorsing is nodig om die gesondheidseffekte van hierdie groente te ondersoek.

Verbruik van ITPV-studie: Dit is duidelik dat ‘n beperkte getal ITPV-spesies verbou en verbruik is. Verbruikers, veral die ouer mense, het oor uitgebreide kennis beskik in verband met die beskikbaarheid van ITPV-spesies, hul habitat en gebruike, seisoensbesikbaarheid en die moontlike gesondheidseffekte. Daar is ‘n behoefte aan verskerpte onderrig oor bewaring van natuurlike bronne en meer studies behoort onderneem te word om tradisionele voedselsisteme te dokumenteer en kennis te versprei. Verder is daar ‘n behoefte om bestaande gesondheid- en voedingintervensies met tradisionele voedselbevordering te integreer.

Verbruikerstudie: Die resultate het die belang van die gebruik van ‘n gemengde metode-benadering uitgelig, wat dit moontlik gemaak het om nie net faktore wat die verbruik van ITPV beïnvloed te identifiseer nie maar ook uit fokusgroepbesprekings die dinamika daarvan te verstaan en hoe dit aanvaarbaarheid, voorkeur en voorneme om te verbruik beïnvloed. Belangrike voordele (drywers) en knelpunte in IBG-verbruik sowel as voorstelle oor hoe om ITVP-verbruik te vermeerder is geïdentifiseer. Knelpunte in ITVP-verbruik en lae tellings van aanvaarbaarheid verkry deur jonger deelnemers kan verbind word aan wanopvattings oor ITVP en onbekendheid met die produkte. Daarom kan ‘n kombinasie van strategieë gemik op verhoging van individuele bewussyn van die gesondheidseffekte van ITVP, vermindering van knelpunte en die uitvoering van meer aanvaarbaarheidstudies ‘n positiewe impak op die jonger segment van die bevolking hê.

SLEUTELTERME: verbruikers, verbruikers se opinies, voorneme van verbruik, blare van swartbekboontjies, verbouing, inheemse kennis, inheemse en tradisionele plantvoedsels, nie-verbruikers, nutriëntinname, tradisionele blaargroentes, voorkeur en produkaanvaarding

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ACRONYMS

AIDS	Acquired Immune Deficiency Syndrome
ANOVA	Analysis of variance
BMI	Body mass index
CDT	Carbohydrate deficient transferrin
CI	Confidence Interval
CLT	Central location test
CVD	Cardiovascular disease
ECG	Electrocardiogram
EDTA	Ethylene diamine tetra acetic acid
FACT	Food action rating scale
FAO	Food and Agriculture Organization
FLAGH	Farm Labour and General Health Programme
g/day	Gram per day
HBP	High blood pressure
HDL-C	High density lipoprotein cholesterol
HDL	High density lipoprotein
HIV	Human Immune Deficiency Virus
IK	Indigenous knowledge
ITF	Indigenous and traditional foods
ITPF	Indigenous and traditional plant foods
kg/m²	Kilogram per metre squared
kJ/day	Kilojoules per day
NFCS	National Food Consumption Survey
NWP	North West Province

OR	Odds ratio
QFFQ	Quantitative food frequency questionnaire
PURE	Prospective Urban and Rural Epidemiology study
RDP	Reconstruction and Development Programme
RSA	Republic of South Africa
SADC FANR	Southern African Development Committee Food Agriculture and Natural Resource
SAS	Statistical Analysis System
SD	Standard deviation
SMAC	Sequential Multiple Analyzer Computer
SPSS	Statistical Package for Social Sciences
TB	Tuberculosis
THUSA	Transition, Health and Urbanization in South Africa
TLV	Traditional leafy vegetables
UNICEF	United Nations Children's Fund
WHO	World Health Organization

LIST OF SYMBOLS

°C	Degrees Celsius
%	Percentage
ß	Beta
<	Less than
>	Greater than
=	Equals
+VE	Positive
-VE	Negative

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CHAPTER 5

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DEFINITION OF TERMS

The following definitions were adapted from: Maudu *et al*. (2009). Biodiversity of African vegetables. (*in* African indigenous vegetables in urban agriculture. eds. Shackleton *et al.*). 298 p.

INDIGENOUS (or native) refers to species varieties or any taxa known to be native to or have originated in a specified geographical location, in this case, Africa.

TRADITIONAL refers to exotic or indigenous species, varieties or taxa that have been in use for a sufficient length of time to be part of the local food habits, knowledge systems and customs of communities.

EXOTIC/MODERN or introduced species that were brought into Africa from other parts of the world.

VEGETABLE the term is limited to plant parts (underground or shoot parts, including stem, leaves, fruit and flowers) usually eaten fresh or processed in any way (cooked, steamed, dried, marinated etc.) and that are not used as conventional fruit, nut, root/tuber crop, pulse or staple, but as an accompaniment of the main dish or alone as a snack mainly for their micronutrient benefit.

INDIGENOUS KNOWLEDGE (IK) is the local knowledge that is unique to a given culture or society (Warren, 1991)

(Warren, D.M. 1991. The Role of Indigenous Knowledge in Facilitating the Agricultural Extension Process. Paper presented at International Workshop on Agricultural Knowledge Systems and the Role of Extension. Bad Boll, Germany, May 21-24, 1991).

CHAPTER 1

INTRODUCTION AND MOTIVATION

CHAPTER 1: INTRODUCTION

1. Introduction and motivation

1.1 Problem statement

It is well known that hunger and malnutrition are universal problems, facing the majority of the world's poor and needy people, and continue to dominate the health of the poorest nations. According to the United Nation's Millennium Project (2005), malnutrition and poverty remain at unconscionable levels in most parts of the world, especially in Africa, resulting in poor health, high rates of mortality and morbidity, disability, stunted mental and physical growth. The above consequences had led to retarded national socio-economic development (WHO/FAO, 2003; Flyman & Aflolayan, 2006).

The catastrophic nature of malnutrition can also be noted with the escalating numbers of micronutrient deficiencies worldwide. Nearly 30% of humanity is currently suffering from one or more of the multiple forms of malnutrition (WHO/FAO, 2003). The Food and Agriculture Organization (FAO) estimated that more than 3.7 million deaths could be attributed to annually underweight in children and that vitamin A and iron deficiencies caused an additional 750 000 to 850 000 deaths worldwide per year (FAO, 2004).

It has been observed that with urbanisation and industrialisation in many developing countries, fundamental changes in diets of people, patterns of work and lifestyle have occurred founded on economic factors, modernisation in agriculture, ecosystem degradation, loss of biodiversity and indigenous knowledge and the globalisation of markets (Flyman & Aflolayan, 2006; Damman *et al*., 2007). In this process of seeking more economic opportunities, increasing numbers of poor people live in urban areas. In many cases the low cost of staple food relative to non-staples leads to diets simultaneously adequate or excessive in energy but deficient in micronutrients. Consumption of a diet high in energy, low in micronutrients, coincides with low energy expenditure contributed to obesity and malnutrition in the same person (Johns & Sthapit, 2004; Flyman & Aflolayan, 2006; Damman *et al*., 2007). Given the rapidity with which traditional diets and lifestyles are changing in many developing countries, it is not surprising that food insecurity, undernutrition and obesity persist in the same countries where chronic diseases are emerging as a major epidemic (WHO/FAO, 2003). The existence of this combination of poverty-related infectious and lifestyle-

related non-communicable diseases, both driven by malnutrition, creates a 'double burden of disease' (Bourne *et al.*, 2002*;* WHO/FAO, 2003).

Reliance on a limited number of energy-rich foods and the so-called westernised diets had reduced consumption of foods accessed through fishing, hunting, herding, and gathering or own food production (Wahlqvist, 2005). Increasing reliance on purchased diets consisting of pre-processed foods and drinks, high in refined carbohydrates and saturated fats contributes to the emerging epidemic of non-communicable disease (Johns & Eyzaguirre, 2006a; Damman *et al*., 2007). Frison *et al*. (2004) affirm that these refined foods are high in energy and less in other vital nutritional elements and this lack is associated with ill health. The effects of westernised diets can be noticed in black South Africans, in which case the adaptation to a western lifestyle has contributed to the increase in prevalence of chronic diseases (Fourie & Steyn, 1995; Vorster *et al*., 2000; Vorster *et al*., 2007). The tendency in developing countries to avoid traditional foods and diets which are often associated with poverty and stigmatized as backward has been associated with the rising double burden of diseases (Vorster & Kruger, 2006; Frison, 2007; Vorster *et al*., 2011).

Bourne *et al*. (2002) reported that in South Africa, increased westernisation of diets is occurring even in rural diets. Such changes also profoundly affect local systems of food production where few farmers engage in modernised subsistence farming which results in erosion of the agricultural biodiversity (Johns & Sthapit, 2004). The introduction of crops such as maize and soybeans in many countries in sub-Saharan Africa over the past century has to a large extent replaced the drought resistant crops such as sorghum and millet (Babu, 2000; Jansen van Rensburg *et al* 2007; Vorster, 2007) hence, a loss of indigenous knowledge systems related to cultivation and utilisation of traditional and indigenous crops has occured (FAO, 1989).

On the other hand, studies in West Africa have shown that the shift in diets are a result of traditional food processing techniques which are tedious and time consuming, and many traditional meals involve lengthy preparation and cooking. The absence of women working away from their homes had led to replacement of traditional and indigenous foods by convenience foods (Frison *et al.*, 2004). Because of their changing roles, women today favour less time consuming semi-processed foods and those foods requiring longer cooking times are less frequently consumed, resulting in the disappearance of traditional foods that require elaborate or tedious processing (Frison *et al.*, 2004).

Although traditional and indigenous foods are considered to be tastier and healthier, in South Africa, discrimination of these foods is on the rampage (Modi *et al*., 2006). Previous research in other countries has shown that indigenous and traditional foods have been subjected to subordination and considered "low status" and "poor people's food" and was avoided especially by

young consumers (Modi *et al*., 2006; Damman *et al*., 2007). In most cases leafy vegetables are consumed as relish together with starchy foods such as sorghum and or maize meal as in the case of South Africa. Diouf *et al*. (2007), however, raise a new angle to this in the sense that the consumption of green leafy vegetables may be strongly related to the availability and consumption of starchy food together with which it is traditionally consumed. The implication of such changing patterns in the consumption of grain-based staple food might be likely to affect the intake of green leafy vegetables. Another contributing factor to low consumption of traditional leafy vegetables (TLV) is the issue of hygiene particularly with vegetables that thrive well along dirty places such as dirty drains and dumping sites (Gockowski *et al*., 2003). Also the size of the markets which are informal, small in scale, often dominated by poor people and weak in terms of the linkage with formal outlets such as supermarkets and high prices of traditional and indigenous foods compared to cheaper modern foods were sited as a problem (Gockowski *et al*., 2003). All these factors impose on traditional foods and cause a shift in consumption patterns.

Although food biodiversity in many African countries is ignored in research, a number of African indigenous and traditional foods have been known and reported to have health protecting properties and uses (Vainio-Mattila, 2000; Turan *et al*., 2003; Flyman & Afolayan, 2006; Hassan and Umar, 2006; Frison, 2007). These studies have confirmed the importance of wild vegetables as sources of micronutrients. In South Africa Nesamvuni *et al.* (2001) and Faber *et al*. (2007) also underscored significant contribution of wild vegetables as sources of micronutrients. The nutritional quality of four wild vegetables analysed in Ghana was found to be within the same range as conventional vegetables (Wallace *et al.,* 1998). There is, however, a need for more systematic studies to fill the gaps of documented knowledge of the nutritional value of these foods. In addition, controversy exists over whether consumption of TLV contributes to nutrient adequacy due to issues of bioavailability (Flyman & Afolayan, 2006; Faber *et al*., 2010). According to Flyman and Afolayan (2006), the presence of relatively large amounts of various nutritional essential micro-nutrients in the vegetables does not mean that these nutrients are bio-available. Hence the determination of the bioavailability of micro-nutrients in TLV is vital.

In the United States, dietary diversity was associated with lower mortality rates from all causes in a large sample of women (Kant *et al*., 2000). In Italy it was also evidenced that dietary diversity protects against stomach cancer (La Vecchia *et al*., 1997). Furthermore, several previous epidemiological studies reported the health benefits of a diet rich in fruits and vegetables, which has resulted in the World Health Organization's (WHO) recommendation of a daily intake of five fruit and vegetable portions to protect against diet related chronic diseases (WHO/FAO, 2003). In view of the above, the contribution that biodiversity makes in terms of diverse and nutritious diets cannot be underestimated. In general it may be safe to conclude that more diverse diets reflect

higher diet quality. Adding diversity in the form of indigenous and traditional plant foods can contribute to dietary quality that could lead to the elimination of most essential nutrient deficiencies.

Indigenous knowledge (IK) and useable plant biodiversity are complementary phenomena essential to cultural heritage. According to Ohiokpehai (2003), indigenous knowledge is a key factor in the development of local cultures and in their continued adjustment to modifications in their environments. This knowledge has been important for the survival of society in their environments by entitling communities to identify resources and products vital to their sustenance (Tabuti, 2002). Due to the impact of socio-economic changes upon the ethnic communities and the realisation that most indigenous knowledge and practices are ignored, maligned by outsiders, dying out, and under-utilised (Ohiokpehai, 2003), education on local knowledge and indigenous biodiversity is crucial. This view is supported by Easton (2004) stating that educational activities provide one of the prime means for transmitting, accumulating, enhancing and transforming indigenous knowledge. Generally speaking, adapting indigenous knowledge in order to transform traditional institutions and generate resources is required for addressing community specific problems.

There is currently a lack of documented data concerning consumers' views of indigenous and traditional plant foods and sensory acceptability of products made with traditional plant foods such as cowpea leaves in South Africa, particularly in the North West Province. This aspect of food consumption is often overlooked. In consumer behaviour, attitudes, beliefs and opinions play a crucial role in determining product acceptance and consumption. In addition, proper knowledge on the preparation, preservation and nutritional impact of traditional plant foods is lacking (Nguni & Mwila, 2007). Therefore, information is required on consumer behaviour, to guide possible future interventions on how to include traditional plant foods into food choices. In addition, the results of this study will guide low cost and effective interventions to promote the production and utilisation of TLV, especially in many poor rural and urban communities, hence resulting in possible improved nutrition status and quality of life.

Against this background, the main purpose of this study was to subsequently fill the gaps in knowledge regarding the availability, acceptability and consumption of indigenous plant foods. In addition, possible health effects of TLV were assessed. Based on the above discussion, the aim and objectives of this study are presented in the following section.

1.2 Aim of the study

The main aim of this study was to explore the possibilities of promoting the cultivation, utilisation and consumption of indigenous and traditional plant foods (ITPF) to urban and rural communities in the North West Province of South Africa that could possibly lead to increased indigenous knowledge and dietary diversity. The outcome of this study may also serve as a model in similar community environments.

1.3 Objectives of the study

The objectives of this study were to:

- Assess consumption of traditional leafy vegetables (TLV) in rural and urban areas;
- Compare the nutritional status of consumers and non-consumers of TLV using data from the Prospective Urban and Rural Epidemiology study (PURE-SA study);
- Assess the availability, cultivation and consumption patterns of ITPF;
- Assess indigenous knowledge (IK) within the rural and urban communities;
- Assess consumers' views of ITPF in the rural and urban communities;
- Assess consumers' acceptance of, preference for and consumption intent of dishes made from cowpea leaves; and
- Compile recipes on the most important ITPF, commonly consumed in the study areas to promote the cultivation and consumption of ITPF. (see Addendum D)

1.4 Positioning of the study within a larger research infrastructure

This research formed part of a larger research study entitled "Biodiversity and indigenous knowledge to enhance dietary diversity: the impact on health and nutrition" carried out in collaboration with Kenya and Benin. The South African leg of this study investigates the situation within the North West Province of South Africa where the ultimate purpose is to explore possibilities of promoting the utilisation of ITPF in rural and urban communities of the North West Province that could possibly lead to increased indigenous knowledge and dietary diversity. The project in South Africa started in April 2008 where the three collaborative countries held their first meeting to endorse the project implementation plan. The South African leg is coordinated from the Africa Unit for Transdisciplinary Health Research (AUTHeR) in the Faculty of Health Sciences of the North-West University (NWU), Potchefstroom Campus. The disciplines of Nutrition Science,

Consumer Sciences, Environmental Science and Agriculture Economics from the NWU, as well as the Agricultural Research Council in Roodeplaat, Pretoria were all involved. The research used for this thesis was funded by Biodiversity International and AUTHeR. The research for this thesis fits within the main aim of the larger study to provide empirical evidence of how the role of biodiversity can be translated into improved health status in contemporary poor rural and urban communities in the North West Province of South Africa and followed a mixed method approach.

1.5 Research setting and participants

A comparative study was conducted between the rural communities (Ganyesa and Tlakgameng) and the urban communities (Ikageng, Extension 7 and 11, and Sonder Water) surrounding the main town of Potchefstroom in the North West Province of South Africa.

The research for this thesis was done in sub-studies to address the different objectives of the research, starting with the sub-study entitled "Comparison of health between consumers and non-consumers of TLV from a rural and urban setting in South Africa" (see Chapter 3) which used data from the PURE-SA[1] study' enrolling a total of 1004 urban and 1006 rural participants. During the time of data collection for the PURE-SA study, the North West Province and especially the rural areas suffered droughts which impacted on the local agricultural production of food, hence in the ability of the households to sustain livelihoods. In the PURE study, one of the observations was that diets in the rural areas were more compromised than in urban areas (Kruger *et al.,* 2009, 2011).

To investigate the rest of the objectives for this thesis, a total population of 400 consumers of ITPF was randomly selected from the PURE-SA participants (200 urban and 200 rural) to obtain in-depth information on the utilisation of ITPF. Selection of participants for the various sub-studies within the larger study was based on a defined set of criteria (see Chapters 4 and 5).

1.6 Overview of the study areas

This study was conducted in urban and rural areas of the North West Province. The urban area consisted of Ikageng with established households and surrounding informal housing areas of Sonder Water, Extension 7 and 11, while the rural area comprised of Ganyesa and Tlakgameng.

[1] PURE is an acronym for Prospective Urban and Rural Epidemiology. A study conducting within 17 different industrialised countries in which the health transition in urban and rural subjects are investigated over a 12 year period. The baseline data of the South African leg of the PURE study were collected in 2005 and is also coordinated from AUTHeR.

The rural and urban areas were identified based on the THUSA study's[2] definition where "urban" locations are areas with people living in established townships and squatter camps while "rural" locations are people still living under tribal laws. Figure 1.1 shows an illustration of the North West Province and the study areas as indicated with red arrows.

Figure 1.1 Map of North West Province indicating the study areas (Source: www.places.co.za/maps/north_west_map.html)

1.6.1 The urban environment

Ikageng

Ikageng is situated west of Potchefstroom between latitude 26 43' 00'' and longitude 27 06' 00''. It is 1 343 meter above sea level (Tlokwe City Council, 2009, personal communication). The average temperature is maximum 29.83 °C and minimum 16 °C. The average rainfall is approximately 767 mm per annum. The climate is hot in summer and during winter there is severe frost and cold. Middle-income inhabitants characterise the area, therefore less poverty exist. Tarred roads serve the area and there are adequate toilet facilities. There are several tuck shops and market areas for modern fruits and vegetables. The vendors in the informal market source most of their fresh produce from fruit and vegetable wholesalers in town, repack and sell it in smaller sized portions. There is limited marketing of indigenous and traditional foods. People in this area depend largely on bought fruit and vegetables. There are a number of primary schools and high schools, clinics, a

[2] THUSA study-Transition and Health during Urbanisation in South Africans: This is a cross-sectional epidemiological study that monitors the impact of urbanisation on the health determinants of black South Africans in transition to provide information for appropriate health interventions.

nearby hospital, taxi ranks, and grocery stores. Although there is water and land for cultivation, only a few vegetable gardens are found. Fruit trees are popular in some back yards while indigenous foods and local foods are only seen growing in the surrounding dumping areas and bushes with none observed in the vicinity of the households.

Extension 7 and 11

These areas are found just west of Ikageng. They are characterised by a high population density, a high population growth rate, and high levels of unemployment and low monthly household incomes. High rates of malnutrition, poverty, poor health and sanitation, and poor roads characterise these areas. Inhabitants of these areas are from different ethnic backgrounds and nationalities, with the Tswana being the dominant group. There are a number of primary schools, clinics, shopping centers and street vendors seen around with modern vegetables and fruits. The dwelling units consist of shacks and RDP (Reconstruction and Developement Programme) housing, with good water systems. The roads are passable but probe a problem during rainy seasons. A few households have vegetable gardens in the backyard which are well maintained. No traditional and indigenous foods are, however, found in the vicinity, except for a few sold in the market place and those growing in the bushes and the dumping sites.

Sonder Water

Sonder Water is situated midway between Ikageng, Extension 6 and 7 and is characterised by self-constructed structures for shelter which are densely populated. The unemployment rate is high and this area suffers from poor service delivery, poor sanitation, poverty, malnutrition, food insecurity and HIV/AIDS that are some of the health factors threatening the community. Residents rely on communal pipes for water, while the land is rocky and hence not suitable for agriculture.

1.6.2 The rural environment

Ganyesa

Ganyesa is one of the poorest areas in the North West Province. This village is located in the Kagisano municipality under the Bophirima subdistrict. Ganyesa district is found at 26°26'31" latitude and 23°26'40" longitude, 70km north west of the town of Vryburg (See Figure 1.1) and next to the tarred highway to Botswana. The Ganyesa district receives an average rainfall of 342 mm per annum (Fig. 1.1). Ganyesa consists of a population of ± 75 946 which are about 17% of the North West Province's population (South African Statistics, 2000). Ganyesa is characterised by a

high population growth rate, high levels of unemployment, a relatively young population, inhabitants with low education levels and low monthly household incomes. Most people in the village depend on the government for RDP housing and social grants. Poverty, malnutrition amongst children and adults, food insecurity and HIV/AIDS are some of the health factors also threatening this community. There are several primary and high schools in Ganyesa.

Tlakgameng

Tlakgameng falls within the Bophirima region of North West Province and is situated 30km north east of Ganyesa. The geographical coordinates are 26°28'00" E (Fig. 1.1). Tlakgameng has a high incidence of malnutrition among children and women and utmost poverty exists. Unemployment is wide spread and most of the people are depending on government grants, since only a few economic activities are found. Although there is sufficient land for cultivation, only a few agricultural practices are active. The area is characterised by extreme land degradation due to excessive cutting of trees mainly for charcoal. This area suffers from poor service delivery, an acute shortage of water and poor sanitation, while sewage disposal is informal. Villagers have to travel up to 30km for the nearest hospital.

In both these villages the education systems are poor, rurally motivated and more informal than formal, while tertiary education is outsourced from Vryburg. Local residents depend mostly on government grants. A hospital, a district head quarter, a library, bottle stores, grocery stores, funeral parlors, a youth centre and a community hall characterise the villages. The villages are served by dirt roads which are passable but can also be a problem during the rainy season with a few horses and donkeys as a means of transport. Few of the families are farmers with the majority rearing cattle and only a few gardening activities due to little available arable land. Indigenous and traditional foods such as pumpkin, tswai-tswai (root like potato), sekaname (a traditional root vegetable used as remedy for hypertension), sweet potatoes, bean leaves, maize, watermelon, lentils, beans, melons (makatane), sugar reeds, sorghum, as well as termites and snakes are consumed mostly by some members of the community. There is an acute shortage of water with residents relying on communal pipes and boreholes.

1.7 Ethical consideration

This study was approved by the Ethics Committee of the North-West University, Potchefstroom Campus (Reference number: **04M10**).

Ethical consideration was conducted to ensure that privacy, dignity and integrity of participants are protected. The participants were informed about:

- The purpose of the research, expected duration and procedures;
- The right to decline to participate and to withdraw from the research once participation has begun;
- Any prospective research benefits;
- Limits of confidentiality; and
- Whom to contact for questions about the research and their rights as research participants.

1.8 Organisation of the remainder of this thesis

This thesis is presented in six chapters. Chapters 3, 4 and 5 are reported in article format according to the guidelines prescribed by the respective journals. Based on this approach, each of the chapters in this document is presented as a unit, containing tables numbered for the specific chapter and an applicable reference list. This editorial format facilitates cross-referencing between chapters. Inevitably the chapters share some common observations and references and certain issues are visited more than once. There are naturally some related conclusions drawn amongst chapters.

The study is presented in the following chapters:

CHAPTER 1: The introductory chapter provides the background and motivation, aim and specific objectives, setting of the study, ethical approval and finally the authors' contributions.

CHAPTER 2: Gives an overview of literature considered important for the interpretation of the data from the manuscripts in this thesis.

CHAPTER 3: Consists of a submitted manuscript on comparisons of health between consumers and non-consumers of traditional leafy vegetables from a rural and urban setting in South Africa (submitted for publication in Public Health Nutrition). The food frequency questionnaire used in the study is presented in Addendum A at the end of the thesis.

CHAPTER 4: Consists of a submitted manuscript on the utilisation of ITPF in the rural and urban communities (Published in Indilinga). This chapter aims at assessing the availability, cultivation, consumption patterns of ITPF and general knowledge about ITPF in the study areas. The survey questionnaire, focus groups and key informant questions and selected recipes on the most commonly used TLV used in the communities under study, are presented in Addenda B.

CHAPTER 5: Consists of a submitted manuscript on the consumers' general views on indigenous and traditional foods and acceptance of products made with cowpea leaves (submitted for

publication in African Journal of Agricultural Research). Focus groups questions and transcripts and the consumer questionnaire used in the study are presented as Addenda C.

CHAPTER 6: In this chapter, firstly a general discussion and summary of all the results are provided; secondly conclusions are drawn and recommendations made.

The relevant references for Chapters 3, 4 and 5 are provided at the end of each chapter according to the authors' guidelines of the specific journal to which the manuscripts were submitted. In addition, the references used in Chapters 1, 2 and 6 (not in manuscript format) are provided according to the mandatory style stipulated by the North-West University.

Addenda for all the studies are found at the end of this thesis.

1.9 Authors' contributions

The study reported in this thesis were planned and executed by a team of researchers and the contribution of each is listed in Table 1.1. A statement from the co-authors is also included, confirming their role in the study and giving their permissions for the inclusion of the articles in this thesis. The statement is as follows:

> *"I declare that as co-author I have approved the above-mentioned article, that my role in the study, as indicated above, is representative of my actual contribution and that I hereby give my consent that the manuscript may be published as part of the Ph.D. thesis of Ms STP Matenge."*

Table 1.1: List of research team and their contributions to the study

Name	Role in the study
Sarah TP Matenge (Ph.D. candidate)	Co-responsible for design, planning and execution of the total study; responsible for the design and/or adaptation and validation of questionnaires, statistical analyses, interpretation of the results, literature searches and writing of publications. First author of the three manuscripts (Chapters 3 to 5).
Prof. A Kruger (Promoter)	Supervised this thesis, responsible for design, planning, coordinating the South African legs of the PURE and Biodiversity studies, guidance in the interpretation of the results and co-authored all the three manuscripts in this thesis.
Prof. M van der Merwe (Co-promoter)	Co-supervised this thesis, responsible for design, planning, execution of the study. Supervised the writing of the thesis and co-authored all the three manuscripts in this thesis.
Dr. H de Beer (Assistant-promoter)	Assistant-supervised this thesis, responsible for design, planning, execution of the study. Supervised the writing of the thesis and co-authored all the three manuscripts in this thesis.
Prof. MJC Bosman	Planning the acceptability study, interpretation of the results, supervised the writing of Chapter 5 and co-authored Chapter 5.

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CHAPTER 2

LITERATURE REVIEW

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

As several of the important concepts that are to be discussed in this chapter have been reviewed by other authors, only the most important aspects and relevant contributions have been synthesised and will be addressed. The aim is to put the literature in context, to give the reader the necessary factual background for the understanding and interpretation of the manuscripts presented in Chapter 3, 4 and 5, as well as to provide insight into the study as a whole.

In this chapter, a brief overview is given on the current food insecurity and malnutrition situation in the world as a whole and with reference made to the South African context. The devastating causes and consequences of poverty will be looked into, thereof, will set the background for the rest of the discussion. It should be noted that in this chapter, reference will be made on indigenous and traditional plant foods (ITPF).

2.2 Malnutrition and food insecurity

In spite of the dramatic progress which has been made in some areas of nutrition in recent years, nutritional status is actually deteriorating in many countries and many of them in Africa. In developing and developed countries, 790 million people and 34 million respectively are either lacking enough food or facing periodic food shortages or do not consume sufficient of the nutrient-rich foods necessary for the maintenance of good health and quality of life (Flores, 2001; WHO/FAO, 2003; UN Millennium Project, 2005). Oniang'o *et al*. (2003) affirm that a large proportion of households in sub-Saharan African is poor and exists on a diet composed primarily of staple foods prepared from cereals (maize, millet, sorghum, teff), tubers (cassava, cocoyam, yam) and plantains, which are generally low in micronutrients.

Sub-Saharan Africa has 204 million hungry and it is the only region of the world where hunger is increasing (UN Millennium Project, 2005). In addition, there is a problem of "hidden hunger" where basic energy needs are satisfied, but there is deficiency of micronutrients or functional components in diets (WHO/FAO, 2003). Indicators such as level of underweight, stunting, and wasting show that in Sub-Saharan Africa at least one in three children is affected by the persistent low caloric intakes. A Global Progress Report by United Nation Children's Fund (UNICEF) (2001) and FAO

(2004) estimated that more than 3.7 million deaths per year could be attributed to underweight in children. In addition to this, deficiencies in vitamin A, iron, and zinc causes an additional 750 000 to 850 000 deathS.

In South Africa, 43% of children below seven years live in a disintegrated family structure and under poverty conditions (Aphane *et al*., 2003). Children in these families are vulnerable and often living in unhealthy, unsafe and disadvantaged communities. Furthermore, 40% of the country's families live in poverty. According to Aphane *et al*. (2003), children raised in these poor families are at risk for infant death, low birth weight, stunted growth and dropping out of school. In 1999, the National Food Consumption Survey (NFCS) conducted in South Africa, found that a significant majority of children aged 1-9 years consumed a diet deficient in energy and a large number of micronutrients (Labadarios *et al*., 2000). According to Black (2003), the deficiency of one micronutrient can exacerbate the deficiency of another, thus there is likely to be concomitant deficiencies of more than one micronutrient in individuals. In addition, there is an evidence of overweight and obesity.

The food situation in South Africa is characterised by food sufficiency on a national scale in spite of occasional food supply fluctuations (Frayne *et al*., 2009). Despite this national food security, the majority of South African households cannot afford to buy sufficient food (Altman *et al*., 2009) and their poverty is often associated with macro-and micronutrient deficiencies typically due to limited diets consisting mainly of starchy foods, with little in the way of animal products, fruits and vegetables (Aphane *et al*., 2003). Rural communities are nutritionally more vulnerable than those in the urban areas (Labadarios *et al*., 2000). Steyn *et al*. (2001) concluded that large sectors of the population were food insecure. According to Statistics South Africa (2000), about 14.3 million South Africans are vulnerable to food insecurity particularly women, children and the elderly. In addition, previous research has shown that farm workers in the North West Province are an extremely vulnerable group regarding their poor nutritional, physical and mental health (Vorster *et al.*, 2005). This is a consequence of their working, living conditions which are poor and below the recommended standards of living. Another study on poverty and household food security among farm workers in the North West Province by Kruger *et al*. (2006) reported that household food security is compromised due to lack of financial resources, infrastructure and in equal household resources allocation. This impacts negatively especially on children with half of them in some areas being underweight, stunted or wasted (Kruger *et al*., 2006; Phometsi *et al.*, 2006).

A number of factors have been implicated in nutritionally inadequate food and diet, hence malnutrition and poverty. According to Medaglini and Hoeveler (2003), HIV/AIDS, malaria and tuberculosis are both cause and consequence of poverty and account for more than half of all

deaths in Sub-Saharan African countries. The impact is devastating. HIV/AIDS, however, is distinguished by the fact that infections are the highest among adults aged between 20 and 40, and this has a marked impact on the income, expenditure pattern, food production and coping strategies of rural households [Southern African Development Committee/Food Agriculture and Natural Resources (SADAC FANR), 2003]. According to Steinberg *et al*. (2002), the loss of income and additional care-related expenses reduce the ability of caregivers to work and mounting medical fees push affected households deeper into poverty. The HIV/AIDS epidemic also adds to food insecurity, as agricultural work is neglected or abandoned due to household illness (FAO, 2004). According to Beresford (2001), food security is jeopardised as labour, time and money are diverted to deal with the illness. Additionally, a loss of agricultural labour is likely to cause farmers to switch to less labour- intensive crops. Thus AIDS could affect the production of cash as well as food crops.

Other factors that have been exacerbating poverty and the already food insecure situation and loss of dietary diversity include urbanisation, socio-economic and cultural changes, ecosystem degradation, loss of biodiversity and indigenous knowledge, and climate change. It has been observed that diets in many developing countries are not optimal (Johns, 2003) and that globalisation and modernisation of agriculture has resulted in a dramatic increase in the production of major staples, hence simplification of diets, displacement of indigenous food crops (Frison *et al*., 2005) and loss of indigenous knowledge systems related to cultivation and utilisation of these crops (FAO, 1989). According to Frison *et al*. (2005), the trend towards commercial farming also had a negative effect on the cultivation of the less commercial indigenous crops that had in turn contributed immensely to the food habits and nutrition of the local population. Furthermore, the so called “Nutrition transition”, urbanisation and increased westernisation of diets have reduced consumption of foods accessed through fishing, hunting, herding and gathering or own food production (Wahlqvist, 2005). According to Fouere *et al*. (2000), these socio-economic changes force both rural and urban families to turn to high-carbohydrate, high-fat street foods in order to meet their daily food needs. Frison *et al*. (2004) affirm that diets that are inadequate in quantity and/or quality of foods are associated with ill health. Consumption of a diet high in energy, low in micronutrients, coincides with low energy expenditure contributing to obesity and malnutrition in the same person (Johns & Sthapit, 2004; Damman *et al*., 2008). Given the rapidity with which traditional diets and lifestyles are changing in many developing countries, it is not surprising that food insecurity, undernutrition and obesity persist in the same countries where chronic diseases are emerging as a major epidemic (WHO/FAO, 2003; Popkin, 2004). More and more women are also being forced to find jobs to help support their families, still increasing the number of take-out versus home-cooked nutritious meals (Frison *et al*., 2005).

High rates of population growth have also been associated with an already food insecure situation and loss of biodiversity. A consequence has been an accelerated rate of biodiversity degradation in developing countries resulting in diminished resources, instability in ecosystem functions and a further environmental degradation as consumers turn to more destructive activities to survive (Frison *et al*., 2005). The effects of land degradation cannot be underestimated. According to Tabuti (2002), the effect of ecosystem destruction further causes a reduction of wild food plants because their habitats have been cleared paving way to large-scale agriculture and settlement.

Given the seeming depth of household food insecurity and in response to the Rome Declaration of World Food Security in 1996, South Africa pledged to support the World Food Summit Plan of Action to reduce the number of food insecure people by half by 2015. Following the recommendation by the Rome Declaration of World Food Security and the Millennium Development Project to eradicate poverty and micronutrient deficiencies, a number of authors have advocated the use of food-based strategies to achieve optimal dietary requirements to combat micronutrient deficiencies (Vorster & Kruger, 2006; Johns & Eyzaguirre, 2006; Faber & Wenhold, 2007). Strategies targeting food diversification are aimed at an increase in the production, access to and subsequently the consumption of foods rich in vitamin A and pro-vitamin A carotenoids. Integrating indigenous leafy vegetables into diets has been promoted as the most practical and sustainable way to achieve this since they are important sources of micronutrients including vitamin A and C, mineral elements and crude fibres (Chadha & Oluoch, 2003). The South African Food Composition Tables for vegetables and fruits show that several indigenous leafy vegetables are richer sources of various micronutrients than conventional green leafy vegetables (Kruger *et al*., 1998). Indigenous leafy vegetables are often easy to grow, require simple technologies and low inputs to grow, resistant to pests and diseases, grow quickly and can be harvested within a short period of time and are quite acceptable to local tastes (Jansen van Rensburg *et al*., 2004; Van der Walt *et al*., 2005). In view of the above, consumption of indigenous leafy vegetables can play an important part in alleviating food security and ill health. Smith and Eyzaguirre (2007) argued that in sub-Saharan African countries Indigenous leafy vegetables could play an important role in the WHO global initiative on increased consumption of vegetables and fruits. Based on an analysis of the use and nutrient composition of wild leafy vegetables in the Limpopo Province of South Africa, Nesamvuni *et al*. (2001) suggested that health educators should promote the consumption of wild green leafy vegetables in order to increase micronutrient intakes and alleviation of poverty.

2.3 Indigenous and traditional food plants in South Africa

South Africa is a country rich in plant biodiversity and culture with many people still using plants to fulfil their food, shelter, water, fuel and medicine needs (Van Wyk & Gericke, 2003). In Southern Africa, the use of plant foods dates back to 120 000 years when the Khoisan, bushmen and the San relied heavily on gathering of plants from the wild for survival (Parsons, 1993). Among these people, there were differences regionally regarding the nature of food gathered. The most common foods were the fruit and nut of the mongongo tree; the tsi bean, a tuber weighing up to 10kg, with seeds; the tsa plant, with its roots swellings and the all purpose tsama melon (Walker, 1996). The latter was very important throughout low rainfall areas like the Kalahari Desert on account of its high water content (Walker, 1996). The Bantu-speaking tribes which started to settle in South Africa about 2 000 years ago also collected plant foods from the wild (Bundy, 1998)**.** Many of these plants are indigenous to Africa while others originated in other parts of the world, but given their sustainability to local, social and environmental conditions they have been "naturalised" and internalised as important elements of the local food culture and livelihood resource (The National Agricultural Directory, 2010/11). The different parts of the plant that are used as foodstuffs include roots, tubers, stems, rhizomes, leaves, flowers, fruits, nuts, gums, berries, cereals and legumes (The National Agricultural Directory, 2010/11). In South Africa, local people formerly ate a diet of meat, milk, wild cereals and wild fruits (Van Wyk & Gericke, 2003), but the Pedi proverb "Meat is a visitor, but morogo a daily food" [(morogo is a siPedi name for relish made from traditional leafy vegetables (TLVs)] has now become a reality for most rural people. Traditional plant foods are usually obtained from different sources. Some of the food plants grow voluntarily on fallowed land during the rainy season or they are cultivated in small backyard gardens. The rest of the plants, especially fruits, are wild and are collected for home consumption during the rainy season.

2.3.1 Traditional leafy vegetables

In this study, the words indigenous and traditional leafy vegetables are words used interchangeably to describe leafy vegetables that have been part of the food systems in sub-Saharan Africa for generations. However, there is a distinction between the two terms. Indigenous leafy vegetables are those that have their natural habitat on sub-Saharan Africa while the traditional leafy vegetables were introduced over a century ago and due to long use, they have become part of the food culture in the sub-continent (Smith & Eyzaguirre, 2007). There are 45,000 species of plants in sub-Sahara Africa of which 1,000 can be eaten as green leafy vegetables which happen to be the mainstay of African traditional diets (MacCall, 2004). African people refer

to these plant species collectively as *morogo* (Sesotho, isiPedi) or *imifino* (isiZulu, isiXhosa), which means leafy vegetables. African people obtain leafy vegetables in different ways. They may be harvested from the wild or from fallow and cultivated fields, or may be cultivated. Many of the leafy vegetable species, especially those that grow as weeds or in the wild, are seasonal and highly perishable (Jansen van Rensburg *et al*., 2007). The plant species that are used as leafy vegetables are also varied in terms of their origin (Jansen van Rensburg *et al*., 2007). Examples of some of the most important indigenous/traditional leafy vegetables found in South Africa include Amaranth (*Amaranthus spp*), spider flower (*Cleome Gynandra*), cowpeas (*Vigna inguiculata*), rape or Chinese cabbage (*Brassica rapa* subsp. *chinensis*), night-shade (*Solanum retroflexum*), pumpkins (*Cucurbita pepo, C. maxima* and *C. moshata*), melons (*Citrul-lus lanatus* and *Cucumis melo*) and balsam pear (*Momordica balsamina*) (Jansen van Rensburg *et al*., 2007). According to Vorster (2007), amaranth is always the most popular *morogo* and amongst the most important consumed species. A complete description of these leafy vegetables is found in Jansen van Rensburg *et al*. (2007). The popularity of specific species depends on many factors such as availability, ease of preparation, taste, consistency and appearance (Jansen van Rensburg *et al*., 2007). These factors are described in detail under "Factors affecting consumption of ITPF" (Chapter 2.8.2). Table 2.1 presents some of the ITPF that are found and utilised as traditional plant foods in South Africa. This list is not exhaustive, but represents plant foods that have been commonly cited in recent literature reports.

Table 2.1: Some commonly available and consumed ITPF in South Africa

Scientific name/English name*	Local African names	Edible parts
Amaranthus hybridus L. ssp cruentus L. Thell	Thepe	**Leaves**
Amaranthus hybridus L. subsp hybridus var hybridus	Thepe	**Leaves**
Amaranthus viridis	Thepe	**Leaves**
Amaranthus thunbergii Moq.	Thepe	**Leaves**
Amaranthus hybridus L. subsp. cruentus (L). Thell	Thepe	**Leaves**
Cleome gynandra L.	Lerotho	**Leaves**
Chenopodium album L.	Lerotho	**Leaves**
Pentarrhinum insipidum E. Mey	Lefe	**Leaves**
Vernonia fastigiata Oliv.& Hiern	Letlhanye	**Leaves**
Cucurbita spp.	Morogo wa lephutse	**Leaves**
Cleome gynandra L.	Rotlhwe/lerotho	**Leaves**
Vigna unguiculata (L.) Walp. Subsp. unguiculata	Morogo wa dinawa	**Leaves**
Cucurbita maxima	Lephutshe	**Leaves**
Cucurbita pepo		**Leaves**

Bottle goard, calabash	Lekgomane	**Leaves**
Vigna unguiculata	Dinawa tsa setswana	**Seeds**
Cucurbita spp.	Disata tsa lephutshe	**Seeds**
Arachis hypogaea	Madopi/manoko	**Seeds**
Vigna subterranean	Ditloo	**Seeds**
Arachis hypogaea	Manoko/madopi	**Seeds**
Tylosema esculentum	Marama	**Seeds**
Ipomea batatas	Dipotata	**Tubers**
Tylosema esculentum	Marama	**Tubers**
Plectranthus esculentus	-	**Tubers**
Wild fig	Mochaba	**Fruits**
River bush willow	Modimo wa noka	**Fruits**
Vanguera cyanescens	Vanguera cyanescens	**Fruits**
Grewa flava	Moretlhwa	**Fruits**
Purslane	Mongongo	**Fruits**
Grewia flavesens Juss.Var. Flavescenes	*Motsotsojane*	**Fruits**
Ziziphus mucronata	Sekgalo	**Fruits**
Seretologa	Monkey orange	**Fruits**

*Plant species identification by SA National Botanical Institute (SANBI), Pretoria

2.4 Traditional leafy vegetables and health

It has been noted in the literature that traditional leafy vegetables have health protecting properties and uses (Smith & Eyzaguirre, 2007; Mensah *et al*., 2008) and significantly contribute to the dietary vitamin and mineral intakes of the local people (Kruger *et al*., 1998; Steyn *et al*., 2001; Abukutsa-Oyango, 2003; Odhav *et al*., 2007; Uusiku *et al*., 2010). The nutrient content of the different types of vegetables varies considerably and are not major sources of carbohydrates compared to the starchy foods which forms the bulk of food eaten, but contain proteins, minerals and vitamins for the poor people (Fasuyi, 2006). Other studies conducted by Gupta and Bains, (2006) and Gupta *et al*. (2005) in Asia and Freyre *et al*. (2000) in South America have also confirmed the importance of TLVs as sources of micronutrients. Studies conducted on the wild African leafy vegetables by Vainio-Mattila (2000) and Nesamvuni *et al*. (2001) in South Africa also underscored their significant contribution as sources of micronutrients. In addition, TLVs contain micronutrient levels as high as or even higher than those found in most exotic leafy vegetables (Kruger *et al*., 1998; Steyn *et al*., 2001; Odhav *et al*., 2007). A clearly different position is taken by Wallace *et al*. (1998), who found that the nutritional quality of four wild vegetables analysed in Ghana were found to be in the same range as conventional vegetables. Therefore, further studies are required covering a wide range of species before wild vegetables can be recommended as substitutes for conventional ones (Flyman

& Afolayan, 2006). Based on the high nutrient content, availability and affordability of these traditional plants, crop production systems should increase the use of underutilised crop such as traditional crop plants (Nesamvuni *et al*., 2001; Modi *et al*., 2006). Labadarios and Steyn (2001) suggest that "one should guard against the exclusive promotion of exotic fruits and vegetables which could result in indigenous plants and their produce being regarded as inferior when many are nutritionally superior". Table 2.2 illustrates that in Africa some of these crops are more nutritious in comparison to the favoured exotic vegetables in this case cabbage. For a review of the nutrients (micronutrients and macronutrients) found in some TLVs consumed in sub-Saharan African countries, the reader is referred to Kruger *et al*. (1998), Odhva *et al*. (2007) and Uusiku *et al*. (2010).

Table 2.2: Comparison of the nutritional content of five traditional leafy vegetables and one domesticated vegetable (per 100g)

	Amaranth	*Spider Plant* Cleome gynandra	*Cowpea* Vigna inguiculata	*Jute/jews mallow* Corchorus olitorius	*Pumpkin leaves* Curcubita maxima	*Cabbage brassica* oleracea var. carpitata
Iron (mg)	8.9	6.0	3.9	6.3	15.9	0.7
Protein (g)	4.6	4.8	4.1	5.2	4.2	1.7
Moisture (%)	84.0	86.6	87.6	81.0	87.3	91.4
Kilojoule	176.4	142.8				109.2
Carbohydrates (g)	8.2	5.2	6.8	10.3	5.0	6.0
Fibre (g)	1.8					1.2
Ascorbic acid (mg)	64	13				54
Calcium (mg)	410	288	221.1	548.5	382.9	47
Phosphorus (mg)	103	111	80.1	136.4	119.2	40
ß-carotene (mg)	5716		2249.35	3662.99	1694.55	100
Thiamine (mg)	0.05		0.05	0.07	0.12	0.04
Riboflavin (mg)	0.42					0.1
Folate (ug)	122		107	90		

(Source: Kruger *et. al*., 1998)

2.4.1 Health promoting properties

There is convincing research evidence that TLVs contain non-nutrient bioactive phytochemical components (Bahorun *et al*., 2003; Banso & Adeyemo, 2007; Smith & Eyzaguirre, 2007). Some of these reported beneficial effects of these phytochemicals include antibacterial, antiviral, antiflammatory, antithrombotic and vasodilatory action, as well as pronounced antioxidant and free

radical scavenging properties. Beneficial phytochemicals include, for example, flavonoids, carotenoids, glucosinolates and allyl-sulphur compounds, which function as antioxidant, anti-cancer, anti-inflammatory or anti-microbial compounds or influence blood lipid profiles (Hasler, 2000). However, Orech *et al*. (2005) observed that some of these phytochemicals found in some TLVs consumed in Western Kenya may pose toxicity problems when consumed in large quantities or over a period of time. These include cowpea (*vigna unguiculata*) and its leaves, bitter gourd (*momordica charantia*), wild cabbage (*Brassica oleracea*) and jute mallow (*corchorus olitorius*). A complete review of phytochemical components found in some TLVs is available in Mensah *et al*. (2008) and Uusiku *et al*. (2010). On the other hand, epidemiological studies in South Africa show that, in rural populations consuming a traditional diet rich in green leafy vegetables, the incidence of lifestyle diseases such as coronary heart disease, hypertension, stroke and the type 2 diabetes is low compared with urbanised population who adopted a Westernised diet and lifestyle (Fourie and Steyn, 1995). However, most recent research indicated less usage of fresh fruits and vegetables in rural areas with accompanying micronutrient deficiencies and emphasised the dynamic ongoing process of transition (referred to our own work in the NWP).

2.4.2 Nutrient retention and bio-availability

Studies have indicated that TLVs, especially the wild dark green leafy vegetables, contain oxalates, phytates, tannins, saponins and nitrates (Steyn *et al*., 2001; Gupta *et al*., 2005) which are known to reduce the absorption of certain micro-nutrients in the body. Oxalic acid, for example interferes with calcium absorption by forming insoluble salts of calcium, whereas phytates bind iron, zinc, calcium and magnesium rendering them unavailable (Gupta *et al*., 2005). Concerns with respect to issues of bioavailability of vitamin A have been raised (Gupta *et al*., 2005). The bio-availability of ß-carotene in dark-green leafy vegetables seems to be lower than previously thought (De Pee *et al*., 1995). Nevertheless, the stability and retention of carotenoids are influenced by the chemical nature, the method of and severity of processing, food particle size, storage time and storage conditions (Cheynier, 2005). Consumption of cooked and pureed spinach leads to higher total ß-carotene concentration, compared to when these vegetables are consumed raw (Haskell *et al*., 2004). This is consistent with the study done in South Africa that showed that home-gardens that focused on dark green leafy vegetables and yellow/orange-fleshed vegetables improved children's vitamin A status (Faber *et al*., 2002). The use of oil in the preparation of vegetables has been shown to increase bioavailability of β-carotene (Hedrén *et al*., 2002). Masrizal *et al*. (1997) observed a greater retention of ß-carotene in the vegetables prepared by microwave, steaming and stir-frying with oil than those stir-fried with water or boiled. Given the prevalence of vitamin A

deficiency in developing countries, consumption of foods rich in ß-carotene including TLVs can play a significant role in improving the vitamin A intake. Since malnutrition is common in sub-Saharan Africa, the information provided about bioavailability of micronutrients would be of fundamental importance in addressing dietary deficiencies in impoverished African rural communities.

2.5 Cultivation of traditional plant foods

In South Africa various crops are grown depending on the biophysical (soil, climate and availability of water) conditions (Vorster, 2007). According to Vorster (2007), where water is available for irrigation, a variety of traditional and exotic vegetables are grown, however, where water is scarce, traditional vegetables form the basis of home food production. In South Africa the most popular grown TLVs include cowpeas (*Vigna inguculata*), amaranth (*Amaranthus spp.*), spider flower (*Cleome gynandra*), Chinese cabbage (*Brassica rapa Subsp. chinesis*), night shade (*Solanum retroflexum* and selected other species belonging to the *S. nigrum complex*), Jew's mallow (*Corchorus olitorius and C. tridens*) and pumpkins (*Cucurbita pepo, C maxima* and *C moschata*), melons (*Citrullus lanatus* and *cucumis melo*) and selected other indigenous cucurbits such as balsam pear (*Mamordica balsamina*). Amaranth and spider flower, however, are rarely cultivated because people believe the plants grow naturally (Jansen van Rensburg *et al*., 2007). Other plant crops popularly grown in South Africa are maize (*Zea mays*), sorghum (*Sorghum bicolour (L) moench*), wild water melon (*Cucumis melo L.*), water melon (*Citrullus*), groundnut (*Arachis hypogea*), sweet potatoes (*Ipomea batata*) and calabash (*Langenaria siceraria*) (Vorster, 2007). Multi-purpose crops (i.e. pumpkin, cowpea) that provide more than one product, as determined by the associated IK, are important for women who have to provide for the household (Hart & Vorster, 2006). Generally, where a plant provides a number of sources of foodstuffs, the greater the priority given to it by local people. The production of certain species is based on the aspect of ease of cultivation, pests and diseases resistance, high nutrient content and low inputs of water and fertilisers (Van den Heever, 1995).

TLVs are grown under rainfed conditions as intercrops with local staples in home gardens or fields and management thereof is relatively low (Hart & Vorster, 2006; Abukutsa-Onyango, 2007). In some parts of South Africa, knowledge about crop interactions (i.e. cowpea and pumpkin are never planted together as they affect each other's growth) is widespread. TLVs are commonly intercropped with maize and therefore their production is linked with maize (Abukutsa-Onyango, 2007; Vorster, 2007; Vorster *et al*., 2008).

Planting dates used in the production of ITPF vary greatly depending on the species, the locality and season. However, in South Africa, October and December are the most common sowing months (Jansen van Rensburg *et al*., 2007; Vorster, 2007). In Africa, the use of organic and inorganic fertilisers are common (Diouf *et al*., 2007) and influenced by income, access to resources and the size of the area planted (Vorster, 2007). The socio-economic conditions determine the growth stages at which TLVs are harvested. Young leaves are harvested before the plant starts to flower and harvesting of older leaves only occur when a shortage of young leaves occur (Vorster, 2007). Major constraints facing production of plant crops are; poor seed quality, pests and diseases, drought, poor marketing channels and lack of transport to markets (Abukutsa-Onyango, 2007; Vorster, 2007).

2.6 Uses and preparation of indigenous and traditional plant foods

Traditional fruits and vegetables are mainly used as food, in the form of snacks, as relish and for medicinal purposes (Musinguzi *et al*., 2006; Diouf *et al*., 2007). Regarding the preparation of vegetable dishes, for most species, the young growth points and tender leaves are the plant parts that are used (Vorster, 2007). Petioles and in some cases young tender stems are included, however, old, hard stems are discarded (Vorster *et al*., 2002). The leafy dishes may be prepared as potherbs or as relishes, primarily to accompany starchy dishes (Vorster *et al*., 2002; Vainio-Mattila, 2000). The porridge provides calories needed for the body energy but is very low in other nutrients. Leaves of *Physalis peruviana* and *Prunus persica* are used to enhance the taste of maize (Wehmeyer & Rose 1983). Protein content from amaranthus leaves, which have a lower sulphur amino acid content but are higher in lysine and tryptophane, can supplement the maize porridge and provide a more balanced diet (Feine *et al*., 1979).

In South Africa, different ethnic groupings tend to prepare their TLVs in a particular fashion and exposure to other preparation methods lead them to increase the variety of their diet, both in terms of taste and micronutrient content (Hart & Vorster, 2006). Cooking methods vary from boiling, which may include the replacement of the first cooking water with fresh water in the case of bitter-tasting species, such as solamum retroflexum (Van Averberke & Juma, 2006) to steaming involving the use of very small quantities of water and short cooking times, as in the case of pumpkin leaves and flowers (Jansen van Rensburg *et al*., 2007). Traditional leafy vegetables are usually boiled or fried for up to 10-15 minutes. According to Gupta and Bains (2006), the cooking and preparation methods and period of cooking may affect the nutrional value as well as the bioavailability of many nutrients. However, the use of cooking oil in the preparation of vegetables has shown to increase bioavailability of ß-carotene (Hedrén *et al*., 2002). Groundnut powder or

peanut butter is also used as it increases nutrient density and enhance the palatability. The addition of other vegetables and condiments in the preparation of TLVs depends on the availability of funds in the households (Faber *et al*., 2010). Furthermore, from observation, recipes in urban areas are characterised by modern ingredients such as carrots, tomatoes, onion and sweet peppers.

Regarding the preparation of other plant foods, fruits from the wild plants are usually consumed raw as they are picked. Roots are either eaten raw or boiled. Root parts need a longer preparation time and process. Some wild tubers are first dried and then crushed. Legumes and nuts are boiled for a long time before consumption (Van Wyk & Gericke, 2003).

Regarding medicinal uses, traditional plant foods have been reported to have medicinal properties. In Nigeria *amaranthus cruentus* leaves are used as a curative for tapeworm, expellant and relief of respiratory diseases (Mensah *et al*., 2008). However, in Limpopo, *amaranthus* was reported to cure constipation (Faber *et al*., 2010). In Ghana, the leaves eaten in soups are thought to assist conception in women (Addae-Mensah, 1992). In addition, the fruits are used as a curative for rheumatism, syphilis, common cold and herpes zoster while the stem and fruits are for treating cough (Mensah *et al*., 2008). Eating cowpea leaves and seeds to prevent vitamin deficiency has been reported (Mensah *et al*., 2008).

2.7 Processing of indigenous and traditional plant foods

As observed by other researchers, sun drying is regarded as the most common method of preservation in South Africa (Nesamvuni *et al*., 2001; Vorster, 2007) and other African countries (Smith & Eyzaguirre, 2007). Drying of food is practised in Africa to make the products more durable and preserve them for food insecure periods (Vorster *et al*, 2007). Sun drying is the principal mode of extending shelf life of food commodities (Nesamvuni *et al*., 2001; Vorster, 2007; Faber *et al*., 2010). In South Africa most of the leaves are dried in direct sun, sometimes blanched before drying (Vorster *et al.*, 2007). Blanching of vegetables has shown to improve colour and carotene retention due to inactivation of enzymes, however, it causes losses of ascorbic acid (Nguni & Mwila, 2007). Also in Zimbabwe, the common preservation method is sun drying with some leaves boiled before drying and others cut into small pieces (Chigumira & Mvere, 1999). However, open drying methods do not protect against re-wetting of the material by rain, contamination by dust and dirt, the possibility of microbial spoilage or mould and predation by birds, rodents and insects (Yang *et al*., 2009). Crops or products that are susceptible to fungal growth can also be contaminated with mycotoxins (Bankole & Mabekoje, 2004). Mycotoxins are hazardous to consumers' health and

affect food quality leading to economic losses including loss of economic value (Hell *et al*., 2009). In an effort to reduce microbial contamination of dried products, in Burkina Faso the introduction of solar drying programme ensures a sufficiently good quality, so that products can be sold on the market (Yang *et al*., 2009).

2.8 Consumption of indigenous and traditional plant foods

2.8.1 Consumption patterns of indigenous and traditional plant foods

A low intake of vegetables and fruit is among the top ten risk factors contributing to mortality worldwide (Ezzati *et al*., 2002). Since vegetables are usually considered a relish and always as a side dish accompanying starchy food, the amount consumed can be small. Per capita consumption of fruits and vegetables in sub-Saharan Africa lags behind that of other regions, showing an overall decline between 1986 and 1995 (Shiundu & Oniang'o, 2007). While *per capita* apparent consumption of vegetables in developing countries went from 68.7kg *per capita* in 1986 to 75.3kg in 1995 on average, sub-Saharan Africa showed a 0.19% decline and remained as low as 29kg of vegetables *per capita* consumption on average (Shiundu & Oniang'o, 2007).

The frequency of vegetable consumption depends upon the frequency of meals. However, frequency of consumption of TLVs has decreased over the years, probably because TLVs are often considered to be inferior in their taste and nutritional value compared to exotic vegetables such as spinach and cabbage (Weinberger & Msuya, 2004). In South Africa consumption of TLVs is variable, with some households consuming them daily, but others only every few days (Shackleton *et al.*, 1998). Nevertheless, several studies in South Africa reported that consumption of TLVs has declined (Labadarios *et al*., 2000; Nesamvuni *et al*., 2001; Modi, 2003; Mbhenyana *et al*., 2005). The National Food Consumption Survey (NFCS) of 1999 showed that green leafy vegetables were the 16th most frequently consumed food item for one-to-nine year-old South African children (Labadarios *et al*., 2000).

2.8.2 Factors affecting consumption of indigenous and traditional plant foods

In South Africa, the consumption pattern of ITPF including TLVs varies among households and depends on factors such as poverty status, socio-economic conditions, degree of urbanisation, distance to fresh produce markets and season of the year (Vorster *et al*., 2002). A survey done in Nigeria showed that culture and availability due to high price strongly influence households' choice and consumption of TLVs (Hart, 2005). In Kenya, ethnicity was shown to influence households'

choice and consumption (Kimiywe *et al*., 2007). In the Balamogi County of Uganda, the consumption of wild plant foods is limited to casual encounters, periods of food shortages and as supplements to major food plants (Tabuti *et al*., 2004). Musinguzi *et al*. (2006) and Shackleton (2003) reported similar observations in previous studies.

Figure 2.1 illustrates a number of factors relating to food choice decisions in relation to TLVs consumption. Other frameworks have been developed that include some or all of these factors in different forms and to differing degrees of complexity. This simplified framework was developed as part of the present literature review and the review will cover in depth those factors illustrated in the following sections. Factors such as demographics, socio-economic conditions, personal views, familiarity/product knowledge and habit, convenience, sensory appeal, cost and availability and food safety will be reviewed.

Demographics

Evidence suggests that gender differences exist in relation towards TLVs consumption (Boguel *et al*., 2005) and production (Vorster *et al*., 2008). A study conducted by Vorster *et al*. (2008) showed that females dominated TLVs production, a trend observed in other studies (FAO, 1995; Posel & Casale, 2001). Dixon and Gulliver (2003) stress the role of women in many aspects of farming systems and their contribution to the evaluation of these systems. In South Africa, the collection and knowledge of TLVs is still a practice associated with women (Jansen van Rensburg *et al*., 2007). According to Van Averberke and Juma (2006), men only become involved especially when the production is commercialised. Regarding the consumption of TLVs, Vorster (2007) revealed that men would not want to eat these vegetables and insisted on leaving TLVs for women and children. Similar results were found by Keller (2004). Consequently, TLVs are regarded women's crops.

Age has also been shown to be a significant variable in food consumption (Guàrdia *et al*., 2008). Vorster (2007) found that children indicated blandness in the taste of cooked TLVs while older consumers had more positive attitudes. According to Modi (2003) and Damman *et al*. (2007), younger consumers tend to view traditional foods negatively which plays a crucial role in determining product acceptance and consumption. In order to improve the health of the nation, the intake of fruit and vegetables including TLVs need to be increased especially by those groups whose diets are particularly lacking in these important dietary components.

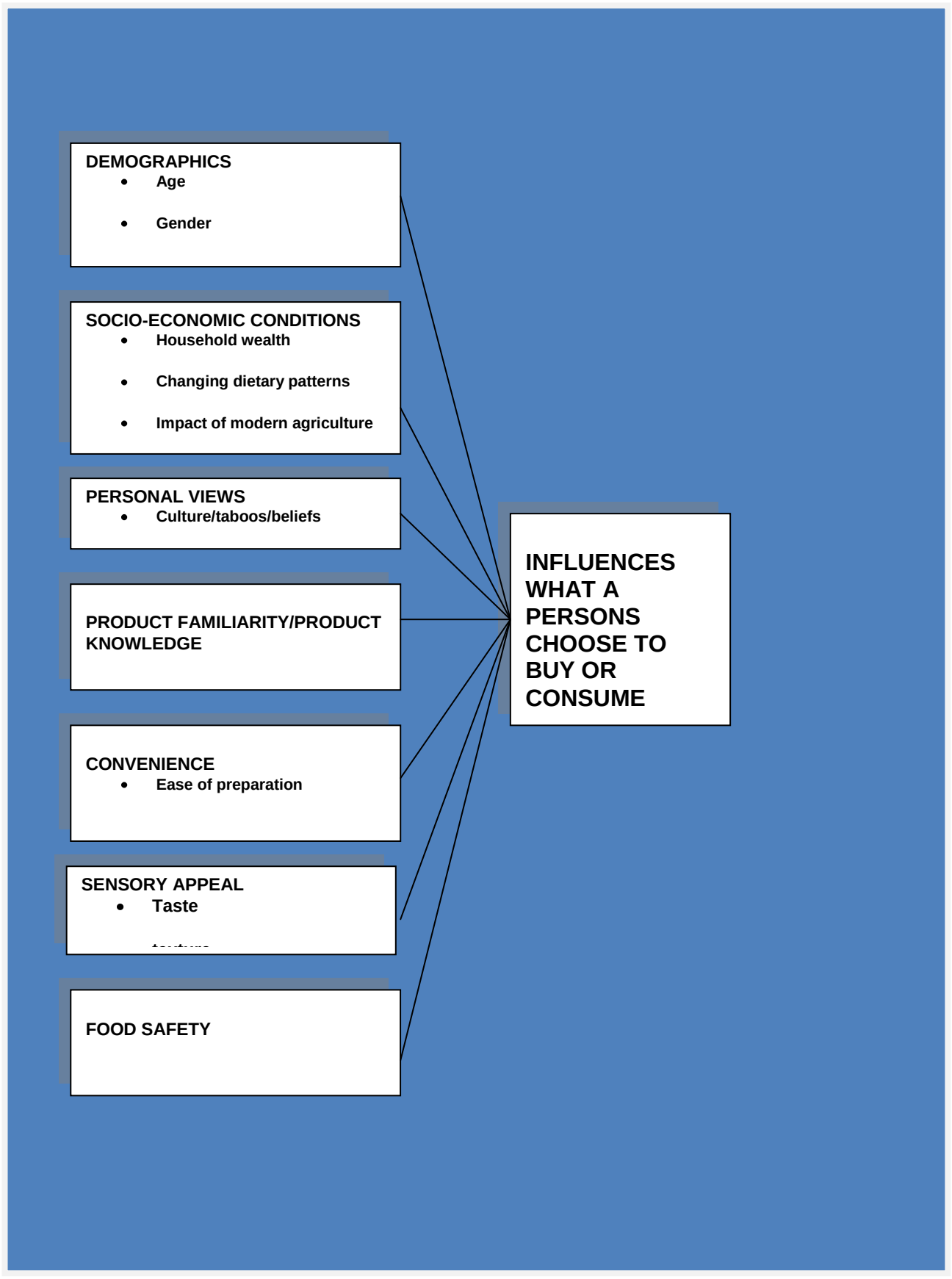

Figure 2.1: The food choice and consumption framework for the study

Socio-economic conditions

It has been found that poor households relied more heavily than wealthy households on “essential” indigenous resources such as TLVs and wild fruit (Vorster *et al*., 2002; Twine *et al*., 2003). This is especially true where unemployment is high and in the older households where children no longer qualify for the child support grants. Analysis of per capita consumption suggests that individuals in wealthy households supplemented their diet of wild indigenous plants with either cultivated or purchased food products (Twine *et al*., 2003). Similarly, Cocks (2006) found that poor households in South Africa consumed significantly more TLVs than their wealthier counterparts (41kg and 29kg per household per year respectively). The same trend was reported by Musingizi *et al*. (2006). However, in rural areas Shackleton and Shackleton (2006) found no difference in the amounts consumed between wealthy and poor households.

Changing dietary patterns due to Nutrition Transition also influence the nutritional health of consumers (Popkin, 2002). Within its course, traditional plant-based diets that are rich in fruits and vegetables are replaced with diets rich in animal fats and sugar and low in complex carbohydrates (Wahlqvist, 2005). According to Popkin (1999), urban residents obtain a much higher proportion of energy from fats and sweeteners and consume a more diversified diet than do rural residents. Increasing incomes, a greater penetration of the mass media and modern marketing further impacts the nutrition transition (Popkin, 1999). The effects of westernised diet can be noticed in black South Africans. According to Fourie and Steyn (1995), the adaptation to a western lifestyle has contributed to the increase in prevalence of chronic diseases. Changes in diet and physical activity have accelerated the rate of increase in obesity in the developing world (Popkin, 2004). Furthermore, more than 1 billion adults are overweight of which 300 million are obese (IASO, 2004).

It has been found that culture and taboos play an important role in TLV consumption (Hart, 2005; Kimiywe *et al*., 2007). In a study conducted by Vorster *et al*. (2008) in Arthurstone, Mars/Glenroy and Watershed, taboos in South Africa concerning TLVs were evident and associated with the female fertility cycle (menstruation, pregnancy and lactating mothers). These beliefs and taboos have critical effects on availability of labour resources, especially in female households as women cannot take part in any cultural activities during these periods (Vorster *et al*., 2008). According to Vorster *et al*. (2008), beliefs associated with weather lead to temporary cessation of agricultural work. In addition, the type of crop that can be grown by male or female is mainly influenced by cultural beliefs (Vorster *et al*., 2008). In Tanzania, most taboos concerning TLVs consumption are applied to pregnant or lactating women, but also to people with certain diseases or men, in general (Keller, 2004). The fact that men wouldn’t eat green leafy vegetables in Tanzania could be traced

back to their history as pastoralists. For most pastoralists, besides meat fresh blood mixed with milk was an important food item (Maundu & Imbuni, 2003) whereas green plants were only regarded as animal fodder and not suitable for humans. Culture seems to be important in relation to TLVs consumption. According to Guerrero *et al*. (2009) and Chambers (2007) found that ITPF were consumed for cultural reasons and form part of local traditions and cultural heritage.

The impact of modern agriculture on TLVs consumption has been discussed in a number of studies (Shava, 2005; Smith & Eyzaguirre, 2007). Modern agriculture promotes the cultivation and use of popularised commercial food plant varieties at the expense of ITPF (Shava, 2005; Smith & Eyzaguirre, 2007). This has led to marginalisation in the growing and improvement of ITPF, making ITPF insignificant components of modern livelihood systems (Shava, 2005; Smith & Eyzaguirre, 2007).

The cost of food is a major factor in determining food choice, affecting some groups of the population more than others (Gockowski *et al*., 2003; Chambers *et al*., 2007). TLVs are the most affordable and sustainable dietary source of vitamins, minerals and other bioactive compounds. However, the high cost of TLVs especially in urban areas due to transportation constraints is a barrier to sufficient consumption (Gockowski *et al*., 2003). The low availability of TLVs in urban areas due to physical effort required to obtain the food and availability of TLVs in the market also pose a major problem in TLVs consumption. According to Abukutsa-Onyango *et al*. (2006), TLVs are less available in urban areas where purchase of fresh vegetables is difficult for poor households because they are seasonal and unavailable year long. The ubiquitous availability of amaranth species explains why these plants are used as leafy vegetables in most parts of South Africa (Jansen van Rensburg *et al*., 2007).

Personal views

Despite the overwhelming interest of researchers in the promotion of the utilisation and consumption of traditional food plants, in South Africa the youth and the urbanised tend to associate their consumption with poverty and low self-esteem (Modi *et al*., 2006; Damman *et al*., 2007). Even in selected rural areas of the country a decline in the consumption of these leafy vegetables has been observed, particularly those that are harvested from the wild or as weeds, in favour of exotic vegetables (Jansen van Rensburg *et al*., 2007). This is evident from other studies conducted in the region (Keller, 2004; Hart, 2005; Musinguzi *et al*., 2006). Association of ITPF with HIV/AIDS scourge has also been shown to be a significant variable in food consumption. According to an observation made by Shava (2005), consumers usually believed that those who frequently use ITPF are mostly likely to be infected with HIV/AIDS. This is despite the nutritive

advantages that these food plants can add to the diet of any person. This assumption might be a response arising from the media messages from HIV/AIDS advocating for the use of these foods (Shava, 2005). A lack of intergenerational knowledge transfer within communities has a profound effect on the consumption of ITPF (Shava, 2005). Moreover, oral knowledge systems have been replaced by written knowledge without the corresponding conversion of individual oral knowledge to written information.

Familiarity/product knowledge

A study on traditional food consumption and motives in six European countries found that importance attached to familiarity with a product was shown to positively influence traditional food consumption behaviour (Pieniak *et al*., 2009). A study by Bech-Larsen *et al*. (2001) indicated that ingredients which are familiar to consumers achieved higher rates for consumer acceptance than ingredients which have been used only for a short period of time. This supports research that repeated exposure to taste of unfamiliar food products significantly increased acceptance and hence consumption (Wardle *et al*., 2003). According to Shava (2005), lack of intergenerational knowledge transfer within communities has resulted in the loss of indigenous knowledge (IK). The youth possesses as little knowledge of wild food plants, particularly in urban environments (Mtshali, 1994).

Convenience (ease of preparation)

Indigenous and traditional plant foods' preparation was considered as barrier to increased consumption (Larson *et al*. 2006). Studies in West Africa have shown that the shift in diets is result of traditional food processing techniques which are tedious and time consuming and many traditional meals involve lengthy preparation and cooking (Frison *et al*., 2005). In South Africa, the soft, fast cooking leaves of pumpkin and night shades species are preferred to the fibery leaves of cowpeas and old amaranth plants which require long cooking times (Jansen van Rensburg *et al*., 2007).

Sensory appeal

Food is not just eaten for its nutrient value, for many people it is a source of pleasure, an enjoyable experience and even a comforting activity (Clark, 1998). The sensory characteristics of food such as taste, texture, quality, smell and appearance play a significant role in the acceptance of a food product. Consumers seem to be born with a liking for sweet food flavours although a liking for bitter or hot spicy food is often acquired through repeated exposure (Clark, 1998). The importance of

sensory characteristics as a quality factor in determining consumers' acceptance or rejection has been reported in a number of studies (Clark, 1998; Muchenje *et al*., 2010). A study by Vorster (2002) indicated that taste was an important factor in food consumption of TLVs, though it was subjected to regional and gender diversity. In the North of South Africa, the bitter taste of nightshade and cleome are highly appreciated, particularly by males, whereas in the South the sweet taste of amaranth leaves is preferred. Another study by Vorster (2007) found that young children in Arthurstone, South Africa would not eat *momordica balsamina* because it was too bitter. Complaints about the texture of TLVs are common in many studies (Keller, 2004; Weinberger & Msuya, 2004; Keding *et al*., 2007; Vorster, 2007. In South Africa, people from the north dislike the sliminess texture of okra and *corchorus* while people from the south enjoy the mucilaginous texture (Vorster, 2007). It is clear from these findings that sensory responses to taste and texture of TLVs are major influences on TLVs preference. More research is needed to identify other sensory attributes in TLVs that might influence food preference.

Food safety

Consumers' choice of food depends on the benefits food offers such as satiety value, pleasure in consumption and food that will keep them healthy. In addition, safety of food plays an important role in food selection and consumption. Consumers' concerns about food safety in general have been reported in a number of studies (Nayga, 1996; Smith & Riethmuller, 2000; Renee, 2010). Consumers' food safety risk perception with respect to food-related hazards has a direct negative effect on food consumption. Food may contain additives and agricultural products such as chemical residues, whose consequences may be unknown and devastating. Therefore, food safety practices are of importance with particularly emphasis on handling and hygienic practices (Abou-Arab *et al*., 1999). Concerns about issues of food safety have been a major issue in consumer studies, however, there is limited information on the potential risks of traditional and indigenous leafy vegetables (Mudzwiri, 2007).

Although traditional foods offer many health benefits, Johns and Sthapit (2004:151) assert that they are not inherently safe or all positive. This view is supported by Russell *et al*. (1997) who found that certain famine plants were toxic. According to Smith and Eyzaguirre (2007), food safety issues such as microbial and toxicity contamination require research attention as strategies are put in place for the promotion of increased consumption of traditional and leafy vegetables. Mudzwiri (2007) investigated 18 traditional vegetables commonly consumed by native South Africans and believed to be high in medicinal and nutritional value to determine their safety for human

consumption. The study showed that the highest toxicity and mutagenicity was recorded in *Senna occidentalis* and that caution needs to be maintained with the consumption of certain vegetables.

Van de Walt *et al*. (2005) investigated the folate content of traditional leafy vegetables and anticarcinogenic potential of indigenous rooiboos tea and other traditional foods. Traditional leafy vegetables were contaminated with fungi belonging to genera with known toxigenic species which may have an adverse impact on health. In addition, Kritzinger *et al*. (2003) reported the prevalence of fumonisms Bı in *Vigna unguiculata* (L) *walp* at concentrations ranging between 0.12 and 0.61µg/g. According to Hell *et al*. (2009), factors such as inappropriate methods of collection, processing and packaging were reported to have an effect on fungal contamination and levels of infestation. The aforementioned factors have contributed to the negative impact with regard to African natural plants competing in the international markets (Tadmor *et al*., 2002). Other sources of fungal infestation include the informal markets' conditions which are often contaminated by dust and microbial spores (Hell *et al*., 2009). Climatic and environmental conditions were also reported as factors that favour fungal development and mycotoxin formation (Hell *et al*., 2009:103).

2.9 Indigenous knowledge

Indigenous knowledge (IK) is the collective knowledge, practices and beliefs that are acquired over generations by communities as they interact with the environment (Tabuti, 2002; Domefeh, 2007). This knowledge has enabled indigenous people throughout the world to adapt and survive in their environments by entitling communities to identify resources and products vital for their sustenance (Tabuti, 2002, Domefeh, 2007). Indigenous knowledge is transmitted orally between generations and within the community (Shava, 2005). Unfortunately, IK is being lost under the impact of modernisation and the ongoing globalisation process, despite the significance of these plants to food security and livelihood. Four reasons responsible for the loss of IK as identified by Tabuti (2002) are (i) the dying of the principal custodians of IK before it has been adequately transferred or documented, (ii) Christian religious beliefs and values which are said to have dominated the traditional belief systems in many ways. These religious groups are intolerant of most traditional practices; they condemn traditional medicine, (iii) scarcity of plant species due to exploitation and lastly (iv) a change in consumption patterns where many homes have replaced the traditional diet the with modern diet. The major challenge is how to reconcile IK and modern science without substituting each other, respecting the two sets of values, and building on their respective strengths (Domefeh, 2007).

In South Africa, knowledge of the different groups of plants is available from both males and females, however, leafy vegetables tend to be the domain of the women (Jansen van Rensburg *et al*., 2007). Knowledge of cash crops fruits and cereals seemed to be in the male domain, with children having only rudimentary knowledge of these plants (Voster *et al*., 2008). Formal education of the children was blamed by older people for the lack of their knowledge as small boys go to school and do not spend days in the field looking after the livestock and surviving on the knowledge of wild plants. The girls only tend to know the common and the abundant TLVs such as amaranth, cleome, cucurbits and actively cultivated vegetables (pumpkins, cowpeas) as they spend their days at school and have to do homework before dark, due to lack of electricity (Hart & Vorster, 2006).

2.10 Sensory evaluation and consumer acceptability of food products

Consumer choice of foods depends on acceptance and preference of the sensory properties of foods. Thus, the success of a new product in the market requires some measures of whether the products will be accepted or not. Since the ultimate target of the food industry is thus the satisfaction of the consumer, it is essential to consider not only the objective consumer needs (nutrition, safety, affordability) but also subjective aspects such as consumer satisfaction (sensory properties and consumer attitudes) (Scholtz, 2002). Previous research has shown that food preference and acceptance constitutes 50% of the variability in consumption (Cardello *et al*., 1996) and is not only a result of the intrinsic quality of the food, but can also be related to consumer expectations and the degree to which the food item matches them (Oh, 2000). Furthermore, there is more demand by consumers for value added products instead of for greater quantities of food (Imram, 1999). Therefore, involving the end users in product testing gives a better measure of consumer product acceptance. According to Imram (1999), the sensory evaluation techniques are important in the product development process. These techniques are employed from the initial planning stages right up to the formulation-reformulation stages leading to full scale production (Imram, 1999). Understanding the human response to sensory properties, however, presents problems because of the difficulty of correlating sensory properties with chemical composition and physical structure and of quantifying customer response to several demographical, environmental, social and economical factors (Karel, 2000).

Notwithstanding, perceptions of a food product have been shown to be affected by many individual factors including taste, odour, information from labelling, attitudes and memories of previous experiences (Imram, 1999). Sensory characteristics such as appearance, flavour, texture and

temperature have been found to be the most important to the consumers when judging food quality (Clark, 1998). Texture and flavour have a profound effect on perception and acceptability, however, “the first taste is almost always with the eye” (Szczesniak, 1972). It can be concluded that visual sensory properties are, thus, of critical importance in consumers’ choice of products.

2.10.1 Test methods in sensory evaluation

There are different methods used to evaluate the products, namely (1) descriptive, (2) affective and (3) difference testing. *Descriptive testing* is designed to provide information on selected characteristics of food samples. It requires a panel that is well trained (Lawless & Heymann, 1998; McWilliams, 2008). *Affective testing* determines acceptability or preference between products. It can be used for consumers or trained panelists. Affective test includes (a) pair comparison – preference between two samples, (b) ranking – when more than four or five samples are served in a ranking test in order to determine preference. This test is an extension of a paired comparison test, and (c) hedonic test – samples are scored according to liking or disliking and particular attributes are scored on a scale (Lawless & Heymann, 1998; McWilliams, 2008). *Difference testing* is designed to determine whether detectable differences exist between products. The judge is asked to test the two samples presented to identify the sample with the greater amount of characteristics being measured (Lawless & Heymann, 1998; McWilliams, 2008). A detailed description of the methods is provided in McWilliams (2008).

For the purpose of this study, only the affective tests involving untrained consumer participation will be classified in detail. In Chapter 4, only the hedonic scale, preference tests and food action rating scales were used to measure the acceptability of, preference for and consumption intent of the test products. The acceptance tests used in this study consisted of the 5-point hedonic scale, with each point accompanied by a descriptor. This scale was found to be appropriate for participants with a limited literacy level (Lawless & Heymann, 1998). The acceptance test was followed by a simple preference test where participants could indicate which of evaluated samples were preferred, if any. Finally, a 5-point food action rating scale was included, on which consumers could indicate their intension to consume the evaluated food samples.

2.10.2 Test location

There are four key venues for affective tests. These include laboratory, central location, home use, and mobile tests (Moskowitz *et al*., 2006). A complete description of these tests is found in

Resurreccion (1998), Stone and Sidel (2004) and Moskowitz et al. (2006). For the purpose of this study, the central location test (CLT) was conducted in a community hall in each study area in order to make the tests more accessible; to reduce the cost of bringing the participants to and from a sensory laboratory; and to have a large number of participants in a short amount of time as suggested by Meilgaard et al. (1999). Participants where recruited prior to the test as suggest by Stone and Sidel (2004) and Moskowitz *et al*. (2006).

It is clear from these findings that sensory characteristics of food (appearance, taste, smell, texture and colour) have a major influence on consumers' food acceptance and preference. Although several studies concerning the acceptability of ITPF are reported (Ahenkora *et al*., 1998; Davel *et al.*, 2003; Khumalo, 2007; Mkanda, 2007; Simela *et al*., 2008), reports on acceptability of TLVs are scanty. According to Babu (2000), an acceptance analysis should be conducted in order to determine the impact of taste and preference on the dietary intake pattern of different groups of households and as a way to improve the successful acceptance of indigenous plant foods.

2.11 Conclusion

In conclusion, although there is evidence of health benefits from using TVLs there are also suggestions of the contrary under certain circumstances. Therefore, the need for a better understanding and more adequate evidence on health and bio-availability of nutrients before promoting them is urgently needed. There is also a need for more systematic studies to fill in the gaps in knowledge on consumer awareness and the risks related to food handling that could possibly lead to improved methods of production and processing, hence improved product quality and reduced fungal and mycotoxin contamination. The need to understand consumer behaviour is crucial in the acceptance of ITPF, taking into consideration cultural values and other factors that guide consumer decision making about food selection and intended use. Therefore, consumer education is crucial as a means to modify dietary practices, conceptual understanding and behaviour. Promotion of ITPF through education and advertising campaigns might be the best accomplishment in directing ITPF that taste better, are cheaper and are readily available.

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CHAPTER 3

COMPARISON OF NUTRITIONAL STATUS OF CONSUMERS AND NON-CONSUMERS OF TRADITIONAL LEAFY VEGETABLES

(*Submitted for publication in Public Health Nutrition*)

Comparison of health between consumers and non-consumers of traditional leafy vegetables

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ABSTRACT

***Background**:* The combination of poverty-related infectious and lifestyle-related non-communicable diseases, both driven by malnutrition and overnutrition including hidden hunger, causes a high burden for South Africa. Consumption of traditional leafy vegetables (TLV), legumes, and fruits is the most sustainable way of reducing micronutrient deficiencies in resource-poor communities as they are often easier to grow, resistant to pests and diseases and acceptable to local tastes.

***Objective**:* To asses the consumption of TLV and compare the nutritional status of consumers and non-consumers of TLV.

***Design**:* A cross-sectional and comparative study.

***Setting*:** North West Province

***Subjects**:* Demographic characteristics and frequency of consumption of TLV data were collected from 396 subjects whom were also participating in the Prospective Urban Rural and Epidemiological SA study. An extensive health profile of these subjects including a blood sample, blood pressure and anthropometric measurements and total dietary intakes by means of a quantitative food frequency questionnaire was compiled.

***Results**:* As expected, rural inhabitants were more likely to consume TLV. Urban subjects had significantly ($P<0.05$) higher macronutrient intake than rural subjects. However, there was no significant difference ($P>0.05$) between intake of the selected micronutrients. Non-consumers of TLV had higher total cholesterol levels than consumers. The relative risk to develop high blood pressure was higher in the non-consumers of TLV than in consumers [OR=1.5 (0.7-3.3) vs. OR=1.05 (0.6-2.0)].

***Conclusion**:* Although the beneficial effect of rural diets was seen in this study, the lack of knowledge about the composition and the bioavailability of nutrients from TLV is of concern. More research is needed to investigate the health effects of these vegetables.

Key words: traditional leafy vegetables, nutrient intakes, consumers, non-consumers

INTRODUCTION

The combination of poverty-related infections and lifestyle-related non-communicable diseases, both driven by malnutrition including hidden hunger, causes a high burden for South Africa[1]. Consumption of vegetables, fruits and legumes is seen as the most sustainable way of reducing micronutrient deficiencies in resource-poor communities. Several previous epidemiological research studies reported the health benefits of a diet rich in fruits and vegetables. This has resulted in the World Health Organization's (WHO) recommendation of a daily intake of five fruit and vegetable portions per day to protect one against diet related chronic diseases[1]. In South Africa, consumption of fruits and vegetables is low compared to WHO recommendations[2] and consumption of traditional leafy vegetables (TLV) is declining[3,4,5]. Lack of popularity and unavailability have been reported as reasons for the low consumption of TLV[6]. Acceptance and affordability have also been attributed to low vegetable and fruit intake[2]. Many researchers suggested the use of TLV to eliminate most of the micronutrient deficiencies and in addition will address food insecurity[7]. Traditional leafy vegetables are often easier to grow and resistant to pests and diseases[8].

Previous research has shown that TLV contain non-nutrient bioactive phytochemicals that have been linked to protection against cardiovascular and other generative diseases[9]. TLV have been reported to have healing properties, uses and as source of micronutrients[5,10,11]. Thus, TLV could play a significant role in the success of the WHO global initiative on increased vegetable and fruit consumption in sub-Saharan countries[12]. However, controversy exits over whether or not consumption of TLV contributes to nutrient adequacy due to issues of bioavailability[13].

Reports on TLV consumption and nutritional status seem to be limited in literature. The aim of this study was to assess consumption of TLV in rural and urban areas and to compare nutritional status of consumers and non-consumers of TLV using data from the Prospective Urban and Rural Epidemiology (PURE-SA) study which investigates the health transition in urban and rural areas.

The results of this study will be used to tailor health education messages aimed at increasing traditional vegetable and fruit consumption, especially in rural areas where availability and affordability are the major constraints in the consumption of fruit and vegetables.

MATERIALS AND METHODS

Study design and subjects

A comparative study was conducted on the baseline data of the population that participated in the PURE-SA study which investigates the health transition in urban and rural subjects. The main selection criterion for the communities participating in the PURE study was that there should be migration stability within both rural and urban communities. The baseline data for the North West Province of South Africa were collected from October to December 2005. The rural communities were identified 450 km west of Potchefstroom and still function under tribal laws. The urban communities were located near the University in and around Potchefstroom.

Selection of subjects

During 2005 a household census regarding the number of people, their ages and health profile was randomly done in 6000 houses (1500 in each community). In order to fill out the questionnaire, every head of a household signed informed consent. If a person refused or was not at home, the next house was sampled and a non-complier questionnaire was filled out. During the census, written information was left with every household about the PURE study and letting them know that they were invited to participate in the survey. From the data obtained possible subjects who were older than 35 years with no reported chronic diseases of lifestyle, tuberculosis (TB) or known HIV were invited to participate in the survey. A total of 1004 urban and 1006 rural participants enrolled in the study. After giving voluntary and informed consent, an extensive adult questionnaire regarding physical and psychological health, social economic background, lifestyle practices,

information on crime in neighbourhoods and available support system was filled out. For the purpose of the present study, a representative randomly sub-selection of these PURE study participants was made who filled an additional questionnaire on the use of TLV including 200 rural and 200 urban participants. From these 400 people, 175 were consumers and 221 were non-consumers. The remaining four participants (n=4) did not meet the criteria.

Ethical consideration

Permission to conduct the study in the communities involved was obtained from the North West Department of Health, tribal chiefs, community leaders, employers and mayors. Ethical approval was obtained from the Ethics Committee of the North West University, Potchefstroom, South Africa (Ethics number: 040M10). All the subjects were informed about the objectives, procedures and its benefits from participation and for the community in general and details regarding the protection of confidentiality in the language of their choice after which they gave written consent to participate. In addition, subjects were told that they could withdraw from the study at any stage. Prior to the study, an agreement with clinics and hospitals serving the communities from which the subjects were recruited was reached for the team to refer all newly identified subjects with HIV, abnormal blood pressure, lung dysfunction, tuberculosis and abnormal electrocardiogram (ECG) to them for further follow up. Subjects received remuneration for all the travelling expenses to and from the clinics. Because they were asked to be in a fasting state, they also received sandwiches and a fruit after the blood sample and blood pressure were taken.

Blood samples

Blood was drawn by registered nursing sisters from the ante-cubital vein in the subject's right arm, using a disposable needle. The blood collection tubes were filled (vacutainers) to capacity. Excessive use of tourniquets was avoided as this may lead to heamo-concentration and inaccuracies in analytical results. Contents of the tubes were mixed thoroughly by gently inverting

each tube five times. For the collection of serum, blood was allowed to clot (at room temperature for 30 minutes) and centrifuged at 2000g for 15 minutes at 10 °C. Collected serum was subsequently transferred to cryo tubes and stored at -70 °C until analysis. For plasma samples, blood was collected in ethylenediamine tetra acetic acid (EDTA) and fluoride coated tubes and centrifuged at 2000g for 15 minutes at 4°C. Plasma and serum was transferred to cryo tubes and stored at -70 °C until analysis.

Biochemical analyses

The Sequential Multiple Analyzer Computer (SMAC) method was used making use of Konelab™ auto analyzer (Thermo Fisher Scientific Oy, Vantaa, Finland) for analysing total protein (T-protein), albumin, fasting glucose, serum high-density lipoprotein cholesterol (HDL-C), triglycerides, total serum cholesterol, liver enzymes and iron.

Blood pressure

Blood pressure was measured using the Omron automatic digital blood pressure monitor (Omron HEM-757). Measurements were recorded after a 5-10 min rest.

Anthropometry

Anthropometric measurements (height, weight, waist and hip circumference, calf skinfold, supra spinal skinfold, upper flexed arm circumference) were recorded using the guidelines adopted at the NIH sponsored Arlie Conference[24].

Questionnaires

A total of 2010 subjects were interviewed using structured, validated demographic, socio-economic, lifestyle and dietary questionnaires (QFFQ and 24 hour recall) (see Addenda A), local food consumption and beliefs in the rural and urban areas. The questionnaires were conducted in the homes of the subjects by 16 intensively trained field workers recruited from the different enrolled communities. A culture-sensitive quantified food frequency questionnaire (QFFQ), developed and validated for the use in this population, was used to obtain the dietary (including alcohol) intake of respondents[14]. Portion sizes were estimated using a food portion photograph book developed for use in the African population in the North West Province[15]. Portion sizes were reported in household measures and were converted to weights using standard tables[16]. The food intake was coded using the new food codes of the South African food composition database of the South African Medical Research Council and expressed as average amounts consumed per day.

As part of dietary interviews, a questionnaire to assess availability and sources of TLV in the communities, preparation techniques and uses of TLV was administered to a representative randomly selected group of participants (n=396). These data was collected during a season of high traditional leafy vegetable use (October-December, 2010) where the dietary intakes of the subjects were recorded seven days of the week. Factors influencing TLV consumption and frequency thereof were determined. To determine the frequency of consumption, consumers of TLV were categorised into three groups: “rarely consumed” if a subject reported consuming traditional leafy vegetables less than twice a month, “often consumed” if a subject reported consuming traditional leafy vegetables between 2 to 10 times a month and “very often consumed” if a subject reported consumption more than 10 times a month. If consumption of TLV was not reported he or she was assigned a category of “non-consumer”. This way of categorising gave a broad picture of the TLV consumed by subjects and a base for identifying health or nutritional related problems for possible promotion of TLV consumption.

STATISTICAL ANALYSES

Data were analysed using SPSS for Windows (version 17.0; SPSS Inc, Chicago). Statistical analyses performed included descriptive statistics to compile the frequencies, means and standard deviations for intake of each of the nutrients stratified by consumers and non-consumers of TLV and place of residence, and to describe demographics. As data were not normally distributed, non-parametric tests were used to test the significant differences in median within groups using the Kruskal-Wallis test. Logistic regression was performed to calculate odds ratios and confidence interval for odds ratios to examine associations among cardiovascular disease (CVD) risks (blood pressure, triglycerides and cholesterol) and consumers and non-consumers of TLV. All statistical analysis used $P<0.05$ for the level of significance.

RESULTS

The socio-demographic characteristics of the consumers and non-consumers of TLV are summarised in Table 1. Overall the consumers of TLV were found to be more common among participants in rural areas, were females, had primary education level, married and were consumed by participants in the age category 46-50 years mainly from rural communities. In urban communities, consumption of TLV was popular among older respondents in age category 61-65.

Table 1: Socio-demographic characteristics of traditional leafy vegetable consumers and non consumers

Characteristic	RURAL				URBAN			
	Users(n=145)		Non-users (n=51)		Users (n=30)		Non-users (n=170)	
Age (yrs)	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
36-40	11	8	3	6	3	10	11	6
41-45	12	8	11	22	4	13	30	18
46-50	34	23	7	14	2	7	28	16
51-55	25	17	6	12	3	10	25	15
56-60	16	11	11	22	4	13	21	12
61-65	23	16	9	18	6	20	26	15
66-70	12	9	3	6	6	13	10	6
70+	12	8	1	2	4	13	19	12
Sex								
Female	94	65	26	51	22	73	101	59
Male	51	35	25	49	8	27	69	41
Education								
Primary								
Grade 0-7 yrs	141	97	51	100	27	90	138	81
Secondary								
Grade 8-12 yrs	4	3	0	0	3	10	32	19
Marital status								
Married	75	52	20	39	13	43	62	39
Widowed	25	17	11	22	8	27	21	22
Divorced	6	4	0	0	2	7	17	0
Living together	6	4	7	14	4	13	23	14
Single	27	19	10	20	3	10	44	20
Separated	1	1	1	2	0	0	1	2
Traditional marriage	5	4	2	4	0	3	2	4

Consumption of traditional leafy vegetables

Table 2 shows the frequency of consumption and sources of TLV. As one would expect, households in the rural areas had the highest frequency of consumption of TLV. Traditional leafy vegetables were consumed less than twice a month by 83% and 32% of households in urban and rural areas respectively and two to ten times a month by 17% and 68% in urban and rural areas respectively. No households reported to consume these vegetables more than ten times a month. The rural communities noted a decline in the availability of TLV in the area. Reasons contributing to the decline were poor soils (89%) and insufficient rains (70%).

Table 2: Respondents' frequency of consumption and sources of traditional leafy vegetables

	RURAL		URBAN	
Frequency of vegetable consumption	**N**	**%**	**n**	**%**
Rarely consumed (*consumed less than twice a month)*	46	32	25	83
Often consumed *(consumed two to ten times a month)*	99	68	5	17
Very often consumed *(consumed more than ten times a month)*	0	0	0	0
Sources of traditional leafy vegetables (%)				
Informal markets	54	37	29	97
Vendors	28	19	26	88
Wild	42	29	5	18
Home gardens	96	66	0	0
Outside village	54	37	6	20
Ploughing fields	1	1	0	0
Supermarkets	0	0	1	1

The most consumed leafy vegetables were amaranth, spider plant and cowpea leaves. Factors that influenced the consumption of TLV were mainly price (99% in urban areas versus 76% in rural

areas), culture (83% in urban areas versus 89% in rural areas), accessibility (24.3% in urban areas versus 15% in rural areas) and availability (65% in urban areas versus 31% in rural areas). In urban areas, availability comprised two aspects: availability of TLV and easy-to-get-to points of purchase and availability because of seasonal influences were mentioned. TLV in rural areas were obtained from home gardens (66%), informal market and outside the village (37%), while the informal markets (97%) and vendors (88%) were mostly indicated as source of access in urban areas as indicated in Table 2. TLV were prepared as relish (100%) and eaten as an accompaniment with starchy dishes. The main preparation methods were boiling (100%) with salt and oil added and stewing (100%) with tomatoes, onions, salt and oil and sometimes with stock cubes to enhance the flavour. As addition to the ingredients used in the preparation of vegetables, groundnut powder was used in the rural areas.

Table 3 presents macronutrient intakes for rural and urban areas. There was a large difference between the two areas with urban subjects having a higher macronutrient intake than that of rural subjects for protein (70.8 g/day vs. 44.8 g/day; P=0.000), fat (70.9 g/day vs. 36.3 g/day; P=0.000), and carbohydrates (316.3 g/day vs. 259.1 g/day; P=0.003). The mean intake of energy was 9375.3 kJ/day for urban subjects and 6312.4 kJ/day among rural subjects (P=0.000). Results demonstrated that carbohydrates were the principle source of energy. With regard to selected micronutrient intakes, there was no significant difference (P>0.05) in iron, calcium, zinc and vitamin C between consumers and non-consumers of TLV in both rural and urban areas (Table 4). However, vitamin C intake in urban areas among consumers and non-consumers of TLV was 38mg which was 62% of the RDA compared to 11mg which was 21% RDA in rural areas. Iron intake among consumers of TLV in urban areas was 16.5mg which was 92% of the RDA compared to 11mg (61% RDA) in consumers of TLV in rural areas. The intake of calcium was reported low in both areas, however, consumers of TLV in urban areas had intakes of 410mg which was 41% of the RDA compared to 173mg (17% RDA) of non-consumers of TLV in rural areas.

Table 3: Means, SD, and P-value of macronutrient intake of the total population

		Rural (n=187)		Urban (n=195)		
Nutrient	WHO (Recommended ranges)	Mean intake (g)	SD	Mean Intake (g)	SD	[a]P value
Energy (kJ)		6312.4	2777.5	9375.3	4054.6	0.000
Total protein (g)	*10-35%	44.8	18.3	70.8	28.4	0.022
Total fat (g)	**<30%	36.3	17.8	70.9	28.5	0.000
Total carbohydrate (g)	***>55%	259.1	110.5	316.3	136.6	0.042

Abbreviation: SD, Standard Deviation; kJ=kilojoules; g=gram

*total protein intake recommended ranges (Whitney and Rolfes, 2008)[33]; **total fat intake recommendations (Wolmarans and Oosthuizen, 2001)[34]; ***total carbohydrate recommendations (Vorster and Nell, 2001)[35]

[a]P value between the communities

The relationship between health markers of consumers and non-consumers of TLV are presented in Table 5. As expected, health markers for non-consumers of TLV residing in urban areas were higher than in rural areas except for HDL Cholesterol which was at par in all categories. In urban areas, only total cholesterol (5.1 vs. 4.8mmol/L; *P*=0.02) was significantly higher in non-consumers than in consumers of TLV (Table 5).

Using the logistic regression to predict the future health of the subjects, the risk scores of CVD namely high blood pressure (HBP), total serum cholesterol and triglycerides were correlated with the consumers and non-consumers of TLV (Table 6). The risk ratio showed that the urban consumers and non-consumers of TLV were more likely than rural consumers and non-consumers to experience the risk of high blood pressure 1.46 (95% CI 0.7, 3.3) (Table 6). However, the risk ratio of total cholesterol and triglycerides was not significantly different.

Table 4: Comparison of selected micro-nutrient intake between consumers and non-consumers of TLV rural and urban areas

		RURAL		URBAN	
		Consumers (n=139)	Non-consumers (n=59)	Consumers (n=28)	Non-consumers (n=169)
Nutrient	*RDA/Day	**Median	**Median	**Median	**Median
Iron, *mg*	18 mg	11.4 (8.6; 14.4)	11.2 (9.1;15.7)	16.5 (9.9; 20.6)	14.1 (10.2; 18.9)
Calcium, *mg*	1000 mg	216.8 (138.2; 313.2)	173.4 (128.4;320.9)	410.6(248.4; 597.6)	368.2 (272.7; 539.3)
Zinc, *mg*	15 mg	8.2 (6.32; 10.2)	8.1 (6.4;10.3)	12.8 (7.9;14.3)	10.9 (8.2 ; 15.2)
Vit C, *mg*	60 mg	12.8 (9.6; 19.5)	11.2 (7.9;15.7)	37.0 (18.6; 64.3)	38.1 (18.9; 59.2)

Abbreviation: mg, milligram, *RDA, Recommended Dietary Allowances as defined by Whitney and Rolfes, 2008 [33]

**Median (lower quartile; upper quartile); Kruskal-Wallis was performed because the data was non-parametric

Table 5: Comparisons of selected health indicators for non-communicable diseases in consumers and non-consumers of TLV in rural and urban areas

	RURAL		URBAN	
	Consumers (n=139)	Non-consumers (n=60)	Consumers (n=28)	Non-consumers (n=169)
Indicators	*Median	*Median	*Median	*Median
Systolic blood pressure (mmHg)	129.5 (115.5; 145.5)	129.0 (116.0; 140.0)	135.0 (118.0; 152.0)	137.0 (124; 126)
Diastolic blood pressure (mmHg)	87.0 (77.5; 97.0)	87.0 (73.0; 94.0)	91.0 (80.0; 95.0)	90.0 (81.0; 99.0)
Total cholestrol (mmol/L)	4.8 (4.1; 5.8)	4.9 (4.1; 5.8)	≠4.8 (3.7; 5.4)	≠5.1 (4.3; 6.2)
HDL cholestrol (mmol/L)	1.4 (1.1;1.9)	1.3 (1.1; 1.9)	1.3 (1.1;1.9)	1.5 (1.1; 1.9)
Triglycerides (mmol/L)	1.0 (0.8;1.4)	1.2 (0.9; 1.7)	0.9 (0.8; 1.5)	1.2 (0.9;1.7)
Fasting glucose(mmol/L)	4.7 (4.4; 5.2)	4.8 (4.4; 5.1)	4.7 (4.2; 5.5)	4.9 (4.3; 5.5)
Serum ferritin (mmol/L)	14.4 (10.2; 18.9)	16.4 (11.6; 22.4)	17.3 (11.8; 23.5)	17.6 (12.6; 24.4)
BMI (kg/m²)	23.7 (20.3;28.5)	23.0 (19.1; 29.6)	22.1 (19.2; 31.7)	24.3 (20.6; 29.8)
Waist circumference (cm)	78.5 (70.8;88.9)	77.3 (73.1; 91.8)	84.1 (68.3; 95.0)	81.2 (73.9;89.2)

Abbreviation: BMI, Body Mass Index (kg/m²)

*Median (lower quartile; upper quartile); Kruskal-Wallis was performed because the data was non-parametric

≠Significant differences

Table 6: Association between CVD risk factors of consumers and non-consumers of TLV in rural and urban areas

Risk factors	Community	Consumers	Non-consumers	OR 95% CI
High blood pressure	Rural	144	51	1.05 (0.6 – 2.0)
	Urban	30	169	1.46 (0.7 – 3.3)
High triglyceride	Rural	133	49	1.50 (0.8 – 2.9)
	Urban	29	159	2.14 (0.9 – 4.9)
High total cholesterol	Rural	135	49	1.29 (0.7 – 2.5)
	Urban	29	159	1.83 (0.8 – 4.2)

Abbreviations: CVD, Cardiovascular diseases, OR, Odds Ratio, CI, Confidence Interval

DISCUSSION AND CONCLUSION

The results of this study should be interpreted with care and the limitations of the study should be taken into account. One of the major limitations is that the South African food composition tables do not include analyses of nutrients of all TLV and knowledge of absorbability thereof are not available for all TLV's. However, this limitation is overcome by comparing serum risk factors between users and non-users of TLV's. As expected, findings from this study showed that consumers of TLV were mainly from rural areas. However, the frequency of consumption of TLV in the study areas reported by the respondents were lower compared to previous studies done in Limpopo and KwaZulu-Natal provinces[13]. Many researchers have linked the low consumption of indigenous leafy vegetables to increasing urbanisation, westernisation and the so-called nutrition transition which have consequences for the dietary patterns and the lifestyle of the individuals[1,4,7,17]. In addition, the decline in the intake of TLV can be attributed to misconceptions made about TLV especially among younger people[3]. In the present study, respondents in both the rural and urban areas reported price and culture as the strongest influence on TLV consumption. Similarly, Matenge et al. (unpublished) found that the rural communities besides being farming communities, continued to value their traditional food cultures and tend to link indigenous and traditional foods with tradition and heritage that has been transmitted from one generation to the other.

Besides price and culture, another strong factor that influenced TLV consumption in urban areas was availability of TLV, easy-to-get-to points of purchase and availability because of seasonal influences in urban areas. Gockowski et al[18] emphasise the high cost and unavailability of TLV especially in urban areas as barriers to sufficient consumption. As would be expected, the rural households obtained TLV from various sources, while urban households relied on the informal market sector for access. This difference in the rural and urban areas can be explained by geographical location differences and shortage of agricultural land in urban areas. However, limited or no access to land by no means deters urban agriculture[19]. These findings suggest promotion of urban agriculture and home gardens that could play a potential role in alleviating problems of food insecurities and micronutrient deficiencies. The reliance of urban households on the informal markets as a source of TLV is an indication that trading of TLV thus has an economic value.

Amaranthus species (wild spinach), cow pea and melons are best known and generally the most widely consumed indigenous leafy vegetables in South Africa[20]. In line with the aforementioned study, the present study showed that a limited variety of TLV (amaranthus, cowpea leaves, pumpkin leaves and spider plant) were consumed as relish together with starchy foods and grains[10]. Boiling and stewing of vegetables were common preparation methods used in the study areas. The cooking or preparation methods and period of cooking may affect the nutritional value as well as the bioavailability of many nutrients[21]. However, the use of oil in the preparation of vegetables has been shown to increase bioavailability of β-carotene[22]. The addition of other vegetables and condiments in the preparation of TLV depended on the availability of funds in the household in the study of Faber et al.[13]. In the present study, groundnut powder was used in rural areas as it increases nutrient density and enhances the palatability.

With regard to macronutrient intakes of the total study population, urban subjects reported high mean intakes of protein, fat, carbohydrates and energy which were above the recommended intakes. Although this population is experiencing a health and dietary transition, urban diets are generally more westernised and diversified and often contain more animal products with added

fats/oils than rural diets[23]. The significantly higher total cholesterol levels among consumers and non-consumers in urban areas further demonstrate a diet rich in animal products.

In sub-Saharan Africa, TLV conribute significant amounts of protein, vitamins (ascorbic acid, niacin and riboflavin) and minerals (iron, calcium, zinc and phosphorous) among populations that cannot afford expensive food rich in these nutrients[24]. In the present study, there were no significant differences in the selected micronutrient intakes between consumers and non-consumers of TLV although one would expect some differences if taking into account the high nutrient content of these vegetables[11,25,26]. This may be explained by the mentioned limitations of this study. Studies have indicated that TLV, especially the wild dark green leafy vegetables, contain oxalates, phytates, tannins, saponins and nitrates[27,28] which are known to reduce the absorption of certain micronutrients in the body. Hence TLV micronutrients' bioavailability determination is vital. Since malnutrition is common in sub-Saharan Africa, the information provided about bioavailability of micronutrients would be of fundamental importance in addressing dietary deficiencies in impoverished African rural communities.

In the present study, the relative risk to develop high blood pressure was higher in the non-consumers of TLV than consumers [OR=1.5 (0.7-3.3) vs. OR=1.05 (0.6-2.0)]. These differences observed cannot be linked directly with a diet rich in TLV because the effectiveness of vegetables as a source of antioxidant carotenoids and lutein has been questioned in a number of studies[29]. However, many of the benefits of non-nutrients in TLV on human health may exceed those attributable to nutrients[30]. Studies have shown that TLV contain non-nutrient bioactive phytochemicals that have been linked to protection against cardiovascular and other degenerative diseases[12]. TLV are also indicated as having potential health related functions such as antibiosis, immunostimulation, nervous system action, detoxification, anti-inflamatory, anti-gout, anti-oxidant, glycaemic and hypolipidaemic properties[31]. There are probably several other non-nutrients in TLV that may have protective effects against CVD. Findings of the present study suggest that the low risk to develop blood pressure in consumers of TLV could probably be linked with rural lifestyles

characterised by an appreciation for traditions, friendliness, atmospheric purity and proximity to the natural environment[32]. Such a lifestyle increases a sense of well-being and the good physical well-being of the subjects[32].

Although the lack of information on bioavailability of nutrients from TLV and lack of information on food consumption database of these vegetables constitutes one of the chief barriers to obtaining information on food composition, the present study has found significant beneficial effects of rural diets. However, the low frequency of consumption of TLV in the study areas appears to be of concern. Taking into consideration safe agricultural practices, the promotion of TLV might be a solution towards healthier diets and enhanced food and nutrition security. More research is needed to investigate the health effects of these vegetables and the antioxidant activity in cooked TLV and their effects on degenerative diseases.

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CHAPTER 4

UTILISATION OF INDIGENOUS AND TRADITIONAL PLANTS FOODS IN URBAN AND RURAL COMMUNITIES

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Utilisation of indigenous plant foods in urban and rural communities

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ABSTRACT

In South Africa, malnutrition and poverty often co-exist with urbanization, which is associated with significant dietary change mostly due to neglect of indigenous foods and loss of indigenous knowledge. The article is based on a study that was aimed at assessing the availability, cultivation, consumption and general knowledge about indigenous plant foods in rural and urban communities. A comparative study was conducted in rural and urban populations of the North West Province of South Africa. Data were collected using a questionnaire (n=396 households), key informant interviews (n=4), and four focus groups. The rural area had more plant food available and consumed than the urban area and fewer species were used as edible food material than expected. Consumers noted a decline in the availability of the species. The main reasons attributed to this decline were insufficient rainfall, poor soil quality, deforestation and over harvesting. Consumption of indigenous foods was influenced by price, culture, seasonality/availability, accessibility and diversity in markets. The elderly were more knowledgeable compared to the younger age groups and knowledge was widely distributed in rural areas. The study revealed that there was no cultivation of indigenous crops in the urban areas. In the rural areas, cultivation of indigenous crops was limited to a number of species and restricted to household consumption.

Key words: indigenous knowledge, consumption, indigenous and traditional plant foods, cultivation, consumer

INTRODUCTION

In Africa, indigenous and traditional plant foods are well known for their high nutrition values and the role in the alleviation of micro-deficiencies and food insecurities in developing countries (Uusiku *et al*, 2010). Studies have also shown that Indigenous foods contribute to the livelihoods, self-reliance and the wellbeing of rural communities (Pumezo, 2008). Despite their recognised importance, they are underutilized (Labadarios *et al.*, 1999; Nesamvuni *et al*., 2001; Modi, 2003; Mbhenyane *et al*., 2005; Faber *et al*., 2007). The introduction of modern agricultural methods had led to marginalization of traditional agricultural methods that ensured a wide variety of indigenous foods which permitted better food security. Consequently, this had led to loss of indigenous knowledge systems related to cultivation and utilization of indigenous crops (FAO, 1989).

In developing countries, the low consumption of indigenous and traditional foods has been linked to increasing urbanization, westernization and nutrition transition which has consequences for the dietary pattern and life style of individuals (WHO, 2003, Damman *et al*, 2007). MacIntyre *et al* (2002), in their study on nutrient intake and urbanization found that food intakes showed a shift from the traditional diet high in carbohydrate low fat to a diet associated with non-communicable diseases. The North West Province is known for its agricultural heritage with cultivators, pastoralists and mixed farmers living in the province, great variety of ecosystems and habitats (South African Government information, 2010). However, the effects of urbanisation and nutrition transition towards shift in diets have led to the displacement of traditional vegetables by modern ones.

Our own observations made through studies done in rural and urban communities indicated that a number of uncultivated edible plant species have been used in the North West Province, especially in rural households. However detailed studies regarding their availability, status and contribution to the livelihoods of consumers are lacking. The study was aimed at establishing and comparing the status and level of consumption of indigenous and traditional plant foods (ITPF) in rural and urban communities of the North-West Province of South Africa and to assess the availability, cultivation and consumers' knowledge of ITPF. The results of the study further gave an indication of the types of indigenous food plants available and consumed in the communities under study and guide low cost and effective interventions to promote their

production and utilization especially in many poor rural and urban communities, hence improved nutrition status and quality of life.

MATERIALS AND METHODS

The study area where the research was conducted was in both rural and urban environments.

The rural environment

The rural setting is located in the Kagisano Municipality region under the Bophirima district in the North West Province. The district is located in a savanna biome and consists of Kalahari thornveld and shrub bushveld. The climate is semi-arid that receives an average rainfall of 342 mm per annum.

The urban environment

The urban setting is situated adjacent to and west of Potchefstroom between Latitude 26 43' 00" and Longitude: 27 06' 00". It is 1343 meters above sea level (Tlokwe City Council, 2010). Potchefstroom district is characterised by fertile soils, a long growing season and above average rainfall. The average rainfall is approximately 767 mm per annum. The climate is hot in summer and during winter there is severe frost and cold.

RESEARCH APPROACH AND DISIGN

A sequential explanatory strategy was used to collect data which involved first a collection of quantitative data and analysis, followed by qualitative data and analysis (Creswell, 2009). Quantitative data was collected by the researcher through the use of a questionnaire to assess and compare the availability, consumption and cultivation of indigenous and traditional foods in the study areas. The qualitative research comprised of focus group discussions, key informants and non-participant observation. Focus group discussions solicited information on traditional food systems in the study areas. Key informants were used to investigate methods of food preparation (recipes) on the most important and consumed TLV and other traditional plant food

recipes in general. Preliminary analysis of the questionnaire informed some questions in the focus groups.

Quantitative research: household survey

Study sample

Open ended questionnaires were administered by the researcher to 396 respondents. Of the total number of respondents sampled, 200 respondents were from the urban communities and 200 were from the rural communities. Convenience sampling was used in order to select respondents for this study. During the researcher's visit to the concerned communities, consumers were approached and informed about the study. Criteria for selection were that prospective participants be male and female aged older than 20, residing in the selected communities and be knowledgeable on the indigenous and traditional plant foods of the area. Specific questions were asked regarding availability, cultivation, preparation, consumption and the general knowledge of ITF in the area. On further questioning, the researcher determined whether the consumer complied with the inclusion criteria. Consumers who did not meet the criteria were excluded from the study (n=4).

Questionnaire

The questionnaire was adopted from Vorster (2007) and modified in order to meet the objectives of the present study. The questionnaire was pre-tested for the refinement of questions so as to consolidate validity (Babbie and Mouton 2001). The study leader Prof. Annamarie Kruger and the Biodiversity team of South Africa subjected the questionnaire for assessment. The purpose was to determine that the draft questionnaire was confined to the nature and scope of the study and the principles of questionnaire construction as suggested by Babbie and Mouton (2001). The questionnaire comprised specific sections namely socio-economic situation, questions on availability, consumption, accessibility and cultivation of ITPF. The questionnaire was first formulated in English and then translated into Setswana by the researcher. The questionnaires were administered in houses of the respondents. This provided a chance to observe the respondents in their natural setting and to gain an in-depth understanding by being intimately involved with the participants. During each visit, the

researcher made a brief introduction about herself and the purpose of the study. Given that the respondents were semi-literate, questionnaires were completed by the researcher in a face to face interview.

Quantitative analysis

Quantitative analysis was carried out in conjunction with data collection. Questionnaires were read through to gain a general sense of the data and coded to facilitate easy analysis before being entered into the computer. Codes and data were then entered into SPSS for windows (version 17.0; SPSS Inc, Chicago) in order to make interpretation and reveal meaning of the data. The quantitative data was analysed through the use of simple descriptive statistics to calculate frequencies, medians and means. To determine who the growers of ITPF were, cross tabulation was used to calculate the relationship between growers and socio-demographics.

Qualitative research: Focus group discussion, key informants and non-participant observations

Recruitment and participants

Focus groups were selected to gather qualitative data on traditional food systems. Two separate focus group discussions were each held for women and men. In total four focus groups were conducted; two in rural (Ganyesa) and two in urban (Potchefstroom) communities over a period of two months. To recruit participants, specially arranged meetings by the local leaders were held at the Kgotla. The goal of these meetings was primarily to introduce the researcher to the communities, to inform them about the study, to elicit support and to invite participants to take part in the study.

Participants were recruited based on a specific purpose rather than randomly. To realise this, purposive sampling took place in order to obtain insights into a phenomenon and to allow participants to be recruited according to the inclusion criteria for this study (Strydom and Delport, 2005). In order to meet the objectives of this study, specific inclusion criteria were set to which participants had to comply. Criteria for selection were that prospective participants be male and female aged older than 20, residing in the selected communities and be

knowledgeable on the indigenous and traditional plant foods of the area. Specific questions were asked regarding availability, cultivation, preparation, consumption and the general knowledge of ITF in the area. On further questioning, the researcher determined whether the participant complied with the inclusion criteria. In each focus group 10 consumers participated which allowed the quantitative standard of saturation to be met (Guest *et al*, 2006).

Focus group questions

A semi structured questioning route was used in the focus groups to ensure accuracy in questions asked across groups, yet allow for some flexibility in accordance with topics raised and level of participation within the groups (Neumark-Sztainer *et al*, 1999). Questions were primarily aimed at obtaining in-depth information about availability, cultivation and uses of ITPF used in the study areas. The source (home gardens, ploughing fields, gathered from the wild, purchased from the markets) of each of these plant foods and their seasonality were also obtained from the participants. A picture manual showing pictures of ITPF in the area was presented to the participants for identification. To determine the participants' knowledge of ITPF, each participant was requested to list all the ITPF commonly available in the community in a piece of paper provided. At the end of the exercise, participant's lists were compared and compiled and recorded on a chart.

Conducting of the focus groups

At the commencement of the study, participants were introduced to the moderator (researcher) and assistant moderators who were responsible for making observations, operating the tape recorder, taking notes and handling the logistics. Ground rules as indicated by Krueger and King (1998) were also presented regarding confidentiality, respect for the views of the others and the importance of honesty to the participants before the questions were asked. Verbal consent for the voice recording of the sessions was obtained. Participants were informed that the voice recordings will be transcribed without using their names and that the recordings will be discarded after data analysis. The use of local language Setswana, by the moderator maximized the group's cohesiveness and openness while maintaining cultural homogeneity and language use. Each focus group lasted approximately 90 minutes. The information was captured by transcription, translated and checked.

Key informant interviews

Key informant interviews in this study were used to collect methods of food processing/preparation (recipes) on the most important TLV such as cowpea leaves, amaranthus, spider plant, pumpkin leaves and other ITPF in general commonly consumed in the study areas. The recipes where documented by the researcher (See Addenda B: recipe inventory). Unstructured face-to-face interviews with open-ended questions (see Addenda B) were conducted with key informants (two men and two women) from each community under study. Responses to the questions were written in the form of notes and none were digitally recorded. Key informants were selected for their specialized knowledge and unique perspective on the topic. Consequently, key informants where old people aged 60 and above who have been residing in the communities under study and are familiar with the changes that have taken place during the last several decades. They were identified with the help of the local leaders and the community at large.

Observations

The non-participant observation was used in conjunction with other methods of data collection such as surveys, group and individual interviews to explore the social phenomena in depth and to make data more meaningful. An observation protocol for recording information (Creswell, 2009) was used and it included the following: (a) the environment such as the local vegetation, plant and animal species, soils, crops (b) the participants: their relationships with one another, the structures or groupings existing among the participants and anything else worth observable was recorded in a field book.

DATA ANALYSIS

Qualitative content analysis was used to analyse data from the focus groups and key informants interviews. During the days following the group discussions, the voice recordings were transcribed verbatim and the written transcripts where possible were carefully translated from Setswana into English and compared with the field notes to ensure that the meaning of the data was represented carefully (Creswell, 2009). Data were coded by reading through the transcripts, segmenting sentences into categories and labelling categories (themes, sub-

themes and concepts) with a term and then recorded on forms based on the issues covered in focus groups which provided a base for the results and discussions.

Trustworthiness

This study relied on Guba's proposition framework of trustworthiness (Lincoln & Guba, 1985). Trustworthiness encompasses the following criteria; dependability, credibility, transferability and conformability. Credibility was achieved by gaining field experience during the pilot study, conducting multiple focus groups until data saturation was achieved and frequent debriefing sessions with assistant moderators and the study promoters after every focus group session. Triangulation was reached through the use of multi methods of data collection and analysis methods and collection of data word to word (verbatim) through the interviews, observations and field notes. Transferability was applied during the selection of sample through convenient and purposive sampling and in-depth description of methodology and results. Dependability was reached through the use of the same interview guide with each focus group, encouraging participants to share their views, an in-depth description of the methodology and data from the different methods were analysed separately. Finally, conformability was reached by keeping all field notes and transcripts, providing detailed audit trail of what was done and why and returning to the data to verify concordance of findings with the raw data.

Ethical consideration

A letter of informed consent was drawn up and given to each participant and respondent. Ethical approval for this study was obtained from Ethics Committee of the North-West University, Potchefstroom Campus, No. 040M10.

RESULTS AND DISCUSSION

General characteristics of the respondents

Table 1 shows the socio-demographic characteristics of households consuming indigenous food plants. The age profile ranged between 36 and 70 years. The majority of the respondents

had primary education and only a few were employed. Only a few respondents attained tertiary education and were rural based. The rural communities had the highest number of people (greater than 6) living in a household than in urban communities and majority of the households were female headed (Table 1). The ethnic breakdown of the sample was Tswana (85%), Southern Sotho (8%), Xhosa (4%) and Northern Sotho (2%). Thus, the sample was dominated by the Tswana's, the natural inhabitants of the North West Province.

Availability of ITPF by households based on quantitative survey and qualitative data (focus groups) collection in urban and rural communities

Table 2 shows some of ITPF consumed in the study areas, their sources of collection and the main methods of utilisation. The list of ITPF from the questionnaire was compared with the list obtained from the focus groups and inventory made. The food types fell into six categories, namely; legumes and nuts, roots and tubers, grains, leafy vegetables, fruits and medicinal plants. The foods were listed by their familiar local/English and botanical names where available.

Table 1: Socio-demographic characteristics of the respondents

Demographic characteristics	Urban (n=200)		Rural (n=200)	
	n	%	n	%
Gender				
Male	77	39	78	39
Female	123	62	122	61
Age category				
36-40	14	7	16	8
41-45	34	17	23	12
46-50	30	15	41	21
51-55	28	14	31	16
56-60	25	13	27	14
61-65	32	16	32	16
66-70	14	7	15	8
70+	23	12	13	7
Educational level				
Grade 0-7 years	165	83	194	97
Grade 8-12 years	35	18	6	3

Household type				
Female headed	62	31	63	32
Male headed	36	18	23	12
2 parents - only mother working	21	11	24	12
2 parents – only father working	44	22	50	25
2 parents – both parents working	37	19	40	20
Household size				
1-2	56	28	33	17
3-5	113	56	77	38
>6	31	16	90	45
Employment status				
Employed	25	13	2	1
unemployed	63	34	66	39

As one would expect, the rural communities had a greater variety of ITPF available than the urban communities (Table 2). Older participants aged 50 and above from the focus groups noted a decline in the availability of the species. Reasons attributed to this decline were poor soils, insufficient rainfall, over harvesting, over dependency of local consumers on uncultivated plants and deforestration. This is supported by the findings of Mampholo (2004) who found that a decline in the availability of species in these rural communities was associated with poor soil quality and inadequate rainfall.

ITPF in urban communities were mainly sourced from informal markets while the informal markets, bushes, home gardens and outside the village were mostly indicated as source of access in rural communities (Table 2). According to participants from the focus group discussions in rural communities, almost all fruits were gathered from the wild, seasonal in nature and their utilisation was generally lower than that of vegetables.

Table 2: Some commonly available and consumed indigenous and traditional plant foods in urban and rural areas of the North West Province

Local name	English/scientific name	Area where available		Sources where obtained from		Local use	Seasonality	
		Urban	Rural	Urban	Rural		Dry	Wet
Legumes and nuts								
Dinawa tsa setswana	Cowpea	√	√	a, e	a, c, d, e	Snack/relish	√	√
Disata tsa lephutshe	Dried pumpkin seeds		√		a, c, d, e	Snack	√	
Madopi/manoko	Groundnut	√	√	a, e	a, c, d, e	Snack	√	√
***Roots and tubers**								
Dipotata	Sweet potatoes/ *Ipomea batatas*	√	√	a	a, c, d	Food/snack	√	√
Kwele	Wild potato		√		a, b	Snack		√
Kgereswane	-		√		a, b	Snack		√
Mokawa	-		√		a, b	Snack		√
Tlhakwana	Wild potato		√		a, b	Snack		√
Grains								
Mabele	Sorghum/*sorghum bicolor*	√	√	a	a, c, d, e	Food		√
Mmidi	Maize/zea mays	√	√	a	a, c, d, e	Food		√
Leafy Vegetables								
Lefe	*Pentarrhinum insipidum* E. Mey		√		b, c, d,	Relish		√
Morogo wa dinawa	Cowpea / *Vigna unguiculata*	√	√	a	a, c, d, e	Relish		√
Morogo wa lephutshe	Pumpkin leaves/*Cucurbita spp*.	√	√	a	a, c, d, e	Relish		√
Rotlhwe/lerotho	*Spider plant/cleome gynandra* L.	√	√	a	b, c, d, e	Relish		√
Thepe	Common pigweed/ *Amaranthus hybridus* L. subsp.*hybridus*	√	√	a	b, c, d, e	Relish		√
Other vegetables								
Lekatane/lerotse	Wild water melon	√	√	a	a, c, d, e	Food		√
Lephutshe	pumpkin	√	√	a	a, c, d, e	Food		√
≠Lekgomane	Bottle goard, calabash		√	a	a, c, d, e	Food		√
*Mongongo	Ricinodendron ruuianenii		√		b	Relish		√
*Mogaba	Wild cucumber/gherkin		√		b	Snack	√	√
*Mogabala/tsama	Wild melon		√		b	Snack	√	√
*Motentenyane	Goosefoot fat hen		√		b	Relish	√	√
*Sephinya sa baloi	Anthill mushrooms		√		b	Relish/snack		√

*Tamati ya naga	Wild tomato		√		b	Snack	√	√
*Tomposane	leafy vegetable		√		b	Relish		√
*Tswai tswai	leafy vegetable		√		b	Relish		√
Fruits								
*Mochaba	Wild fig		√		a, b, e	Snack	√	√
*Modimowanoka	River bush willow		√		b	Snack	√	√
*Mmilo	Vanguera cyanescens		√		a, b, e	Snack	√	√
*Moretlhwa/dithekwe	Grewa *flava*	√	√	a, b	a, b, e	Snack	√	√
*Mongongo/monyonk-ololo	Purslane		√		a, b, e	Snack	√	√
*Motsotsojane	*Grewia flavesens Juss.Var. Flavescenes*	√	√		a, b	Beverage/snack	√	
Ntshe	Sweet reeds		√	a	a, b , c,d	Snack		√
*Sekgalo	*Ziziphus mucronata*		√	b	a, b, e	Snack/medicine	√	√
*Seretologa	Monkey orange		√		a, b, e	Snack		√
***Medicinal plants**								
Letlhajwa	Bluebush		√	b	a, b	Medicine	√	
Morarana	-		√		a, b	Medicine/rituals	√	
Sekaname	Blue bush		√	a	a, b	Medicine/rituals	√	
Sengaparile	Devils claw (*harpagophytum procumbens)*	√	√	a, b	a, b	Medicine	√	

N.B: only plants cited by more than four respondents have been included in the table

A=market place, B=bushes, C=home gardens, D=ploughing fields E= outside village

**gathered from the wild*

≠*bottle goard calabash can be used as a container*

√ Availability

-no data

Large quantities of TLV were harvested, dried and stored for off season use. Medicinal plants were gathered from the wild and available all year round. Consistent with research by Faber *et al*. (2010) and Vorster (2007), TLV were mostly available in summer. The main methods of utilisation of the plants are shown in Table 2.

Consumption of ITPF: rural and urban communities

Quantitative data from the questionnaire

The frequency consumption of the various ITPF is shown in Table 3. The most commonly and frequently consumed foods in both urban and rural communities were staples such as maize/maize meal, pumpkin, cowpeas, groundnuts and sweet potatoes. Differences existed in the consumption of TLV, water melons, wild water melons, wild fruits, and wild melons which were low in urban communities. The low occurrence of these foods by urban households can be attributed to change in diets and lifestyle as a results of socio-economic conditions as is confirmed by Bourne *et al*, 2002; Frison *et al*, 2004; Vorster *et al*, 2005; Damman *et al*, 2007 and changes in ecology Delisle, 1990. Results further showed that consumption of ITPF tends to be high in female headed households and lower in household type 2 parents – (only mother working) in both communities (Table 1).

Table 3: Consumption frequencies of indigenous and traditional plant foods by respondents

	Urban (n=200)						Rural (n=196)					
Food plant	**Rarely consumed**		**Often consumed**		**Very often consumed**		**Rarely consumed**		**Often consumed**		**Very often consumed**	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Water melons	68	34	132	66	0	0	130	65	66	33	0	3
Wild water melon	120	60	80	40	0	0	158	79	42	21	0	0
TLV	25	83	5	17	0	0	46	32	99	68	0	0
Wild fruits	192	96	8	4	0	0	118	59	82	41	0	0
Wild melons	0	0	0	0	0	0	180	90	20	10	0	0
Sorghum	172	86	28	14	0	0	172	86	28	14	0	0
Maize	0	0	0	0	200	100	0	0	0	0	200	100
Pumpkin	0	0	0	0	200	100	0	0	0	0	200	100
Cowpeas	0	0	0	0	200	100	0	0	0	0	200	100
Groundnuts	0	0	0	0	200	100	0	0	0	0	200	100
Sweet potatoes	10	5	95	190	0	100	0	0	0	0	200	100
Medicinal plants	166	83	34	17	10	5	42	83	9	17	3	5
Wild tomatoes	0	0	6	3	1	1	172	86	26	13	1	1

Rarely consumed *– consumed less than twice a month;* ***Often consumed*** *– consumed two to ten times a month*

Very often consumed *– consumed more than ten times a month*

Price and culture were major factors influencing the consumption of ITPF in the study areas (Table 4). Another strong factor that influenced consumption in urban communities was availability of ITPF. This could be explained by the fact that urban communities lack agricultural land and access to areas where these foods grow. Accessibility (24% in urban versus 15% in rural areas) and diversity in the market place (50% in urban areas versus 43% in rural areas) also played a role in the consumption of ITPF (Table 4).

Table 4: Factors influencing the consumption of indigenous and traditional plant foods among households

Factors	Rural n(200)		Urban (200)	
	n	%	n	%
Price	38	76	50	99
Culture	45	89	42	83
Seasonality / availability	16	31	33	65
Accessibility	8	15	12	24
Diversity in the market place	22	43	25	50

Indigenous and traditional plant foods processing and preparation for consumption

Quantitative data from the questionnaire and qualitative data from the key informant interviews

Table 5 presents various methods cited by the respondents as being used in the preparation and processing of ITPF for consumption in the study areas. The preparation and processing of the different ITPF is discussed more in detail by the key informants in the next section. Of the 44 households that cultivated indigenous and traditional crops (Table 5), sun drying of TLV, wild water melons, groundnuts and cooked maize cobs and addition of ash to the maize and sorghum grains were mentioned as the most common methods of food preservation by households in rural communities. As observed by other researchers, sun drying is regarded as the most common method of preservation in South Africa (Nesamvuni *et al*, 2001; Vorster, 2007) and other African countries (Smith and Eyzaguirre, 2007). Drying of vegetables ensures the availability during times of scarcity (Vorster *et al*, 2007). In the case of leafy vegetables such amaranthus, spider plant, cow pea leaves, pumpkin leaves, all respondents (cultivators of

ITPF) indicated blanching of vegetables prior sun drying (Vorster *et al*, 2005). Blanching of vegetables has shown to improve colour and carotene retention due to inactivation of enzymes, however causes loss of ascorbic acid (Nguni and Mwila, 2007). Drying of food stuff in the open was common amongst households in the rural communities, a practice that has been reported to have an effect on fungal contamination and levels of infestation (Hell *et al*, 2009). Fermentation of maize and sorghum meal was also common in the study areas (Table 5). Freezing and the making of jam were also used in the preservation of food by urban households (Table 5). Different methods of cooking were used in the preparation of ITPF (Table 5). However, according to the key informants all fruits were consumed raw.

Table 5: Methods used by households to prepare/process indigenous and traditional plant foods

Preparation	Urban (N=200)		Rural (N=200)		Processing /preservation	Urban (N=200)		Rural (N=200)	
	n	%	n	%		n	%	N	%
Boiling	200	100	200	100	**Sun drying**	0	0	44	100
Grilling	70	35	128	64	**Freezing**	25	13	0	0
Mashing	199	100	194	97	**Jam making**	17	9	8	4
Stewing	200	100	198	99	**Add pesticide/ash**	0	0	44	100
Roasting	198	99	200	100	**Fermentation**	195	98	200	100
					Blanching	0	0	44	100

The key informants were also asked to indicate the recipes they use in preparation of the most important and consumed TLV in the study areas. Three recipes were mentioned to prepare fresh/dry cowpea leaves in all the study areas. The fresh leaves were sorted, cleaned, washed and cut if preferred. The leaves were boiled or steamed in a little amount of water together with salt and oil for half an hour or until the liquid runs dry. Two variations for this method were mentioned; the addition of chopped onion, tomatoes, sometimes potatoes and carrots and cooked until the liquid runs dry. In urban communities, the key informants mentioned the addition of mushrooms, green peppers and beef stock and stewed further for 10 minutes. The addition of aforementioned vegetables and condiments depended on the availability of funds in

the households (Faber *et al*, 2010). Another variation was to add groundnut powder just 10 minutes before the end of the cooking time. According to the key informants, groundnut powder was used as it increases nutrient density and enhances palatability. Key informants from the urban communities suggested the addition of peanut butter instead of groundnut powder to give the mixture a soft texture. The use of oil in the preparation of vegetables has shown to aid in the absorption of β-carotene (Hedrén *et al*., 2002). The dried cowpea leaves were prepared similar to fresh leaves, however, they were first soaked in water to soften for about 20 minutes, hence reduced cooking time. The water used for soaking was discarded, a practice that can lead to nutrient loss.

Other recipes mentioned by the key informants were “lerotho” (spider plant) and “thepe” (amaranthus). During preparation, the fresh leaves are boiled in just enough water with salt and oil added. Sometimes chopped onions and tomatoes are added and cooked until the liquid runs dry. Another variation will be to fry onions and tomatoes separately and added to the cooked leaves and stewed further for 10 minutes. The dried spider plant and amanthus leaves were prepared in the same way as dried cow pea leaves. Pumpkin leaves and flowers were cooked in the same as other fresh vegetables. TLV were prepared as relish and served as an accompaniment with starchy dishes. Other vegetables such as tubers (sweet potatoes) and pumpkins were boiled and mashed. Other dishes and beverages common in the study areas are shown in Table 6.

Table 6: Popular dishes and beverages in the North West Province

Traditional name	English name
Cereals and bread	
Bogobe jwa lekatane	Melon porridge
Bogobe jwa mabele	Sorghum/maize meal stiff porridge
Bogobe jwa mashi/ntiyane	Milk porridge
Diphaphatha	Flat bread
Dikuku/magwinya	Fat cakes
Kabu	cooked dried maize
kabu	Cooked and roasted mealies
Matlebelenkwane	Dumplings/sorghum dumplings
Mosutlhwane	Sorghum and bean
Motogo wa mabele/papa	Sorghum/maize meal porridge
Ting	Fermented sorghum/maize meal porridge
Setampa	Boiled samp
Polokwe	Fresh mealie balls
Vegetables and fruits	
Morogo wa dinawa/thepe/rotlhwe/	Cowpea leaves/amaranthus/spider plant
lerotho	Pumpkin leaves
Lekatane	Boiled wild watermelon
Lephutshe	Boiled/mashed pumpkin
Lengangale	Dried wild watermelon
lekgomane	Boiled bottle goard
Meat and meat products	
Digwapa	Bilton/dried meat
Mala le mogodu	Boiled intestines
Mokoto	Offals from different organs
Nama ya kgomo/pudi/nku/kolobe/tonki	Boiled/fried/stewed chicken, beef, goat, pork,
Serobe	Tripe stew
Menoto	Chicken legs
Sebete	Fried liver
Nama ya kgogo	Roasted traditional chicken
Seswaa	Pounded meat
Marapo a nama	Beef bones
Ditlhakwana	Cooked cowheels
Legumes and nuts	
Dikgobe/lohata	Samp and beans/groundnuts/bambara groundnuts
Manoko/manoko	Roasted nuts
Sopo ya dinawa	Bean soup
Ditloo	Cooked bambara groundnuts
Beverages	
Bojalwa jwa setswana	Sorghum beer
Gemere	Ginger beer
Khadi	Alcoholic beverages made from roots, yeast etc
Kgomodimetseng tea	Mint tea
kgodu	Melon juice

Consumers' knowledge of ITPF based on qualitative data collection

(Observation and focus group discussions)

With regard to consumers' knowledge about ITPF, results indicated that knowledge varies widely among age, gender and between communities. Observations showed that the younger consumers (aged 35-49) had difficulties recalling known ITPF while the older group (aged 50 and above) who retained their preference for ITPF were able to recall more plants. This finding

suggests that younger consumers' might have less knowledge of ITPF than the older consumers. Older consumers (aged 50 and above) also mentioned the potential health benefits of consuming ITPF particularly TLV and legumes.

As far as gender is concerned, men had limited knowledge compared to women mainly due to division of labour. In South Africa, the collection and knowledge of TLV is still a practice associated with women (Jansen van Rensburg *et al*., 2007). According to Van Averberk and Juma (2006), men only become involved especially when the production is commercialized. It was further observed that consumers in the rural communities are generally more knowledgeable about ITPF than consumers in urban communities. In the urban communities, knowledge was often limited particularly among consumers who had resided in urban areas most or all of their lives and had little contact with the rural area.

Cultivation of indigenous crops

Quantitative data from the questionnaire and qualitative data from focus group discussions and observation

Although the commercial value of indigenous crops as well as their role in food security has been highlighted in other studies (Venter *et al*, 2007), in the present study, their production is very low. Of the 400 respondents, only 11% cultivated indigenous and traditional crops and were from the rural communities. Observation shows that the cultivation of modern vegetables in the study areas was more common than indigenous and tradtional crops. While the practice of subsistence food production in home gardens is evident in urban communities, in this study, there was no cultivation of indigenous and traditional crops by urban households. These findings suggest promotion of urban agriculture and home gardens that could play a potential role in alleviating problems of food insecurity (Neegard *et al*, 2009).

In rural home gardens were used for cultivation and usually occupied about 78% of the area under food production. According to one participant from the focus groups, "*growing in backyard gardens is less demanding with regard to management and inputs"*. Theft from the ploughing fields was mentioned as common phenomenon and therefore *"staying close to our crops offers an opportunity to keep an eye on them"* said one of the participants. In this study,

primary crops cultivated are shown in Table 7. Results revealed that, out of the diverse species available in the rural area (Table 2), fewer crop varieties than expected were cultivated. According to the participants of the focus group discussions, the production of certain species was based on the aspect of ease of cultivation, pests and diseases resistance, high nutrient content and low inputs of water and fertilizers. This finding indicates clearly the advantage of indigenous and traditional crops over exotic crops as the latter lack drought, pest and diseases tolerance (Jansen van Rensburg *et al*, 2004; Van der Walt *et al*, 2005).The main indigenous food production period is between October and April (Vorster *et al*, 2008). Vegetables such as amaranthus, spider plant and other vegetables occurring in the wild are harvested wherever they occur, in particular where manure or household refuse has been left in piles near homes, and whenever they are available, which is mainly during the rainy season (Mnzava, 1997).

Table 7: Common indigenous and traditional plant foods cultivated in rural communities (n=44)

Plant common name	Scientific Name	Part of plant used	n	%
1. Maize	*Zea mays*	Grains	44	100
2. Sorghum	*Sorghum bicolor (*L*) moench*	Grains	7	15
3.Cow pea	*Vigna unguiculata*	seeds and leaves	10	22
4.Cowpea	*Vigna sinensis*	leaves and leaves	10	22
5.Wild water melon	*Cucumis melo* L.	Flesh/fruit and seeds	32	63
6. Water melon	*Citrullus*	Flesh/fruit and seeds	38	76
7. Groundnut	*Arachis hypogea*	Seeds	7	15
8. Sweet potatoes	*Ipomea batatas*	Edible tubers	5	10
9. Pumpkins	*Cucurbita pepo*	Flesh/fruit and leaves	27	53
10. Sweet reeds/cane	*Sorghum bicolor*	Stem	3	7
11. Calabash	*Lagenaria siceraria*	Leaves, fruit and seeds	13	30

Table 8 presents land preparation activities and fertilizers used cited by the respondents as being used in the cultivation of indigenous and traditional crops. Tractors and donkeys were the most commonly used methods of preparing the land for cultivation followed by cultivation by hand. The use of organic fertilisers by households in the production of indigenous crops is evident in this study (Table 8). Therefore, this provides a good opportunity for the promotion of organic farming that could be a platform for a market niche for most of the rural households (Nguni and Mwila, 2007).

Table 8: Land preparation activities and fertilizers used by cultivators of indigenous and traditional plant crops (n=44)

Land preparation activities	n	%	Types of fertilizers	n	%
Tractors	16	37	**Cattle**	14	31
Donkeys	11	24	**Goat**	2	4
Cultivation by hand	14	31	**chicken**	4	9

Table 9 presents factors constraining the production of indigenous and traditional crops cited by cultivators of indigenous and traditional crops. Lack of markets for indigenous crops, insufficient rainfall and diseases and pests were cited as the major cultivation problems followed by lack of capital to buy farming implements, veld fires and poor soil quality (Table 9). During the focus group discussions, cultivators expressed a desire to own their agricultural machinery and desired an intervention from the government in this regard.

Table 9: Factors constraining the production of indigenous and traditional plant foods as mentioned by respondents (n=44)

Factors	n	%
Lack of capital to buy farming implements	27	61
Insufficient rainfall	35	80
Poor soil quality	13	30
Diseases and pests	34	77
Veld fires	22	50
Lack of markets for indigenous and traditional crops	42	95

With regard to the issue of water provision, most cultivators do not have piped water and therefore, during dry days they are compelled to fetch water from central water points or from neighbours with boreholes. All respondents cultivate crops for exclusively for home consumption and families exhaust their supply before the next harvest. This can be explained by the magnitude of production being too small for sale. The survey further revealed that 95% of households involved in the cultivation of indigenous and traditional foods used their owned saved seeds from the previous season to plant while 5% obtained them from relatives and neighbours. No seeds were reported to be bought from stores.

Results indicate that the majority of the cultivators of indigenous and traditional crops were from age category 46-50 years (27%), followed by age category 61-65 years (24%). The least occurring age category was 41-45 years (1%). More female (69%) than male (31%) growers were indicated. This result shows the persistent dominance of women in agriculture, a trend observed in other studies (FAO, 1995; Posel and Casale, 2001). Results indicated that 36% of growers were within household type 2 parents - both parents working, followed by household type 2 parents - only father working (29%) and household type 2 parents - only mother working (17%). The household type occuring the least was male-headed (13%).

CONCLUSION

From this study, it is evident that there is a limited number of ITPF species known, cultivated and consumed. Consumers especially old people were found to possess extensive knowledge regarding the availability of ITPF species, their habitat, their uses, information regarding their seasonality and the potential health benefits of consuming TLV and legumes. By knowing which plants are less available or facing extinction can be useful in identifying species and conserve them. In spite of the fact that ITPF have always ensured food security in many households, in the study, their production was too low and exclusively for home consumption. This can be explained by land which was insufficient to cater for households needs. The fact that most respondents from the rural communities were unemployed, inadequacies in such resources may force the community to exploit the natural resources. There is a need to intensify education on conservation of natural resources and more studies should be undertaken to document and disseminate traditional food systems. In addition, there is a need to integrate existing health and nutrition interventions with traditional food promotion.

A lack of cultivation of indigenous crops in urban areas by households calls for promotion of urban agriculture and home gardens that could play a role alleviating problems of nutrition security as well as sensitizing the communities on the nutritional and health value of ITPF. Regrettable, due to seasonal variation of some indigenous and traditional plant foods especially TLV which are abundant during rainy season, and the fact that preserved crops do not last the entire dry season, interventions aiming at promoting exotic vegetables during off-peak season (dry season) are recommended. Of all the TLV used for relish purposes, cowpea leaves, amaranthus, spider plant and pumpkin leaves were found to be the most popular and processed for preservation through sun drying after blanching. There is a need to assess the nutritive status of the preserved vegetables with a view of improving the processes and minimising nutrient loss. The major constraints to consumption of indigenous leafy vegetables were price, culture, seasonality/availability, accessibility and diversity in the market place. An intervention is needed in this regard that aims at promoting the production, utilisation and commercialization of ITPF.

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CHAPTER 5

CONSUMERS' BELIEFS ON INDIGENOUS AND TRADITIONAL FOODS AND ACCEPTANCE OF PRODUCTS MADE WITH COWPEA LEAVES

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Consumers' beliefs on indigenous and traditional foods and acceptance of products made with cow pea leaves

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The study was conducted to obtain background information on consumers' beliefs on indigenous and traditional foods (ITF) and to assess consumers' acceptance of, preference for and intended consumption of products made with cowpea leaves. Four focus groups investigated consumers' beliefs on ITF. Thematic analysis identified three major themes in relation to ITF consumption. These were benefits of ITF consumption, barriers of ITF consumption as well as suggestions on how to increase ITF consumption. Consumers' acceptance of, preference for and intended consumption of products made with cowpea leaves were assessed by 87 respondents. A 5-point hedonic scale and 7-point food action rating scale was used for sensory evaluation. Sample B (bean leaves stewed with tomatoes, potatoes and onions with salt and vegetable oil added) was scored statistically higher for acceptance of general appearance, colour, smell, texture and taste with means ≥4 on a 5-point hedonic scale by respondents of the total study sample. The acceptability, preference and intended consumption of samples differed significantly between the communities, age groups and education levels. Overall, Sample B was the most acceptable, preferred and respondents' intended to eat it more often than the others except for acceptance by respondents from Tlakgameng.

Key words: Consumers, consumers' beliefs, consumption intent, cow pea leaves, preference, product acceptance

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INTRODUCTION

Increasing consumption of fruits and vegetables has been one of the strategies to eliminate micro-nutrient deficiency in Sub-Saharan Africa (WHO/FAO, 2003). Approximately 3 million deaths a year are attributed to diseases relating to inadequate fruit and vegetable intake (WHO/ FAO, 2003). Fruit and vegetable intake in South Africa are lower than recommendations by the World Health Orginization (WHO) (Maunder and Meaker, 2007), which contributes to inadequate nutrient intake and the overall burden of diseases (Labadarios *et al.*, 1999). Dietary intake of traditional leafy vegetables (TLV) have been reported to have healing properties, serve as a source of micronutrients (Flyman and Afolayan, 2006; Hassan and Umar, 2006; Frison, 2007) and reduce the risk of cardiovascular diseases and other degenerative diseases (Smith and Eyzaguirre, 2007). It also represents inexpensive but high quality nutrition sources for nutritionally vulnerable communities (Odhav *et al.*, 2007).

For the purpose of this study, traditional leafy vegetables (TLV) and indigenous and traditional foods (ITF) are vegetables/foods that are either native to a particular region, or were introduced to that region for a long period to evolve through natural processes or farmer selection, including both wild and traditionally cultivated vegetables/foods by the natives in a region.

Previous studies have shown that TLV adapt well to harsh environments, are easy to grow, requiring simpler technology and low inputs(Van der Walt et al, 2005) and have the ability to resist pathogens, thus requiring fewer chemicals and pesticides (Abukutsa-Onyango, 2007). Despite the self reported contribution of TLV to health, nutrition and food security at household level in South Africa, several studies reported that the production and consumption of TLV has declined (Nesamvuni *et al.*, 2001; Mbhenyane et al., 2005; Faber *et al.*, 2007). Some of the reasons mentioned are limited knowledge of the nutritional content of TLV (Modi *et al.*, 2006), the lost of indigenous knowledge, the association of utilisation thereof with poverty and low esteem among rural communities (Modi *et al.*, 2006). This decreased tendency in the utilization and cultivation of TLV necessitates the exploration of consumers' beliefs on these vegetables. A belief is an opinion or assumption about something that a consumer consider as the truth (Bareham, 1995; Hornby, 2005) that could be attained about a food such as TLV through exposure to, or remarks about the product, possibly influencing their attitudes and consequently guide their consumption behaviour (acceptance) (Bareham, 1995).

Sensory characteristics of food such as appearance, smell, texture and taste, also play an important role in consumers' decision to consume a particular food. Although several studies concerning the acceptability of indigenous and traditional foods (ITF) are reported (Davel *et al.*, 2003; Khumalo, 2007; Mkanda, 2007; Simela *et al.*, 2008), reports on acceptability of TLV in particular are limited. Research on the acceptability of food is needed to determine the impact of taste and preference on dietary intake patterns of consumers that can be used to improve the general acceptance of indigenous plant foods (Babu, 2000). For the purpose of this study, the leaves of Cowpeas (*Vigna inguiculata* L.) which are indigenous to Africa were investigated for acceptability. A variety of Cowpea species exist making it one of the most widely grown, versatile and nutritious traditional legume. It provides consumable leaves, immature pods, and peas (with a long shelf life) providing protein, vitamins and minerals (Vorster *et al.*, 2008 and 2007; Jansen van Rensburg *et al.*, 2007). The objectives of this study were therefore: Firstly, to obtain background information on consumers' beliefs of (ITF in general) using focus group discussions. Secondly, to assess the acceptance of, preference for, and intended consumption of products made with cowpea leaves with untrained consumer sensory panels

MATERIALS AND METHODS

Study location

This study was a sub-study in a broader larger study. The main aim of the broader study is to provide empirical evidence of how the role of biodiversity can be translated into improved health status in contemporary poor rural and urban communities in the North West Province of South Africa. The focus of this sub-study was to explore ways of promoting the utilization of traditional and indigenous foods to urban and rural communities that could possibly lead to increased indigenous knowledge and dietary diversity. To reach the objectives of this sub-study, research was conducted in two phases, namely (i) a qualitative phase using focus group discussions and (ii) a quantitative phase, using sensory evaluation. The selection of participants for this study was purposive and based on a defined set of criteria discussed in the next section.

Study design

It was a multi phased study consisted of an explorative and experimental phase in urban and rural communities.

Qualitative research: Focus group discussions

Sampling

Four focus groups were conducted by the researcher, two in rural (Ganyesa) and two in urban (Potchefstroom) communities over a period of two months to investigate consumers' beliefs about ITF. To recruit participants, specially arranged meetings by the local leaders were held at the Kgotla primarily to introduce the researcher to the communities, to inform them about the study, to elicit support and to invite participants to participate in the study. Participants were recruited according to inclusion criteria based on a specific purpose rather than randomly, in order to obtain insights into a phenomenon (Strydom and Delport, 2005) and to meet the objectives of this study. Criteria for selection were that prospective participants be male and female, aged older than 20, residing in the selected communities and be knowledgeable on the indigenous and traditional foods of the area. Specific questions were asked regarding availability, cultivation, preparation, consumption and general knowledge of ITF in the area to determine whether each participant complied with the inclusion criteria. Ten to twelve participants signed an informed consent form before participating in each session after which the qualitative standard of saturation was met (Guest et al., 2006).

Focus group questions

A semi structured questioning procedure was used to ensure consistency in questions asked across groups, yet allowing for some flexibility in accordance with topics raised and level of participation within the focus groups (Neumark-Sztainer et al., 1999). Questions were primarily aimed at investigating consumers' beliefs about ITF. The questions were first translated into Setswana and then reformulated into a conversational form to stimulate the discussion. Data

saturation was met during the fourth focus group, since no new information or themes were observed and it represented an adequate sample size (Guest et al., 2006).

The following are the five questions used:

1. Let's talk about indigenous and traditional foods. What comes to your mind when you hear the words indigenous and traditional?
2. Do you have concerns about the foods families eat?
3. Can you tell me positive things about indigenous and traditional foods
4. can you tell me negatives things about indigenous and traditional foods
5. Of all the things we have discussed, what do you think can be done to motivate consumers to eat these foods?

Conducting the focus groups

At the commencement of the study, participants were introduced to the moderator (researcher) and assistant moderators who were responsible for making observations, operating the tape recorder, taking notes and handling the logistics. Ground rules as indicated by Krueger and King (1998) were also presented regarding confidentiality, respect for the beliefs of the others and the importance of honesty to the participants. Verbal consent for the voice recording of the sessions was obtained. Participants were informed that the voice recordings will be transcribed without using their names and that the recordings will be discarded after data analysis.

The use of local language Setswana, by the moderator maximized the group's cohesiveness and openness while maintaining cultural homogeneity and language use. Each group discussion lasted approximately 90 minutes, after which everyone enjoyed something to eat and drink. On completion of the focus group discussions, discussions of similar recurring and important themes were summarised and compared in context of the socio-demographics of the study population.

DATA ANALYSIS

The focus groups transcripts were analysed using thematic content analysis (Creswell, 2009). The voice recordings were transcribed verbatim to contribute to the trustworthiness of the data. The written transcripts were then carefully translated from Setswana into English and compared with the field notes to ensure that the meaning of the data was represented correctly. Using the transcripts and field notes, the moderator reviewed the data for the purpose of determining trends and identifies major themes or patterns emerging (Krueger, 2000). Predominant themes and sub-themes were noted, outlined and coded. (Rossman & Rallis, 1998).

Trustworthiness

This study relied on Guba's (as quoted in Shenton, 2004) framework of trustworthiness. Credibility was achieved by gaining field experience during the pilot study, establishing participants' trust through prolonged engagement, allowing sufficient time for group discussions and conducting focus groups until data saturation. Triangulation was reached through debriefing sessions with moderators, verbatim transcription of focus group recordings and managing data parallel to field work. Transferability was applied during purposive sampling and using direct quotations when presenting findings. Dependability was reached through conducting multiple focus groups, using a detailed interview guide, encouraging participants to share their beliefs, verifying findings with participants and an in-depth description of the methodology. Finally, conformability was achieved by keeping all field notes and transcripts, providing a detailed audit trail of procedures and verifying the raw data.

Quantitative research: Sensory evaluation

Respondents

A total of 87 volunteers from Black communities aged 20-78 years participated at central locations (Stone and Sidel, 2004). Twenty nine respondents each from an urban township west of Potchefstroom in the southern Kenneth Kaunda district and two rural communities in the northern Bophorima district of the North West Province were recruited to participate in this phase of the study to test the acceptability of different dishes made from Cowpeas.

Convenience sampling was using and the participants were untrained to act as taste panels. To reduce potential bias, selection inclusion criteria were: from both genders; aged older than 20; residing in the selected communities; have a primary education; be willing to taste the products and not be allergic to groundnuts since one of the samples contained groundnuts as an ingredient. Before commencing the sample testing, respondents signed a written informed consent.

Food Sample preparation and presentation

Three different dishes made from cowpea leaves harvested in the study area were tested for acceptability. Recipes were developed using the information gathered from the participants in phase one of this study and standardised, while procedures regarding preparation, handling and serving were also standardised and pre-tested. Three different dishes of cowpea leaves were prepared: (A) cowpea leaves cooked with salt and vegetable oil; (B) cowpea leaves stewed with tomatoes, potatoes and onions with salt and vegetable oil added; and (C) cowpea leaves cooked with groundnut powder, salt and vegetable oil. These recipes were selected to be representative of the main popular recipes to prepare relish and are regarded as highly important in the Setswana tradition in the study communities. Sufficient samples were prepared, transported to the testing sites and served steaming hot in preheated serving containers. Three different samples labelled with digit random numbers were presented to respondents on trays to be evaluated in random order.

The questionnaire

The questionnaire was pre-tested in English to ensure that it was well understood and to be completed within reasonable time. After the pilot study, questions were reformulated and translated into Setswana. The final version was back-translated into English to ensure the retaining of the original meaning. The questionnaire consisted of two sections, namely demographic questions and the sensory score sheet. The score sheet included a 5-point hedonic scale to measure sample acceptance of each attribute and a 7-point food action rating scale (FACT) to score consumption intent of each sample. The hedonic scale ranged from 5=extremely acceptable to 1=extremely unacceptable. Response categories on the FACT scale

were 1= I will never eat it; 2= I would eat this when no other food is available; 3= I would eat this if available, but would not go out of my way; 4= I would eat it now and then/occasionally (once a month); 5= I would eat this frequently (once a week); 6= I would eat this very often (twice a week) and 7= I would eat it everyday.

Consumer acceptability and preference tests

The scales and the main sensory attributes were explained to the respondents and an example was provided to demonstrate the scale properties and its use. On each scale respondents were asked to mark the number that best describe the degree of acceptance of “appearance”, “colour”, “smell”, “texture”, “taste”, and “overall acceptance” of each sample. Secondly, a question on preference of one sample above the other followed and finally, respondents’ consumption intent regarding each sample was requested. Respondents rinsed their mouths before and in-between samples.

Statistical analysis

The sensory evaluation responses were analysed with Windows SAS system, version 9.1 (SAS Institute Inc, 2003) and the demographic data using FREQ procedure of SAS. Mixed models ANOVA ($P \leq 0.05$) were used to determine significant differences in hedonic scores of each sample. The SAS® procedure PROC MIXED was used for mixed models. Significant differences between samples of various groups were examined with Post-hoc tests ($P \leq 0.05$). For the non-parametric variable “consumption intent” which did not have equal distances between the categories, significant differences in median within groups were determined using the Kruskal-Wallis and Mann-Whitney tests (Field, 2005). Partial least squares analysis was used to determine which attribute best predicted consumption intent and preference. Chi-square tests were performed to determine if there was a difference in the proportion of biographical groups’ preferences towards the samples ($P \leq 0.05$). Only statistically significant differences were discussed in the results.

Ethical consideration

A letter of informed consent was drawn up and given to each participant and respondent. Ethical approval for this study was obtained from the Ethics Committee of the North-West University, Potchefstroom Campus, No. 040M10.

RESULTS AND DISCUSSION

Focus groups (Qualitative)

The recruitment procedure produced a gender balance across the communities with 23 male and 23 female. Eleven of the participants were employed, 11 were unemployed, 12 were pensioners, six were self employed and six had part time jobs. Nine participants were aged between 20 and 30, eight were aged 31-40, 10 were aged 41-50 and 19 were aged older than 50. No participant had a tertiary education.

Three major themes identified from the focus group discussions were (i) benefits of indigenous and traditional food consumption (ii) barriers of indigenous and traditional food consumption and (iii) suggestions as to increase indigenous and traditional food consumption. Under each major theme, sub themes were identified.

Theme 1: Benefits of indigenous and traditional food consumption

Health and nutrition

Health and nutrition was the most important reason for the consumption of indigenous foods by most participants from rural communities. Indigenous and traditional foods were believed to be of a higher quality, particularly in terms of freshness (as the cycle from harvesting to consumption is shorter), to be nutritious, natural, unrefined, produced locally and associated with health benefits (*"They are natures foods and it's that naturalness in them that makes them healthy and nutritious" [female, aged 50-59, urban,]*). Older participants from the rural communities spontaneously mentioned the ability of ITF to prevent diseases (*"Indigenous foods*

have health healing properties. Medicinal plants such as blue bush, Kalahari grewia, and devil's claw were used both as beverages and as medicine" [male, aged 60+, rural]). Participants often compared ITF with "modern foods" and considered "modern foods" as unhealthy. These findings confirmed the beliefs that TLVs are high quality nutrition sources for nutritionally vulnerable communities (Odhav *et al.*, 2007) to prevent or reduce degenerative diseases (Smith and Eyzaguirre, 2007).

Food safety

Concerns regarding the safety of modern foods were expressed such as healthiness, food contamination, ethical issues, animal welfare and the environment. . Similar concerns about food safety in general have been reported in a number of studies (Smith and Riethmuller, 2000a; Brewer and Prestat (2002); Renee, 2010). Concerns about the presence of preservatives, antibiotics and pesticide residues in modern food were considered unethical and also motivated the consumption of ITF by some older participants from the rural community. Participants believed ITF to be safe, natural, and pure without processing or manipulation after production ("*The food we eat nowadays is not safe. It is contaminated by fertilizers and chemicals that can harm the body especially if one does not wash or boil her/his vegetables thoroughly" [50-59, urban, female]*). However, younger participants (aged 20-39) from both communities did not express any ethical issues (*"...the taste of food is what matters to me. The modern food production and processing techniques make food tastier" [male, aged 20-29, urban]*). Participants older than 40 years considered food packaging as unnecessary and harmful to the environment ("...*the selling of indigenous foods without packaging supports the Government initiative to prevent harm to the environment" [female, aged 40-49, rural]*). These findings suggest that the older participants are well aware of the inputs of fertilizers on the production of modern foods and the dangers related to the use of pesticides, while food safety of modern foods seemed not be as important to younger participants.

Tradition and culture

Tradition and culture seemed to be important in relation to ITF consumption. (*"Indigenous foods are foods that have evolved from centuries, they form part of the tradition and we are content about them" [male, aged 50-59, rural]*). These participants also believed ITF to be

transferred from one generation to another and that it has been consumed over a long period (*"I still eat them the way I was taught at home by my parents in the past and continue eating according to those habits" [male, aged 50-59, rural])* and they continued to value their traditional food cultures. Extensive food preparation and a greater variety of food consumed during special ceremonies and events were largely related to beliefs on tradition ("*I remember Sundays were very special to us. My mum and sisters would prepare a very big meal and we will all gather and share the lunch/food together. A lot of times we had people coming over, relatives, friends of the family and my mum will just prepare a lot of food and we all share. You know, life was just too good" [male, aged 60+, rural]*). The term "indigenous" thus triggered nostalgic memories and emotions such as joy, warmth and sadness. Similarly, Guerrero et al. (2009) and Chambers (2007) found that ITF were consumed for cultural, traditional and heritage reasons. Participants however considered ITF to be diminishing regarding production and consumption because of socio-economic changes and modern foods.

Theme 2: Barriers of indigenous and traditional food consumption

Lack of knowledge and skills on food preparation and nutrition information

The majority of younger (aged 20-40) participants, in both communities mentioned the need for knowledge and skills to prepare ITF, which was believed to be time consuming as compared to "modern foods" (*"...indigenous foods takes time to process and prepare and are therefore not suitable for a busy lifestyle like mine" [male, aged 30-39, rural]*). Consistent with research by Larson et al. (2006), younger participants found it more difficult to consume ITF due to barriers such as a lack of knowledge and skills on preparation of ITF. Limited nutritional information on ITF products were also considered a barrier ("...*how does one knows that they are healthy because there is a lack of information to prove this" [female, aged 30-39, rural]*) leaving participants sceptical since the nutritional value is not proven. Similarly, research has indicated a lack of information as a barrier to make consistently healthy choices (McGee et al., 2008) and information about nutritional qualities can increase the acceptability of food (Kahkoen et al., 1996) and thus consumption. Participants from both communities believed that they were insufficiently informed about ITF by their parents ("*I don't know how to cook them. It will be nice if they could show us how to prepare them*" *[female aged 20-29, urban]*; *"If my mother has raised me eating indigenous foods, I would have learnt to prepare and eat them" [male, aged*

30-39, rural]). However some elderly who were knowledgeable about the preparation of ITF blamed this on urbanization, modernization and a lack of the interest regarding indigenous knowledge by the youth (*"Modernisation and urbanisation has brought a lot of changes in terms of the eating habits of our children. They now refuse to eat traditional foods" [female, aged 60+, rural]*). The early introduction of ITF into the meals of young children, might teach them to prepare and consumer it thereby increasing indigenous knowledge (Smith, 1995). Research shows that familiar ingredients, increase consumer acceptance of food as compared to those unfamiliar Older participants were knowledgeable about cooking of ITF and tend to blame the lack of preparation skills of younger participants on urbanization and changing lifestyles. Smith (1995) recommended that early introduction of ITF into the meals of young children, might teach consumers to prepare and eat it which also implies increased knowledge. Familiar food increase consumer acceptance as compared to those unfamiliar (Bech-Larsen **et al.**, 2001) although repeated exposure to the taste of unfamiliar food could also significantly increased consumer acceptance and hence consumption (Wardle *et al.*, 2003).

Negative image and unfamiliarity

The younger participants associated ITF with "*a lifestyle that was too traditional and old fashioned*". Younger participants (aged 20-29) from both communities did not identify with

ITF and took pride in their preference and consumption of "*modern foods*" associating ITF with "*poor people's food*", "*traditional*" lifestyle and "*food of the older generation*". This could be due to a lack of exposure, unfamiliarity with ITF and believing that older generations have the time, knowledge and skills to prepare ITF. Younger participants found ITF rather revolting and undesirable. Examples of some of the undesirable themes emerge from quotes from urban and rural youngsters are: *"The thought of indigenous foods makes me sick. ...they forced us to eat the sorghum porridge and the vegetables everyday.....the taste, smell and even the texture of these foods was awful." These y*ounger consumers' beliefs regarding ITF were thus negative which plays a significant role in determining product acceptance and consumption (Damman *et al.*, 2007; Frison, 2007). Their strongly negative beliefs might be explained as a type of rejection caused by unfamiliarity (Rozin and Fallon, 1987). Older participants blamed a lack of knowledge transfer between generations for younger generation's beliefs and pickiness (*"as*

parents we should also take the blame for not passing on the knowledge about traditional foods to our children" [male, aged 50-59, urban]).

Different beliefs on ITF with regard to sub-themes "sensory acceptability", "cost and availability" and "convenience" could not be fitted under either the category of benefits or barriers of ITF consumption as the statements made were contradictory. However, these differences were critical and determined whether a person was likely to consume ITF or not.

Sensory acceptability

Major differences in participants' beliefs regarding the sensory attributes of ITF were found. As indicated in the previous section too, older participants (≥40 years) were more positive considering ITF tastier and more appealing than "*modern foods*" with unique attributes. (*"Indigenous foods taste better than exotic foods and the cooking is easier, need no condiments to enhance the flavour" [female, age 40-49, rural]; "Indigenous foods are made with natural ingredients, processed naturally and grown naturally and therefore taste really good" [male, aged 60+, rural]*).

On the contrary, younger participants put more emphasis on the importance of taste, smell and texture as reasons for not consuming ITF. The unacceptable taste of ITF was more important than their health benefits (*"Indigenous foods may be healthy, but the taste of food is more important" [male, aged 20-29, urban]; "The taste, smell and even the texture of these foods is awful ... and ... amaranths and spider plant have a bitter taste that makes it unacceptable" [female, aged 20-29, urban]; "The taste, appearance and quality of indigenous foods are not as good as that of modern foods" [male, aged 20-29, rural].*).

Cost and availability

Older participants (≥40 years) residing in the rural communities believed ITF to be highly available and therefore cheaper as compared to "*modern foods*". (*"They are locally grown and thus make them plentiful and inexpensive" [male, aged 60+, rural]; "They are inexpensive compared to modern foods and they are naturally grown, cheap to produce and maintain" [male, aged 40-49, rural]*).

However, most participants from urban communities identified *"cost and availability" as a* barrier to ITF acquisition. Indigenous and traditional foods were believed as being more expensive than "*modern foods*" (*"Indigenous vegetables have become more expensive than conventional ones due to limited availability and seasonality" [female, aged 40-49, urban]*). A lack of diversity and choice was evident for urban participants due to the absence of ITF in supermarkets and restaurants (*"there's no variety of ITF in the market place and so we end up buying modern foods" [male, aged 50-59, urban]*).

Convenience

There were differences in the beliefs of participants' from both communities regarding "convenience". Some older participants believed that ITF were more convenient than "modern foods" in terms of food preparation (*"Indigenous foods make life easier in the sense that they are easy to prepare" [male, aged 60+, rural]*). An older participant from the urban community however indicated ITF is less convenient, due to its absence in supermarkets *("I prefer convenience foods over indigenous foods because they make my life easier as they are quick to prepare" [female, aged 60+, urban]*). Overall, issues of convenience were most often raised by women who were more concerned about food preparation (*"Preparing an indigenous meal can be a daunting task and time consuming especially when you have a busy lifestyle like mine. We need foods that are easy to prepare" [female, aged 40-49, urban]*).

Theme 3: Suggestions to motivate consumers to consume indigenous and traditional foods

Participants made a number of important suggestions to motivate consumers to eat ITF, namely:

- Promotional education to create awareness on health benefits and preparation of ITF using different media. (*"...the use of media like TV, magazines, radio and newspaper could help spread the message about the importance of consuming indigenous foods" [female, aged 20-29, urban]).*
- Increase the availability of ITF in formal and informal markets through commercialization of ITF (*"Commercializing indigenous crops will make them more accessible ..." [female, aged 20-29, rural]; "If we can have them available in supermarkets ... we would consume them" [female, aged 30-39, urban]*). Older participants also recommended

using home gardens to produce ITF to increase availability and to alleviate hunger and food insecurities in poor households, contributing to self reliance and indigenous knowledge.

- Marketing of ITF on television and using acceptability studies to promote ITF product development ("*Marketing indigenous foods on TV especially on children's programmes will be the best way to advertise these foods". [female, aged 20-29, urban]).*

- Providing in-store samples of ITF was highly recommended by younger participants to taste the food before consumers consider buying it (*"Food fairs especially in towns can also help create awareness where food demonstrators can showcase their skills and allow people to taste indigenous foods" [female, aged 30-39, urban]*).

- Gradual transition and introduction of ITF in family meals to familiarise young children with these foods (*"As parents we should introduce these foods gradually in our diets so that our children can eat or get to like them" [male, aged 50-59, urban]*).

Sensory evaluation (quantitative)

A total of 87 respondents (46 male and 41 female) completed the sensory evaluation questionnaire. The majority had a primary education (n=60), of which 27 where from the rural area while only two respondents attained a tertiary education and both were rurally based.

Acceptance, overall acceptance and consumption intent of total study sample

The mean sensory acceptance scores for the "general appearance", "colour", "smell", "texture", "taste", "overall acceptance" and "consumption intent" for the pooled data of the total study population are presented in Table 1. Statistically significant differences were found between the means for acceptability of all attributes, overall acceptance of the samples and the consumption intent of the total study population. Sample B (bean leaves stewed with tomatoes, potatoes, onions, salt and vegetable oil) was scored significantly more acceptable (means ≥4.4 on a 5-point hedonic scale) than sample A (means≥3.0) and C (means≥3.3) for all attributes and is therefore the most acceptable overall. Acceptance of colour, texture and taste of the three samples differed significantly from one another with sample B in all cases being the most acceptable. For acceptance of colour, sample A was scored higher than sample C, while for

texture and taste sample C was scored higher than sample A. There was however no significant differences (P>0.05) between sample A and C regarding acceptance of general appearance and smell as well as overall acceptance, while sample B had a significant higher score than both samples. Sample A was the least acceptable for texture and taste and sample C for colour. Consistent with research by Bosman *et al.* (1997) and Scholtz and Bosman (2005), the high acceptance scores for the individual attributes for sample B can be interpreted as a true reflection of product acceptance by the respondents.

Consumption intent was also high for sample B with a median food action rating of 6 (5; 7), which denoted that consumers would eat sample B very often (twice a week), while they would consume samples A and C only frequently (once a week). This supports previous research that has demonstrated a positive relationship between acceptance and consumption intent of food products (Scholtz and Bosman, 2005).

Table 1: Acceptability of attributes and consumption intent (median) of cowpea leaves samples of consumers in the total study sample (n=87)

[+] Mean scores and standard errors for sensory attributes							
Food sample	**General appearance**	**Colour**	**Smell**	**Texture**	**Taste**	**Overall Acceptance**	**[#]Consumption Intent[≠]**
A	3.32±0.12[b]	3.83±0.11[b]	3.66±0.13[b]	2.98±0.13[c]	2.97±0.13[c]	3.33±1.20[b]	5 (2;6)[b]
B	4.66±0.12[a]	4.69±0.12[a]	4.56±0.13[a]	4.38±0.13[a]	4.59±0.13[a]	4.57±0.53[a]	6 (5,7)[a]
C	3.57±0.12[b]	3.29±0.11[c]	3.46±0.13[b]	3.56±0.13[b]	3.55±0.13[b]	3.45±1.01[b]	5 (4;7)[b]
P values	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

Samples with different superscripts differed statistically significant (p<0.05)

[+] *Hedonic scores: 1 = extremely unacceptable; 2 = unacceptable; 3 = neither acceptable nor unacceptable; 4 = acceptable; and 5 = extremely acceptable*

[#] Consumption intent is reported as median (lower quartile; upper quartile); Kruskal-Wallis was performed because the data was non-parametric

[≠] *Food action rating scale: 1 = I will never eat it 2 = I would eat this when no other food is available 3 = I would eat this if available but would not go out of my way 4 = I would eat it now and then/occasionally (once a month) 5 = I would eat it frequently (once a week) 6 = I would eat this very often (twice a week), 7 = I would eat it everyday*

Acceptance testing for different demographic groups

According to the results differences in acceptability of food sample attributes and overall acceptability were observed between the communities (Table 2). No significant differences in acceptance of all attributes and overall acceptability (P=0.0001) were however found between communities for sample B, which was indicated as being the most acceptable sample. Although significantly different from sample B, acceptance of samples A and C did however not differ from each other for most attributes between the communities.

These results indicate that the general tendency of respondents from Potchefstroom and Ganyesa towards sample A (cowpea leaves cooked with salt and vegetable oil) and sample C (cowpea leaves cooked with groundnut powder, salt and vegetable oil) fell within an unacceptable to acceptable range (2.3-3.6) as compared to sample B ranging from acceptable to highly acceptable (4.0-4.8) (results not shown). Respondents from Tlakgameng (deep rural) scored acceptance of most attributes of samples A and C significantly higher than respondents from Ganyesa (rural) and Potchefstroom (urban). This may be explained by preference differences and the method of food sample preparation or other personal and cultural factors (Thompson et al., 1999), such as sample B being currently more familiar.

With regard to age, respondents 20-30 , 41-50 and 50+ years scored the acceptability of sample B significantly higher (means=3.8-4.5; 4.6-4.8 and 4.4-4.9 respectively) for all attributes than samples A (means=2.3-3.2; 3.3-4.0 and 3.0-4.0 respectively) and C (means=2.8-3.3; 2.9-3.3 and 3.6-4.0 respectively) (results not shown). The age group 20-30 years found no difference in acceptance of samples A and C for most attributes (means=2.3-3.3;), which was also true for the 41-50 year age group. In the case of age group 31-40 years respondents also scored the acceptance of sample B (means=4.3-4.8) higher than the other samples while no differences were found between samples A (means=2.8-4.0) and C (means=3.7-4.0) for most attributes. Similarly, the age group 50+) years also found no difference in acceptance of samples A and C for most attributes.

According to these results indicating the main effect of age, younger respondents (20-30 years) scored samples' acceptability of general appearance (means=3.5; P=0.0171), colour (means=3.6; P=0.0036), smell (means=3.6; P=0.0462) and overall acceptability (means=3.5;

P=0.0077) significantly lower than the respondents in the 50+ age groups. Although significantly lower, the younger respondents mean scores however still indicated the samples to be acceptable. Both the 20-30 and 50+ age groups' acceptance scores for all attributes did not differ from those of the 31-40 and 41-50 age categories. No differences were found between all age groups for the acceptance of texture and taste.

The influence of age on food acceptability and consumption is well documented (Guàrdia et al., 2008; Niva and Mäkelä, 2007)., Despite differences for acceptability of food samples between respondents of the age categories 20-30 and 50+ years in the present study, these differences as well as overall acceptability showed that sample B was considered highly acceptable by respondents of all age groups.

Among genders**,** there were no differences between males' and females' acceptance of food samples for colour (P=0.7522), smell (P=0.5522), texture (P=0.4292**),** taste (P=0.9078) and overall acceptability (P=0.4014), while general appearance had a borderline P-value (P=0.0439). Male and female respondents scored the acceptability of sample B (4.25-4.78; acceptable to highly acceptable) higher than samples A (2.89-3.89; neutral to acceptable) and C (3.26-3.62; neutral to acceptable) (results not shown). Acceptance of general appearance, smell and overall acceptability of samples A and C was also not scored differently by both genders, while both scored texture and taste of sample C higher than A.

Evidence from literature suggests that gender differences exist in relation to food consumption (Bogue et al., 2005). A study by Vorster (2007) revealed that men insisted on eating meat, leaving TLV for women and children. Consequently, indigenous vegetables are regarded women's crops. Findings from the present study showed that there were no positive association between acceptability of food samples and gender, a tendency which was also observed in consumption intent. However, within gender, male and female respondents scored the acceptability and consumption intent of sample B higher than those of sample A and C.

With regard to educational levels, significant differences in acceptance of samples were observed between respondents with a primary and secondary education (P=0.001) and between the samples within the education groups. Respondents with a primary education scored the acceptability of sample B (4.57-4.76; highly acceptable) significantly higher for all

attributes than sample A and C. No significant differences were found in acceptance of sample A and C for all attributes (3.30-3.86; neutral) except for colour. However, respondents with a secondary education only scored the acceptance of sample B higher with regard to general appearance, taste, and overall acceptability. These respondents scored the acceptance of sample C higher than sample A for general appearance and taste while they did not differ regarding acceptance of smell, texture and overall acceptability of sample A and C.

Education is also recognised as an important factor influencing food acceptance (Corredor et al., 2010; Simela et al., 2008). In the present study, significant differences in acceptance of samples were observed between respondents with primary and secondary education and between the samples within the education groups. Respondents within both primary and secondary education scored the acceptability of sample B higher on all attributes than sample A and C (except for colour by respondents with secondary education).

Table 2: Acceptability of attributes and consumption intent (median) for cowpea leaves samples of respondents in Potchefstroom, Ganyesa and Tlakgameng (n=87)

[+]Mean scores and standard errors for sensory attributes

	Potchefstroom n=29				Ganyesa n=29				Tlakgameng n=29				
Food sample	**A**	**B**	**C**	***P-value**	**A**	**B**	**C**	***P-value**	**A**	**B**	**C**	***P-value**	**°P-value**
Acceptance[+]													
General appearance	3.16±0.13^{c}	4.68±0.14^{a}	2.94±0.13^{c}		2.56±0.24^{c}	4.79±0.24^{a}	3.61±0.24^{b}		4.32±0.18^{ab}	4.57±0.19^{a}	4.15±0.17^{ab}		0.0001
Colour	3.60±0.12^{c}	4.72±0.13^{a}	2.83±0.13^{cd}	0.0001	3.19±0.26^{c}	4.59±0.27^{a}	3.32±0.23^{c}	0.0001	4.67±0.16^{a}	4.64±0.17^{a}	3.86±1.56^{b}	0.2323	0.0001
Smell	3.37 ±0.18^{b}	4.67±0.19^{a}	3.01±0.15^{c}		3.15±0.26^{c}	4.20±0.27^{a}	3.19±0.26^{c}		4.50±0.16^{a}	4.72±0.16^{a}	4.28±0.14^{a}		0.0001
Texture	2.59±0.14^{c}	4.59±0.15^{a}	3.10±0.15^{bc}	0.0001	2.32±0.30^{c}	4.03±0.30^{a}	2.96±0.30^{c}	0.0005	3.94±0.18^{b}	4.51±0.18^{a}	4.42±0.17^{a}	0.0018	0.0001
Taste	2.79±0.18^{c}	4.74±0.19^{a}	3.34±0.18^{bc}		2.51±0.26^{c}	4.52±0.26^{a}	3.22±0.28^{c}		3.81±0.19^{ab}	4.42±0.19^{a}	4.10±0.18^{a}		0.0001
Overall	3.06±0.20^{bc}	4.70±0.07^{a}	3.05±0.09^{bc}	0.0001	2.76±0.24^{c}	4.45±0.12^{a}	3.23±0.22^{b}	0.0120	4.25±0.09^{a}	4.59±0.09^{a}	4.09±0.17^{a}	0.0950	0.0001
acceptability	5 (3; 6)^{b}	6 (5; 7)^{a}	4 (3; 5)^{b}		3 (1; 7)^{b}	6 (4; 7)^{a}	4 (3; 6)^{b}	0.0008	5 (4; 6)^{b}	5 (5; 7)^{ab}	7 (5; 7)^{a}		0.0029
[#]Consumption				0.0001								0.0477	
intent[≠]								0.0001					
				0.0001								0.0624	
								0.0001					
				0.0001								0.0193	
								0.0140					
				0.0005								0.0629	

Samples with different superscripts differed statistically significant ($p<0.05$) within each community and over different communities.

* P-value between food samples within different communities

°P- values between food samples and communities

[+] *Hedonic scores: 1 = extremely unacceptable; 2 = unacceptable; 3 = neither acceptable nor unacceptable; 4 = acceptable; and 5 = extremely acceptable*

[#]Consumption intent is reported as median (lower quartile; upper quartile); Kruskal-Wallis was performed because the data was non-parametric

[≠] *Food action rating scale: 1= I will never eat it, 2 = I would eat this when no other food is available*
3 = I would eat this if available but would not go out of my way
4 = I would eat it now and then/occasionally (once a month), 5 = I would eat it frequently (once a week)
6 = I would eat this very often (twice a week) and 7 = I would eat it everyday.

Consumer preference testing

Respondent's preference for each food sample within the total study population, all the communities, genders, age groups and educational levels showed that sample B was the most preferred food sample (Table 3). Preference for the samples differed between respondents from the different communities (chi square: 13.13; P=0.01). More respondents from Ganyesa showed a preference for sample B (89.7%) than Tlakgameng (51.7%) where a higher percentage of respondents preferred sample C (34.5%) than from other communities. No significant differences were found between genders (chi square: 0.97; P=0.62) (Table 3). A higher percentage of respondents of the age group 50+ preferred (chi square: 15.01, P=0.02) sample C (35%) than the other age groups. The preference of the 50+ group can be associated with a greater sense of tradition, product familiarity and knowledge of traditional food, as supported previous by research showing a high correlation between food choice and local tradition (Laureati et al., 2006). Significant differences existed (chi square: 5.97; P=0.05) between preferences of respondents with different educational levels. A higher percentage of respondents (88%) with secondary education preferred sample B than those with primary education. According to Partial least squares analysis (results not shown), acceptance of texture of the food samples was more important than other attributes to drive preference. Texture and mouth feel of food and beverages were previously found to play a dominant role in food acceptance and preference (Bosman et al., 1997; Guinard and Mazzuchelli, 1996) and identification of food (Rolls et al., 2003). However, texture is often taken for granted by consumers unless it is definitely inappropriate or expectations are violated (Szczesniak, 2002). In the present study**,** the comparative acceptance for texture could have been attributed to the combination of different ingredients used in the preparation of the food samples, such as the tomato and onion in sample B, that might have masked the natural colour and the texture of the dried bean leaves that could be less acceptable in samples A and C, since a combination of different ingredients could make formerly disliked foods more acceptable (De Moura, 2007).

Table 3: Percentage of respondents preferring food samples (A, B and C) for i) communities, ii) gender, iii) age and iv) educational levels

i)	**Frequency of preference of food samples (%)**		
Community	A	B	C
Potchefstroom	17.2	72.4	10.3
Ganyesa	3.45	89.7	6.9
Tlakgameng	13.8	51.7	34.5
ii)	**Frequency of preference of food samples (%)**		
Gender	**A**	**B**	**C**
Male	8.5	72.3	19.2
Female	14.3	71.4	14.3
iii)	**Frequency of preference of food samples (%)**		
Age groups	**A**	**B**	**C**
20-30	8.7	82.6	8.7
31-40	0.0	85.0	15.0
41-50	26.1	65.2	8.70
50+	8.7	56.5	34.8
iv)	**Frequency of preference of food samples (%)**		
Educational level	**A**	**B**	**C**
Primary	16.1	64.5	19.4
Secondary	0	88.0	12.0

Intended consumption of food samples

Significant differences (P=0.0029) in consumption intent were found between the communities, indicating that respondents from deep rural Tlakgameng differed from those from urban Potchefstroom and rural Ganyesa. Respondents from the deep rural intended to consume all three food samples (P>0.05) as frequently as between once a week and every day, while those from Potchefstroom and Ganyesa intended to consume sample B more frequent (twice a week to every day) than samples A (once a month to twice a week) and C (once a week to everyday). No differences were found for respondents' intended consumption (once to twice a week) of sample B between the three different communities.

There were no significant differences reported in consumption intent of the samples between age categories (P=0.1328) and genders (P=0.6183). Significant differences in consumption intent however existed between the food samples within different age and gender groups. For samples A and C consumption intent increased with age with respondents in the age category 20-30 years intending to eat sample A only when no other food is available and sample C occasionally (once a month), while those from the 50+ year category intended to eat sample A frequently (once a week) and sample C very often (twice a week). On the contrary the respondents from the age group 20-30 years intended to eat sample B more frequently (twice a week) than the age group 50+ (once a week). Thus, intention to eat food samples A and C increased with age, since the better intended consumption of sample A and C by older respondents could be explained in relation to their acceptance of the sensory attributes and familiarity with these samples. Product familiarity has been shown to influence traditional food consumption which indicates that consumers' who attached more importance to a familiar product are more likely to consume a traditional food product (Laureati et al., 2006; Pieniak et al., 2009).

Both male and female respondents intended to consume sample B more frequently (twice a week) than sample A (once a week). Male respondents intended to eat both samples A and C once a week, while female respondents intended to eat sample A once a week and sample C only once a month.

As far as the level of education is concerned, significant differences were reported for consumption intent of respondents between the two educational groups (P=0.0035) and between samples within the primary (P=0.0150) and secondary education groups (P=0.0057) Respondents of both education levels intended to consume sample B twice a week while those with a primary education intended to consume sample A more frequently (once a week) than those with a secondary education (I would eat this if no other food is available but would not go out of my way). Surprisingly consumption intent of sample B did not differ from sample C by respondents from both education groups.

According to Partial least squares analysis (not shown in a table), acceptance of taste of the food samples was more important than other attributes to drive consumption intent. Numerous studies have confirmed that taste is the single largest determinant of food consumption

(Verbeke, 2001) confirming the findings of Bosman et al. (1997) and Clark (1998) also reporting flavour as the most determining factor in food consumption

CONCLUSION

Health and nutrition; tradition and culture; and food safety emerged as drivers for ITF consumption, whereas lack of knowledge and skills on food preparation; negative beliefs and image; and unfamiliarity of ITF acted as barriers. Bean leaves stewed with tomatoes, potatoes, onions, salt and vegetable oil was the most acceptable and preferred dish and respondents indicate an intention to consume it more often than the other samples. However, the older participants preferred the more traditional way of cooking (samples A and C). That comply with the findings of the focus group discussions that the older participants indicated that ITF are natural, fresh, less complex and healthy as compared to “modern” foods. Younger participants’ negative beliefs and dislike of ITF determined their lower product acceptance and intended consumption of the less modernized dishes (samples A and C). The differences in the beliefs and acceptance of the different age generations indicate that childhood exposure to ITF might have influenced the positive beliefs of older respondents that were formed and expressed as nostalgic memories and other emotions. On the contrary to the lack of exposure of younger respondents to TLV, precipitated in negative beliefs and low acceptance of ITF due to unfamiliarity and a lack of knowledge with these products. These younger participants were thus unlikely to increase ITF consumption regardless of older participants’ beliefs that it is natural and healthy due to their preference for familiarity with modern foods.

It is evident that traditional ITF should be modernized (as in the case of sample B) to improve the image of TLV in order to improve acceptability, preference and consumption by younger consumers, thereby presenting food product developers and marketers with the opportunity to make more acceptable ITF product available. Furthermore, younger respondents’ complaints about the lack of commercial availability of convenient ITF highlight that these new products should be sold in retail outlets in a packaged convenience food format that would attract the attention of all consumers. A positive experience regarding the image and sensory attributes of such products by especially younger consumers might result in changing their negative beliefs and thus their acceptance, preference and consumption behaviour. Simultaneously, the older consumer market might also be reached with these more modernized ITF using affective

marketing strategies that might positively change their beliefs about “modern” foods. Marketing messages such as “old-fashioned but new” or “traditional but more convenient” might reach both younger and older consumer markets by triggering nostalgic memories by older consumers while addressing younger consumers’ needs for convenient, tasty and fashionable food products.

Participants also emphasized the need for information that aims to increase awareness on the health and nutritional benefits of ITF, as well as the skills to prepare it, especially among younger consumers that might lead to increased consumption. The need for education is thus crucial in order to preserve and extent the knowledge of ITF. Childhood exposure and education on TLV could be initiated at primary school level by incorporating these products into school feeding programmes in a tasty way, while consumer studies classes can teach children to cook healthy, but tasty TLV dishes, while motivating to prepare it at home.

These findings can also be used as a strategy to promote the production and consumption of ITF resulting in better health related to ITF. Overall, the need to understand consumer behaviour is important in the acceptance of and preference for ITF taking into consideration cultural and traditional values, consumers’ beliefs and childhood exposure to products that guide consumer decision making about food selection and intended use.

The sample used in the present exploratory study was not representative of the South African population, therefore more qualitative and quantitative work needs to be done with a larger, representative sample so that the results can be generalised to the South African population. Additional research is needed to address consumer acceptance of ITF especially in children in order to increase children’s acceptance of ITF that are previously experienced as unacceptable.

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CHAPTER 6

GENERAL SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

CHAPTER 6: GENERAL SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

In this chapter, a summary of the main findings from the research reported in this thesis will be given. As the results of each section of the study has already been discussed, interpreted and compared to the relevant literature in the preceding chapters, only a general integration of the conclusions and recommendations based on the study findings will subsequently be made.

6.2 Main findings

Comparison of nutritional status of consumers and non-consumers of traditional and indigenous leafy vegetables

The study showed that consumers of TLVs were found to be more common in rural than in urban communities, mostly because in rural communities TLVs can more easily be accessed or harvested during the growing season. In this study, no household was reported to consume TLVs more than ten times per month, which is surprising since the dietary data was collected during the rainy summer months, being a peak season for TLVs use. This may indicate a decline in the production and consumption of TLVs, a concern widely expressed in literature (Nesamvuni *et al*., 2001; Modi, 2003; Mbhenyane *et al*., 2005). In the present study a number of factors have shown to constraint the consumption of TLVs, such as price (affordability) and to a lesser extent availability due to easy-to-get-to points of purchase and seasonal influences, especially in urban communities. The reliance of urban households on the informal markets as a source of TLVs is an indication that trading of TLVs thus have an economic value and potential to be explored.

In this study, the high macronutrient intake by urban participants followed the same trend with the high total cholesterol levels of non-consumers of TLVs as an indication that urban diets contain a diet richer in animal products than rural diets. This finding was confirmed by Macintyre *et al*. (2002) who found that urban diets are generally more westernized and

diversified and often contain more animal products with added fats/oils than rural diets. When comparing the intake of iron, calcium, zinc and vitamin C between consumers and non-consumers of TLVs, no differences were found between the groups although one would expect some differences if taken into account the high nutrient content of TLVs. However, the lack of knowledge on the nutrient composition and bioavailability of nutrients from TLV constitutes one of the main barriers to obtaining complete information on nutrient intake. This emphasised the lack of information regarding nutrient composition and bioavailability of these nutrients.

Another significant finding was that urban consumers and non-consumers of TLVs were more likely to experience the risk of high blood pressure (OR 1.29, 95% CI, 0.7-2.5) than rural consumers and non-consumers. This again emphasised the interrelated dynamics of the nutrition and health transition as described by former research (Vorster *et al*., 2000; Vorster & Kruger, 2006; Vorster *et al*., 2007; Vorster *et al*., 2011).

Utilisation of indigenous and traditional plant foods

Availability and consumption of ITPF in rural and urban communities

A comprehensive list of ITPF including their sources, uses and seasonality found in both rural and urban communities under study was compiled (see Chapter 4 Table 2). As expected, the rural communities reported more ITPF species which they utilised than the urban communities. In addition, a decline in the availability of species in both communities was noted due to poor soils, insufficient rainfall, over harvesting, over dependency of local consumers on uncultivated plants and deforestration. The frequency of consumption provided an indication on the various ITPF consumed in the households. Findings from the study showed that consumption of staples such as maize/maize meal, groundnuts and sweet potatoes was common in both communities. However, differences existed in the consumption of TLVs, wild fruits, wild melons, wild water melons, and sorghum which were high in rural households. Price and culture were major factors influencing the consumption of ITPF in both communities followed by availability, accessibility and diversity in the market place, especially in urban communities.

Indigenous and traditional plant food processing and preparation for consumption

Differences in food processing and preparation of ITPF existed between the communities. In rural communities sun drying was shown to be the principal mode of extending the shelf-life of food products (Nesamvuni *et al*., 2001; Vorster, 2007) and ensured the availability during times of scarcity (Vorster *et al.*, 2007). Sun drying in this study was only practiced by rural households involved in the cultivation of ITPF. It was found that TLVs were blanched before drying and that drying was done in the open, a practice that has been reported to have an effect on fungal contamination and levels of infestation (Hell *et al*., 2009).

Fermentation of maize and sorghum meal was common in the both communities under study. However, freezing and the making of jam were other food preservative methods mainly common in urban areas. With regard to ITPF preparation for consumption, generally, the households in both communities used boiling, stewing, mashing, steaming, roasting and grilling. Addition of oil [which, according to Hedrén *et al*. (2002), was shown to aid in the absorption of β-carotene], salt, tomatoes, onions, carrots and condiments was a common practice in both communities under study. However, the addition of aforementioned vegetables and condiments depended on the availability of funds in the household (Faber *et al*., 2010). Furthermore, from observation, recipes in urban areas were characterized by ingredients such as carrots, tomatoes, onion and sweet peppers. This knowledge gained on food preparation practices emphasised the need of a holistic approach which include proper and safe methods of food processing at home to ensure that nutrient values of food are maintained at the highest level possible when planning interventions to promote diet diversity.

Consumers' knowledge of ITPF and the cultivation of indigenous crops

In this study, indigenous knowledge (IK) on food plant species available varied widely among age, gender and between communities. Older consumers were found to possess extensive knowledge regarding the availability of ITPF species, their habitat and uses, information regarding seasonality. Furthermore, knowledge was widely distributed in rural areas between women, but men had limited knowledge thereof.

Of the 400 users and non-users of ITPF in this study, only 11% were involved in the production of indigenous crops and were from the rural areas. The production of indigenous crops was low, limited to a number of species, and restricted to household consumption. In this study, there was no production of indigenous crops in urban households. Observation showed that the cultivation of modern vegetables in the study areas was more common than indigenous crops due to the fact that cultivation is done on a small scale. However, a lack of markets for indigenous crops, insufficient rainfall and diseases were cited as the major cultivation problems followed by the lack of capital to buy farming implements, field fires and poor soil quality. With regard to the issue of who the cultivators were, results indicated that more women than men were involved in the production of indigenous crops, cultivators were within age category 45-50 years and were within household type with two parents - both parents working which is an indication that socio-economic circumstances have a major influence on agricultural activities.

Consumers' views on indigenous and traditional (ITF) foods and acceptance of cowpea leaves products

Based on the qualitative focus group discussions, factors that influence the consumption of ITF were identified as (i) benefits and (ii) barriers, as well as suggestions as to increase indigenous and traditional food consumption. Health and nutrition, tradition and culture, and food safety emerged as drivers for ITF consumption. On the contrary, a lack of knowledge and skills on food preparation and the negative image and unfamiliarity of ITF acted as barriers. Findings of this study showed differences in views between older and younger consumers with regard to ITF consumption. In general, younger consumers found ITF rather revolting and undesirable and they see it as a humiliation to consume, while older consumers reported positive views. The negative views by younger consumers can be related to their unfamiliarity with these food products, since familiarity is a factor shown to positively influence traditional food consumption behaviour (Pieniak *et al*., 2009), but sometimes to stigmatisation as food for the poor (Damman *et al*., 2007; Modi *et al*., 2006).

In the study consumption of ITF was closely connected to the culture and the identity of the older participants from both communities and therefore carried a symbolic value. Specific issues of concern about food safety related to food production and handling of "modern foods" were raised by older consumers. Such issues include the use of antibiotics, chemical residues

and environmental contaminants which presumably acted as a benefit to continue consuming ITF.

Although sensory characteristics of food did not influence ITF consumption by older consumers, results indicated that younger consumers attached more importance to the taste, smell and texture of ITF than the health benefits of food despite being viewed as natural. In this study, comparisons regarding the cost and availability of ITF were made with that of “modern foods”. Due to a high diversity of cultivated ITF in subsistence, older consumers’ residing in the rural communities viewed ITF to be cheaper than “modern foods” whereas urban consumers’ considered them expensive. This might be attributed to availability because of seasonal influences and availability of ITF because of easy-to-get-to point of purchase which discouraged ITF consumption.

Preparation of ITF by young consumers was considered time consuming as compared to “modern foods” which was considered relatively quick. Older consumers tended to blame the lack of preparation skills of younger consumers on urbanization and changing lifestyles. The above mentioned factors must be considered in the promotion of ITF as they influence consumption.

Another major objective of this study was to assess the acceptance of, preference for and intended consumption of products made with cowpea leaves with untrained consumer sensory panels. Statistical analysis for the pooled data of the total study population showed that significant differences existed between food samples’ means for acceptability of all attributes, overall acceptance and the consumption intent of the total study population. Overall, sample B (bean leaves stewed with tomatoes, potatoes with onions and salt and vegetable oil added) was more acceptable than samples A (cowpea leaves cooked with salt and vegetable oil and C (cowpea leaves cooked with groundnut powder, salt and vegetable oil). In this study, socio-demographic backgrounds such as place of residence (urban and rural), levels of education and age have been shown to influence the acceptability of food samples by consumers. However, no positive association between acceptability of food samples and gender, a factor recognised in many studies as influential in food consumption (Bogue *et al*., 2005; Vorster, 2007) were found. Differences were observed in the acceptability of food sample attributes and overall acceptability between the communities. Respondents from Tlakgameng, a deep rural

area, scored acceptance of attributes higher than respondents in other communities for sample C and A, except for general appearance. However, no significant differences were found between the communities for sample B.

With regard to respondents' preference for food samples, sample B was the most preferred. Respondents' preference for each sample was influenced by place of residence (community), age, gender and education level. Preference for the samples differed between the respondents from the different communities and between age groups while no significant differences were found between gender groups. The high preference for sample C by older respondents (aged 50 and above) was associated with tradition, product familiarity with and knowledge of the food sample. In this study, texture of food samples was found to be more important than other attributes to drive preference.

Consumption intent was also influenced by place of residence, age, and education. Significant differences in consumption intent were found between the communities which showed a similar trend as to acceptance of food samples A and C. Respondents in Tlakgameng intended to eat all food samples as frequently as between once a week and everyday while those in Potchefstroom and Ganyesa intended to consume sample B more frequently (twice a week) than samples A and C. This is an indication that product acceptance overall could indicate intention to eat. There were no significant differences reported between age categories and gender groups in samples; however, significant differences in age groups existed in intention to eat food samples A and C. Younger respondents (20-30 years) only intended to eat sample A when no other food is available and sample C occasionally, while older respondents (aged 50 and above) intended to eat these samples frequently (once a week) and very often (twice a week), respectively. These low scores by younger respondents could be related to food unfamiliarity as shown in other studies (Pieniak *et al*., 2009; Laureati *et al*., 2006). Both male and female respondents intended to consume sample B more frequently than sample A. As far as education is concerned, significant differences were reported between consumption intent of respondents with a primary and secondary education. Respondents with a primary education intended to consume sample A more frequently (once a week) than those with a secondary education (if no other food is available). Respondents of both educational levels intented to consume sample B twice a week. In the present study, the taste of the food samples was more

important that other attributes to drive consumption intent, a finding similar to research findings of Bosman *et al*. (1997) and Clark (1998).

6.3 Conclusions and recommendations

Health profile study

This study has found significant differences between the diets of rural and urban participants. The high macronutrient intake in the diets of urban participants is an indication that urban diets are richer in animal products than rural diets as indicated by many researchers. In terms of micronutrient intake between consumers and non-consumers of TLV, unexpectatedly no differences were found between these groups considering the high nutrient content of TLV. However, the lack of knowledge on the nutrient composition and bioavailability of nutrients from TLV constitutes one of the main barriers in obtaining complete information on nutrient intake. More research is needed to investigate the health effects of these vegetables. From the literature it is evident that dietary diversity should be encouraged which include five portions of fruit and vegetables a day. From the study it is not clear if there is a health benefit from TLVs compared with modern vegetables; however, taking culture into consideration TLV should be included as part of diet diversity, especially by poor and rural communities. In addition, food and nutrition professionals also need to focus research efforts on indentifying the specific TLVs that are desirable, along with frequency of consumption guidelines and recommended preparation techniques according to lifestyle changes building on existing knowledge.

Utilisation of indigenous and traditional plant foods study

Despite the significance of indigenous and traditional plant foods to food security and livelihoods, in this study there is a limited number of ITPF species known, cultivated and consumed in the study areas. However, a survey on home gardens conducted in the same study areas showed a higher number of indigenous useful plant species (Molebatsi *et al*., 2010), an indication that knowledge is eroding. Consequently, more attention needs to be paid to indigenous and traditional plants and food crops in order to increase their contribution to food security and the variety of ways in which this can be done from household consumption to commercialisation. A lack of household cultivation of indigenous crops in urban areas calls for

promotion of urban agriculture and home gardens that could play a role in alleviating problems of nutrition security as well as sensitising the communities on the nutritional and health value of ITPF. Regrettably, due to seasonal variation of some indigenous and traditional plant foods, especially TLV which are abundant during rainy seasons, and the fact that preserved crops do not last the entire dry season, interventions aiming at promoting modern vegetables during off-peak season (dry season) are recommended by researchers. Of all the TLVs used for relish purposes, cowpea leaves, amaranthus, spider plant and pumpkin leaves were found to be the most popular and processed for preservation through sun drying after blanching. There is a need to assess the nutritive status of the preserved vegetables with a view of improving the processes and minimising nutrient loss. In addition, acceptable preparation methods of TLVs are called for.

Consumers' views on traditional and indigenous foods and acceptance of cowpea leaves products

This study made use of a mixed-methods approach including qualitative (focus group discussions) and quantitative research (sensory evaluation of food samples). By integrating the different methods, it was possible to identify factors that influence consumption of ITF from focus group discussions and how they relate to influence acceptability, preference and consumption intent. In this study, important benefits (drivers) and barriers to ITF consumption as well as suggestions on how to increase ITF consumption were identified. Barriers to ITF consumption and low scores of acceptability of food samples provided by younger participants for sample A (cowpea leaves cooked with salt and vegetable oil) and C (cowpea leaves cooked with groundnut powder, salt and vegetable oil) could be connected to the misconceptions made about ITF by younger participants and the lack of familiarity with these products. Therefore, a combination of strategies aimed at enhancing individual awareness of the health benefits of ITF, decreasing barriers and conducting more acceptability studies might have a positive impact on the younger segment of the population. The importance of sensory attributes in food choice and consumption cannot be ignored, and thus food and nutrition professionals need to focus research efforts on indentifying the specific TLVs that are preferred, to help increase the acceptability of these vegetables. Additional research is needed to address consumer acceptance of ITF, especially in children in order to increase their acceptance of ITF that are previously experienced as unacceptable.

6.4 Limitations of the study

- One of the major limitations in the health profile study is that the South African food composition tables do not include the analyses of nutrients of all TLV and the bioavailability of nutrients from all TLV's is not known. The lack of knowledge on the nutrient composition and bioavailability of nutrients from TLV constitutes one of the main barriers in obtaining complete information on nutrient intake. Since malnutrition is common in sub-Saharan Africa, information about bioavailability of micronutrients would be of fundamental importance in addressing dietary deficiencies in impoverished African rural communities.
- Because of the nature of the small convenience sample in sensory analysis which had a large effect size, statistically significant differences were important in practice. Therefore it is recommended that sensory analysis be repeated with a larger sample. In addition, the sample used in the present exploratory study was not representative of the South African population, therefore more qualitative and quantitative work needs to be done with a larger, representative sample so that the results can be generalised to the South African population.
- In the consumer study, the large differences in the acceptability of scores between sample A, B and C in the different communities could have been attributed by the fact that sample B was prepared in a modernised and westernised away and therefore more familiar with the respondents from urban (Potchefstroom) and rural (Ganyesa) communities than those in the deep rural area (Tlakgameng) who had a more "traditional" lifestyle. Food samples which are balanced in terms of locality and preparation are recommended to minimise these differences.
- This study was done in the NWP of SA, including only the Setswana speaking population which is not representative to the whole of SA. Therefore, studies are needed in other areas as there are many ethnic groups with different cultures, beliefs and eating habits.

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ADDENDA

ADDENDUM A: Comparison of health between consumers and non-consumers of traditional and indigenous leafy vegetables

APPOINTMENT LETTER AND INFORMED CONSENT

QUANTITATIVE FOOD FREQUENCY QUESTIONNAIRE

POTCHEFSTROOM CAMPUS: FACULTY OF HEALTH SCIENCES

PURE-SA Project (Prospective Urban and Rural Epidemiology)

APPOINTMENT LETTER

Dear Participant

Thank you for being willing to help us in this very important project. We are sure that the project will contribute to improve health of all the people of the North West Province.

The aim of the project is to get enough information regarding the development of chronic diseases like Diabetes, Stroke, Lung disease and Heart disease with urbanisation to plan appropriate health and nutrition intervention strategies. At the time you receive this letter you would have been visited by a fieldworker and you already have filled out several questionnaires and signed consent to give a blood sample. This letter serves to inform you of the date and time the blood sample and other measurements will be done at the premises of the North-West University on the Potchefstroom Campus.

IMPORTANT INFORMATION

1. You will be picked up by a taxi accompanied by Ms Susan Legwete on **……** by 0….h00. Susan will tell you the place where you will be picked up.
2. You **MUST NOT EAT OR DRINK** anything after ten o'clock of the previous night (10 pm of the night before). This is necessary for the glucose test to be accurate.
3. You **MUST BRING YOUR ID DOCUMENT** with you
4. Your taxi fare will be paid by us and you will receive food after the blood sample is taken.
5. If you are employed, please show this letter to your employer.

Dear Employer

This serves to ask you to give one day's paid leave to……. in order to allow him/her to attend his appointment with the research team of the PURE-SA study at the North-West University.

Thank you for your cooperation. For any further information please contact Dr A Kruger at 082 7715778

POTCHEFSTROOM CAMPUS

PURE-SA Project
INFORMED CONSENT FORM

Title of the project: PURE-Project (Prospective Urban and Rural Epidemiology)

INFORMED CONSENT

I, the undersigned …… (full names) read/listened to the information on the project in PART 1 and PART 2 of this document and I declare that I understand the information. I had the opportunity to discuss aspects of the project with the project leader and I declare that I participate in the project as a volunteer. I hereby give my consent to be a subject in this project
.
I indemnify the University, also any employee or student of the University, of any liability against myself, which may arise during the course of the project.

I will not submit any claims against the University regarding personal detrimental effects due to the project, due to negligence by the University, its employees or students, or any other subjects.

I agree to be tested for HIV : YES NO

I want to know my HIV-status YES NO

(Signature of the subject)

Signed at .....on ……..

Witnesses

1. .....

2. .....

Signed at ..... on ……

PURE SA 2010 Quantitative Food Frequency Questionnaire

Subject ID

Subject Initials

☐☐ ☐☐☐ ☐☐☐ ☐☐ ☐☐☐

Centre # Community # Household # Subject # F M L

Today's date: ☐☐☐☐ ☐☐ ☐☐

year month day

1. Name: _____

_____

2. Not applicable in South Africa

3. National identity # or equivalent _____ ☐

N/A

4. DOB: ☐☐☐☐ ☐☐ ☐☐ **OR Age** ☐☐ **years**

5. Sex: ☐ Female ☐ Male

Please think carefully about the food and drink you have consumed during the ***past month*** (four weeks). I will go through a list of foods and drinks with you and I would like you to tell me:

- If you eat the food
- How the food is prepared
- How much of the food you eat at a time
- How many times a day you eat it and if you do not eat it everyday, how many times a week or a month you eat it.

To help you to describe the amount of a food you eat, I will show you pictures of different amounts of the food. Please say which picture is the closest to the amount you eat, or if it is smaller, between the sizes or bigger than the pictures.
There are no right or wrong answers.

Everything you tell me is confidential. Only your subject number appears on the form.

Is there anything you want to ask now?

Are you willing to go on with the questions?

FOOD FREQUENCY QUESTIONNAIRE

INSTRUCTIONS: Circle the subject's answer. Fill in the amount and times eaten in the appropriate columns.

I shall now ask you about the type and the amount of food you have been eating in the last few months. Please tell if you eat the food, how much you eat and how often you eat it. We shall start with maize meal porridge.

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
PORRIDGE AND BREAKFAST CEREALS AND OTHER STARCH								
Maize-meal porridge	Stiff (pap)						3400	
Maize-meal porridge	Soft (slappap)						3399	
Maize-meal porridge	Crumbly (phutu)						3401	
Ting								
Mabella	Stiff						3437	
Mabella	Soft							
Oats							3239	
Other cooked porridge	Type: _____							
Breakfast cereals	Brand name of cereals at home now: _____ _____ _____ _____							

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
Do you pour milk on your porridge or cereal? Yes / No If yes, what type of milk (whole fresh, sour, 1%, fat free, milk blend, etc) _____								
If yes, how much milk								
Do you put sugar on your porridge or cereal? Yes / No								
If yes, how much sugar							3989	
							3989	
							3989	
Samp	Bought Self ground						3250	
Samp and beans	Give ratio of samp:beans						3402 (1:1)	
Samp and peanuts	Give ratio of samp:peanuts						3250 (samp)	
Rice	White						3247	
	Brown						3315	
	Maize Rice						3250	
Pasta	Macaroni Spaghetti Other specify: _____ _____						3262	

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
Pizza	Home made: Specify topping _____ _____						3353 (base+ch)	
	Bought: Specify topping _____ _____						3353 (base+ch)	

You are being very helpful. Can I now ask you about meat?

1.1.1 CHICKEN, MEAT, FISH

How many times do you eat meat (beef, mutton, pork, chicken, fish) per week?

_____

Chicken (codes with skin)	Boiled						2926	
	Fried: in batter/crumbs Eg Kentucky						3018	
	Fried: Not coated							
	Bought: Chicken Licken						2925	
	Bought: Nando's							
	Roasted / Grilled						2925	
	Other: _____							
Do you eat chicken skin?		Always		Sometimes		Never		
Chicken bones stew								
Chicken feet							2997	
Chicken offal								
Red meat	How do you like meat?							

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
	With fat Fat trimmed							
Red meat	Fried							
	Stewed							
	Mince with tomato and onion						2987	
	Other:							
Beef Offal	Intestines: boiled nothing added						3003	
	Stewed with vegetables							
	Liver						2920	
	Kidney						2923	
	Other: Specify _____ _____							
Goat meat	Boiled						4281	
	Stewed with vegetables							
	Grilled / Roasted						4281	
1.1.2 What type of vegetables is usually put into meat stews? _____								
Wors / Sausage							2931	
Bacon							2906	
Cold meats	Polony						2919	
	Ham						2967	
	Vienna						2936	

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
	Other: Specify _____ _____ _____							
Canned meat	Bully beef							
	Other: Specify _____ _____							
Meat pie	Beef						2939	
	Steak and kidney						2957	
	Cornish						2953	
	Chicken						2954	
	Other							
Hamburger	Bought							
Dried beans/peas/lentils	Soup						3145	
	Salad							
Soya products eg. Toppers	Brands at home now: _____ _____						3196 (Toppers)	
Pilchards in tomato/chilli/brine	Whole						3102	
	Mashed with fried onion							
Fried fish	With batter/crumbs							
	Without batter/crumbs							
Other canned fish	Tuna						3056 (oil)	

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
	Pickled fish							
	Other: Specify _____							
Fish cakes	Bought: Fried						3080	
	Home made with potato						3098	
Fish fingers	Bought						3081	
Eggs	Boiled/poached						2867	
	Scrambled: milk + fat							
	Fried: Fat							
Now we come to vegetables and fruit **VEGETABLES AND FRUIT**								
Cabbage	How do you cook cabbage?							
	Boiled, nothing added						3756	
	Boiled with potato and onion and fat							
	Fried, nothing added Fried in ……							
	Boiled, then fried with potato, onion							
	Other:							
	Don't know							
Spinach/morogo/ beetroot leaves other green leafy	How do you cook spinach?							
	Boiled, nothing added						3913	
	Boiled with fat added Type of fat ……...							
	With onion, tomato, potato							
	With peanuts							
	Other:							
	Don't know							

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
Tomato and onion gravy	Home made with fat Type of fat ……...							
	Without fat						3925	
	Canned						4192	
Pumpkin (yellow)	How do you cook pumpkin?							
	Boiled, nothing added						4164	
	Cooked in fat and sugar Fat ……							
	Boiled, little sugar and fat Fat ……							
	Other							
	Don't know							
Carrots	How do you cook carrots?							
	Boiled, nothing added						3757	
	Boiled, sugar and fat Fat ……							
	With potato and onion: Fat							
	Raw, salad						3709	
	Chakalaka							
	Other							
	Don't know							
Mealies/ Sweet corn	How do you eat mealies?							
	On cob – fat added Fat ……							
	On cob – no fat added						3725	
	Creamed sweet corn / canned						3726	
	Whole kernel/canned						3942	
Beetroot	Salad						3699	
	Boiled, nothing added						3698	

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
Potatoes	How do you cook potatoes?							
	Boiled/baked with skin						4155	
	Boiled/baked without skin						3737	
	Mashed							
	Roasted Fat ……							
	French fries (chips)						3740	
Sweet potatoes	How do you cook sweet potatoes?							
	Boiled/baked with skin						3748	
	Boiled/baked without skin						3903	
	Mashed							
	Other: _____							
	Don't know							
Salad vegetables	Mixed salad: tomato, lettuce and cucumber						3921	
	Raw tomato						3750	
	Other salad vegetables: _____ _____							
Other vegetables, specify + preparation	_____ _____ _____							
Do you like fruit?		Yes	No					
Apples							3592	

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
Pears							3582	
Oranges							3560	
Naartjie							3558	
Grapes							3550	
Peaches	Fresh						3565	
	Canned						3567	
Apricots	Fresh						3534	
	Canned						3535	
Mangoes							3556	
Guavas	Fresh						3551	
	Canned						3553	
Avocado							3656	
Wild fruit/berries	Specify type: _____							
Dried fruit	Types: _____							
Other fruit	_____ _____							
If subject eats canned fruit: Do you have custard with the canned fruit?			Yes		**2** No			
Custard	Home made: Milk							
	Commercial eg Ultramel						2716	
1.1.3 BREAD AND BREAD SPREADS								
Bread / Bread rolls	White						3210	
	Brown						3211	

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
	Whole wheat						3212	
Do you spread anything on the bread?		Always		Sometimes		Never		
Margarine	What brand do you have at home now?							
	Don't know _____							
Peanut butter							3485	
Jam/syrup/honey							3985	
Marmite / Fray bentos / Oxo							4058	
Fish/meat paste							3109	
Cheese	Type: _____ _____ _____							
Achaar								
Other spreads	Specify: _____ _____							
Dumpling								
Vetkoek	White flour						3257	
	Whole wheat flour						3324	
Provita, crackers, etc							3235	

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
Mayonnaise / salad dressing	Mayonnaise						3488	
	Other: Specify _____							
1.1.4 DRINKS								
Tea	English (normal)						4038	
	Rooibos						4054	
Coffee							4037	
Sugar/cup tea or coffee	Tea:						3989	
	Coffee:						3989	
Milk/cup tea or coffee	What type of milk do you use in tea and coffee?							
	Fresh/long life: whole/full						2718	
	Fresh/long life: 2%/low fat						2772	
	Fresh/long life: fat free						2775	
	Whole milk powder Brand: _____						2721 (powder)	
	Low fat milk powder Brand: _____						2825 (powder)	
	Skimmed milk powder Brand: _____						2825 (powder)	
	Milk blend Brand: _____						2770 (powder)	

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
	Whitener: type _____ _____							
	Condensed milk						2714	
	Evaporated milk						2715	
	None							
Milk as such	What type of milk do you drink milk as such?							
	Fresh/long life: whole/full						2718	
	Fresh/long life: 2%/low fat						2772	
	Fresh/long life: fat free						2775	
	Condensed milk						2714	
	Sour/maas						2787	
	Other: _____ _____							
Milk drinks	Nestle: _____							
	Milo: _____							
	Flavoured milk: _____							
	Other:							
Yoghurt	Drinking yoghurt						2756	
	Thick yoghurt						2734	

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
	Low fat sweetened with fruit						2732	
Squash	Sweet O						4027	
	Six O							
	Oros/Lecol – with sugar						3982	
	- artificially sweetener						3990	
	KoolAid						4027	
	Other: _____ _____							
Fruit juice	Fresh/Liquifruit/Ceres						2866	
	Tropica (Dairy –fruit juice mix)						2791	
	Other: _____ _____ _____							
Fizzy drinks Coke, fanta, etc	Sweetened						3981	
	Diet							
Maueu/Motogo							4056	
Home brew								
Tlokwe							4039	
Beer							4031	
Spirits							4035	
Wine red							4033	
Wine White							4033	
Other specify	_____							

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
	_____ _____							
SNACKS AND SWEETS								
Potato crisps							3417	
Peanuts	Raw						4285	
	Roasted						3458	
Cheese curls, Niknaks, etc							3267	
Raisins							3552	
Peanuts and raisins								
Chocolates	Name: _____ _____ _____							
Candies	Sugus, gums, hard sweets, etc						4000	
Sweets	Toffees, fudge, caramels						3991	
Biscuits/cookies	Type: _____ _____ _____							
Cakes and tarts	Type: _____							

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
	_____ _____							
Scones								
Rusks	Type: _____ _____							
Savouries	Sausage rolls						2939	
	Samoosas: Meat filling						3355	
	Samoosas: Vegetable filling						3414	
	Biscuits eg bacon kips							
	Other specify: _____ _____							
Jelly							3983	
Baked pudding	Type: _____							
Instant pudding	Milk type: _____							
Ice cream							3483	
Sorbet							3491	
Other specify	_____ _____ _____							

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
SAUCES, GRAVIES AND CONDIMENTS								
Tomato sauce / Worcester sauce							3139	
Chutney							3168	
Pickles							3866	
Packet soups							3165	
Other:	_____ _____							
WILD BIRDS, ANIMALS OR INCECTS (hunted in rural areas or on farms)								
Wild fruit								
MISCELLANEOUS: Please mention any other foods used more than once/two times a week which we have talked about:								

FOOD	DESCRIPTION	AMOUNT	TIMES EATEN				CODE	AMOUNT / DAY
			Per day	Per week	Per month	Seldom / Never		
INDIGENOUS/TRADITIONAL FOODS/PLANTS/ANIMALS **1.1.5 Please tell me if you use any indigenous plants OR other indigenous foods like mopani worms, locusts etc to eat**								
Specify								

Thank you very much for your cooperation and patience.

Good-bye!

ADDENDUM B: UTILISATION OF TRADITIONAL AND INDIGENOUS PLANT FOODS

1. QUESTIONNAIRE: BIODIVERY OF INDIGENOUS AND TRADITIONAL PLANT FOODS
2. LETTER OF PERMISSION TO RUN THE FOCUS GROUP DISCUSSIONS AT THE KGOTLA/COMMUNITY HALL
3. FOCUS GROUP PARTICIPANTS
4. FOCUS GROUPS QUESTIONS
5. INVENTORIES
    - TRADITIONAL FOOD LIST, CULTIVATION AND PROCESSING INVENTORY,
    - PLANTS CULTIVATED; A LIST FROM FOCUS GROUPS
    - RECIPE LIST FROM KEY INFORMANTS
6. KEY INFORMANT INTERVIEW QUESTIONS

QUESTIONNAIRE: Biodiversity of Indigenous and Traditional Plant Foods

Interviewer code						V1	1-2				
Observer code						V2	3-4				
Respondent code						V3	5-7				
Interview date						V4	8-11				

Particulars of the area

1.

Province	North West	1	V5	12

2.

Community	Ikageng	1	Sonder Water	5	V6	13
	Top City	2	Extension 11	6		
	Extension 7	3	Ganyesa	7		
	Tlagameng	4	Moswana	8		

Socio-demographic data

3.

Sex	Male	1	V7	14
	Female	2		

4. Age ..... Years V8 15-16

5. Marital status:

Married	1	Divorced	5	V9	17
Single	2	Living together	6		
Widowed	3	Traditional marriage	7		
Separated	4	Other	8		

	Father/ husband	Mother/	Child	Grandpar	Aunt	Uncle	Cousin	Other		
6. Who usually cooks in this household?	1	2	3	4	5	6	7	8	V10	
7. Who decides what food is bought?	1	2	3	4	5	6	7	8	V11	

	Father/ husband	Mother/	Child	Grandpar	Aunt	Uncle	Cousin	Other		
8. Who is the head of the household?	1	2	3	4	5	6	7	8	V12	
9. Who decides how much money is spent on food?	1	2	3	4	5	6	7	8	V13	

10. How many of the following people are living in your house?

Children under 7		V14	
Children 8-12		V15	
Children 13-18		V16	
Adults		V17	
Pensioners		V18	
Total number of people		V19	
How many contribute income		V20	

11. Ethnic group. Only mark one

1	Northern Sotho	6	Swazi	11	Mozambican	V21
2	Southern Sotho	7	Ndebele	12	Other (specify)	
3	Tswana	8	Venda		.....	
4	Zulu	9	Shangaan		.....	
5	Xhosa	10	Tsonga		.....	

12. How many years have you lived here?	..... years	V22	
13. How many years of schooling have you had??	..... years	V23	
14. How many people in your household can read English?	.....	V24	
15. How many people in your household can read your home language?	_____	V25	

16. What do you do for a living? Please rank your activities in order of economic importance.

Economic activity		Rank		
	1		V26	
Pensioner			V27	
Farming	2		V28	

Employed	3	
Self-employed	4	
Casual labour	5	
Unemployed	6	
Other	7	

Specify other:

V29	
V30	
V31	
V32	
V33	
V34	
V35	
V36	
V37	
V38	
V39	

Questions on availability and consumption and accessibility of indigenous and traditional foods

17. Are there any indigenous and traditional foods available in your area?

Yes [1] No [2] V40 [ ]

18. State the commonly available indigenous and traditional foods in your area. (Use a picture book to help them identify the foods)

						V41	
						V42	
						V43	
						V44	
						V45	
						V46	
						V47	

19. Are there species not available anymore you think the cultivation of indigenous and traditional foods has increased or decreased?

Increased [1] Decreasd [2] V48 [ ]

Why do you think so (V49)?

20. Do you think the use of indigenous and traditional foods has increased or decreased?

Increased [1] Decrease [2] V50 [ ]

☐ d ☐ ☐

Why do you think so (V51)?

21. Are indigenous and traditional foods cooked in your home?

Yes ☐ 1 No ☐ 2 V52 ☐

If YES, which one's in particular? (V53)
22. Give methods of food preparation for consumption.

Indigenous foods	Boiling	Stewing	Grilling	Mashing	Frying	
						V54-58
						V59-64
						V77-82
						V83-88
						V89-94

23. How often do you consume these foods?

Indigenous foods	Rarely consumed	Often consumed	Very often consumed	
				V159-162
				V163-166
				V167-170
				V171-174

24. Name the use of indigenous and traditional plant foods

Indigenous foods	relish	snack	Staple food	Rituals	
					V218-222
					V223-227
					V228-232

Are there any that are not being used anymore?

Yes [1] No [2] V290 [ ]

If any, please name them. (291)

25. Why do you think they are not being used?

	Agree 1	Disagree 2	
They are old fashioned			V292
No space to produce them			V293
They are not nice			V294
They require a lot of preparation			V295
They are considered food for the poor			V296
They are not safe to eat			V297
Other, please specify			V298

26. Where do you obtain these foods?

Indigenous foods	Market place	vendors	bushes	Home gardens	Ploughing fields	Outside village/town	
							V299-308
							V309-315
							V316-322
							V324-330
							V331-337
							V338-344

27. Are there any problems of getting these foods?

Yes [1] No [2] V422 [ ]

If yes, why? (423)
28. Do you like to:

Grow indigenous and traditional foods……..	Yes	1	No	2	V425	
Use indigenous and traditional foods…..	Yes	1	No	2	V426	

If yes to growing, proceed to next section

If no to growing, proceed to questions on cultural knowledge and ethno botany

Questions to <u>GROWERS</u> of Indigenous and traditional foods
If not, proceed to next category

29. What percentage area do you grow these foods on compared to the other crops? ..... % V427

30. What indigenous and traditional foods do you harvest where?
Field (1); Home garden (2); Home garden and fields (3)

Other (4) _

1		V428-429	
2		V430-431	
3		V432-433	
4		V434-435	

31. Why do you grow them there (V438)?

32. Please describe your land preparation activities.

Tractor	1	Donkey	4	V441	
Oxen	2	Hand	5		
Mules	3	Other	6		

33. Do you thin out? Yes 1 No 2 V442

34. Describe the planting process (V443).

35. Are special tools used for planting, weeding, harvesting or storage? Yes [1] No [2] V444 [ ]

Describe them (V445).

36. Do you feed your plants? Yes [1] No [2] V446 [ ]

If yes, how do you feed the plants?

Manure:	[1]	Fertilizer	[4]	V447	[ ]
Cattle	[2]	Compost	[5]		
Chicken	[3]	Other	6		

37. Do you use chemicals to manage your pests? Yes [1] No [2] V448 [ ]

38. Do you use chemicals to manage your diseases? Yes [1] No [2] V449 [ ]

If yes, what and what do you control with it? (V450)

If no and you use alternatives, please name and explain (V451)

39. Do you irrigate? Yes [1] No [2] V452 [ ]

If yes, how?

Flood:	[1]	Pipe	[3]	V453	[ ]
Hand	[2]	Other	[4]		

Please specify other (V454)

Questions on cultural knowledge and ethno botany

40. Are there TLV''s and other indigenous foods growing in your garden/ fields? Yes [1] No [2] V455 [ ]

41. Are there TLV's and other indigenous foods that have disappeared in your area? Yes [1] No [2] V460 [ ]

If yes, name them. (V461)

42. Are there cultural ceremonies linked to some indigenous and traditional foods? Yes [1] No [2] V465 [ ]

If yes, please indicate in which ceremonies are used. (V466)

43. Do you do the following with the specific indigenous and traditional foods?
Yes = √

Indigenous and traditional foods	Dry		Dry: Fresh		Dry: cooked		When you cook, do you cover		
	Yes	No	Shade	Sun	Sun	Shade	Yes	No	
	1	2	1	2	1	2	1	2	***V467-471***
	1	2	1	2	1	2	1	2	V472-476
	1	2	1	2	1	2	1	2	V477-481
	1	2	1	2	1	2	1	2	V482-486
	1	2	1	2	1	2	1	2	V486-490
	1	2	1	2	1	2	1	2	V491-495
	1	2	1	2	1	2	1	2	V496-500

44. Name other ways of preserving these foods (501)

General indigenous and traditional foods questions

45. What part of the indigenous and traditional plant food do you harvest and from which do you collect seed?

Yes = √

Indigenous foods	Young leaves	stalks	All leaves	Fruit	Flowers	Growth points	Age makes difference	Seed collected	
									V502-510
									V511-518
									V519-527
									V1528-536
									V537-545
									V546-554

46. How do you get the seeds, do you pay for it and what does it cost?

Indigenous foods	Collect self	Neigbour	kgotla	relatives	other	Pay for seed	Get free	Cost/ unit	
	1	2	3	4	5	1	2		V555-558
	1	2	3	4	5	1	2		V559-562
	1	2	3	4	5	1	2		V563-566
	1	2	3	4	5	1	2		V567-570
	1	2	3	4	5	1	2		V571-574

TLV's & other indigenous/ foods	47. When do you Harvest (√)												
	Jan	Feb.	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	
													V580-592
													V593-605
													V606-618
													V619-631
													V632-644

Storage

48. Do you store part of your produce? Yes [1] No [2] V659 [ ]

If yes, which ones, how much, how and how long do you store?

Food stored	How much	Sealed	How				How long				
			Clay pot	Bucket	Plastic	Other	<6 months	6-12 months	1-2 years	+ 2 years	
			1	2	3	4	1	2	3	4	V660-664
			1	2	3	4	1	2	3	4	V665-669
			1	2	3	4	1	2	3	4	V598-602
			1	2	3	4	1	2	3	4	V603-607
			1	2	3	4	1	2	3	4	V608-612
											V613-617

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3 February 2009

Dear Sir/Madam

RE: REQUEST FOR PERMISSION TO RUN FOCUS GROUPS DISCUSSIONS

I Sarah Matenge, a PhD student in Consumer Sciences from the North West University, Potchefstroom Campus is undertaking a research project entitled " Utilisation of Indigenous and Traditional Plant Foods in urban and rural communities of the North West Province". The purpose of the study is to explore the different ways of promoting the consumption and production of indigenous and traditional foods.

I would like to have your permission to run the focus group discussions at the Kgotla/Community hall in your community. The proposed date of the group discussions is March the ----------2009.

If you have questions about the project, you may contact me at 018 299 2094.
Thank you for your cooperation

Yours sincerely

Me.Sarah Matenge

(Student)

FOCUS GROUP PARTICIPANTS (pseudo names)

Potchefstroom				
Name	**Age**	**Gender**	**Educational level (years)**	**Employment status**
1. Cidraas	35	M	8	Employed
2. John	63	M	7	Pensioner
3. Tewane	43	M	0	Unemployed
4. Hansie	46	M	10	Employed
5. Thulo	26	M	12	Self employed
6. Mahume	24	M	10	Part time
7. Samuel T	77	M	1	Pensioner
8. Job	36	M	0	Employed
9. Samuel M	94	M	1	Pensioner
10. Story	50	M	10	Unemployed
11. Jacob	54	M	12	Part time
12. Calvin	41	M	10	unemployed
13. Rachel	49	F	1	Part time
14. Maria	61	F	2	Pension
15. Mame	42	F	6	Employed
16. Keketso	62	F	10	Pension
17. Dikeledi	87	F	12	Pension
18. Florence	95	F	5	Pension
19. Nathane	56	F	1	Unemployed
20. Seitiso	50	F	0	Unemployed
21. Motseimang	34	F	0	Employed
22. Maria	38	F	6	Employed
23. Rebecca	27	F	10	Part time
24. Caroline	22	F	12	employed
Ganyesa				
25. Oagile	48	M	5	Self employed
26. Gaompodise	45	M	7	Part time
27. Locus	54	M	2	Unemployed
28. John P.	60	M	4	Unemployed
29. Elias	34	M	1	Part time
30. Oupa	41	M	0	Employed
31. John L.	70	M	6	Pensioner
32. Threeboy	75	M	0	Pensioner
33. Jack	27	M	10	Employed
34. Shadrack	25	M	12	Employed
35. Simon	30	M	1	Part time
36. kebitsamang	77	F	3	Pensioner
37. Dorah	34	F	4	Unemployed
38. Baby	46	F	3	Self employed
39. Gladys	54	F	0	Unemployed
40. Sinah	42	F	5	Part time
41. Elisa	26	F	12	Part time
42. Boitshwarelo	29	F	10	Employed
43. Meisi	37	F	6	Unemployed
44. Lillian	77	F	4	Pensioner
45. Mantsampane	50	F	0	Unemployed
46. Kefilwe	80	F	1	Pensioner

FOCUS GROUP QUESTIONS

1. We are going to talk about indigenous and traditional foods. Let's think about them and generate a list of these foods available in your area. Please record them on the form available.
2. List the most commonly available indigenous and traditional foods in the area and besides each name also write the season when they are available. Is it during the dry or wet seasons?
3. Are there indigenous and traditional foods you know that are no longer available in your area?
4. If yes, state why they are no longer there?
5. List the most commonly consumed indigenous and traditional foods in the area.
6. Also name the uses of the foods you have just listed. What are their uses e.g. as relish, snack etc.
7. Name the most commonly cultivated indigenous and traditional foods in the area.
8. Are there any indigenous and traditional foods that are no longer cultivated?
9. If yes, state why?
10. Where do you grow them?
11. Why do you grow them there?
12. When is the food production period?
13. Do you have problems with regard to production of indigenous and traditional foods in the area?
14. Of all the problems you have with regard to cultivation of these foods, what do you think can be done to improve the situation?

FREE LIST RECORD FORM FOR COMMUNITY TRADITIONAL FOOD NAMES FROM FOCUS GROUPS

COMMUNITY:_____ **DATE:**_____

	Local Name	English/Scientific name	**Habitat**	**Local use**	**Seasonality**
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					
16.					
17.					
18.					
99.					
10.					

PLANTS CULTIVATED; A LIST FROM FOCUS GROUPS

COMMUNITY_____ **DATE:** _____

	Local Name	English/Scientific name	**Part of plant used**	**Preservation**	**Storage**
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					
16.					
17.					
18.					
.19.					
20.					

RECIPE LIST FROM KEY INFORMANTS

COMMUNITY_____ **Date**_____

	Traditional Dish	**Ingredients used**	**Method of preparation**	**Accompaniments**
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				

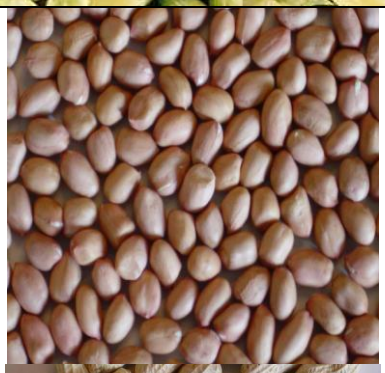
KEY INFORMANTS INTERVIEW QUESTIONS

1. Let's talk about indigenous and traditional food preparation and processing. There are lots of different ways of preparing/processing these foods. How do you prepare these foods and what are traditional ways of preparing them?
2. Give alternative ways of preparing/processing them.
3. Name the most popular traditional dishes consumed in the area.

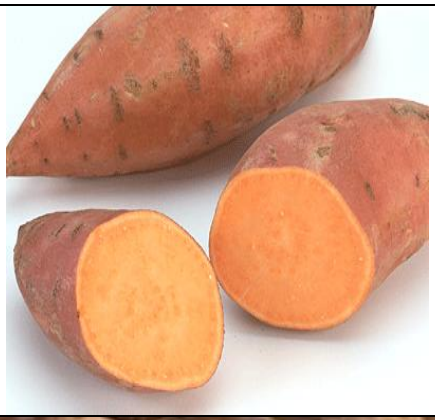
PICTURE MANUAL: INDIGENOUS AND TRADITIONAL FOODS

This card will assist the fieldworker and respondent in indentifying the indigenous and traditional foods consumed in the surveyed household.

1. Legumes and nuts

Names	Images
English: Cowpea Setswana: Dinawa tsa setswana Sotho: Zulu:	
English: Dried pumpkin seed Setswana: *Disata tsa lephutshe* Sotho: Zulu:	
English: Groundnut / peanut Setswana: *Madopi / manoko* Sotho: Zulu:	 

2. Roots and tubers

Names	Images
English: Sweet potatoes Setswana: Dipotata Sotho: Zulu:	
English: Wild potatoes Setswana: *Mokowa, thlakwana* Sotho: Zulu: (Scientific: Hypoxis hemerocallidea)	
English: Setswana: Amadumbe Sotho: Zulu: (Scientific: Colocasia esculenta)	

3. Grains

Names	Images
English: Sorghun Setswana: Mabele Sotho: Zulu:	

4. Leafy vegetables

Names	**Images**
English: African heart-vine Setswana: Lefe Sotho: Zulu:	
English: Cowpea leaves Setswana: Morogo wa dinawa Sotho: Zulu:	
English: Pumpkin leaves Setswana: Morogo wa lephutshe Sotho: Zulu:	

English: Spider plant Setswana: Rotlhwe / lerotho Sotho: Zulu:	
English: Pigweed / amaranth / marog Setswana: Thepe Sotho: Zulu:	

5. Other vegetables

English: Wild watermelon Setswana: Lakatane / lerotse Sotho: Zulu:	
English: Pumpkin Setswana: Leputshe Sotho: Zulu:	

English: Bottle goard / calabash Setswana: Lekgomane Sotho: Zulu:	

English: Wild cucumber / gherkin Setswana: Mongogo Sotho: Zulu:	
English: Wild melon Setswana: Mogabala/tsama Sotho: Zulu:	
English: Goosefoot fat hen Setswana: Motentenyane Sotho: Zulu:	
English: Anthill mushroom Setswana: Sephinya sa baloi Sotho: Zulu:	
English: Wild tomatoes Setswana: Tamati ya naga Sotho: Zulu:	

English: Leafy vegetable Setswana: *Tomposane/tswai tswai* Sotho: Zulu	

6. Fruits and other crops

English: Wild / sour fig Setswana: Mochaba Sotho: Zulu:	
English: River bush willow Setswana: Modimowanoka Sotho: Zulu:	
English: Cyanscens (mushroom) Setswana: Mmilo Sotho: Zulu:	
English: Brandy bush / grewia fleva Setswana: Motlwa / morethlwa Sotho: Zulu:	

English: Purslane Setswana: Mongongo / monyonkolo Sotho: Zulu:	
English: Sandpaper raisin / grewia flavascens Setswana: Motsotsojane Sotho: Zulu:	
English: Sweet reeds Setswana: Ntshe Sotho: Zulu:	
English: Buffalo thorn Setswana: Sekgalo Sotho: Zulu	
English: Monke orange Setswana: Seretologa Sotho: Zulu:	

ADDENDUM C: Consumers' general views on indigenous and traditional foods and acceptance of products made with cowpea leaves

1. **FOCUS GROUP QUESTIONS**
2. **FOCUS GROUP TRANSCRIPTS GROUPED BY THEME, SUBTHEME AND CONCEPTS**
3. **CONSUMER QUESTIONNAIRE**

FOCUS GROUP QUESTIONS

- Let's talk about indigenous / traditional foods. What comes to your mind when you hear the words indigenous / traditional?
- Do you have concerns about the foods families eat?
- Can you tell me positive things about indigenous foods
- Can you tell me negatives things about indigenous foods
- We often hear that indigenous foods are not safe to eat, they are food for the poor and they are old fashioned
- Of all the things we have discussed, what do you think can be done to motivate consumers to eat these foods?

FOCUS GROUP TRANSCRIPTS GROUPED BY THEME, SUB-THEME AND CONCEPTS

ITF consumption benefits

Sub-themes and concepts	Comments made by participants
Health and nutrition	
• Healthiness • Nutritional value • Natural • Diseases prevention • Home made /quality • Digestibility	Indigenous foods are soul foods in that they are natural and healthy. They are produced naturally and processed in a traditional way [60+]. They are healthy and nutritious [50-59]. I think indigenous foods are naturally good because they are nature's food and not altered in anyway like other foods [30-39] Modern foods are not natural in the sense that they are grown with the aid of chemicals [40-49]. indigenous foods are healthy and safe to eat [50-59] They are nature's foods [40-49]. They are natures foods and it's that naturalness in them that makes them healthy and nutritious and that what I like about them [50-59]. Indigenous foods may be healthy, but [20-29]. I am aware of the health benefits of consuming indigenous foods [60+]. It just that they are home made and some of the foods occur naturally in the bush. They are healthier and safe than modern foods because they have not been exposed to chemicals [40-49]. Our diet in the olden days was based on natural and whole food [60+]. They are made of natural ingredients [60+]. Indigenous foods are wholesome, natural [60+]. Traditional foods are of high quality [60+]. I understand the concept of nutrition and health. Yes they are nutritious [30-39] They are healthy and not as complicated as non traditional foods [60+] They are nature's foods and it is that naturalness in them that makes them healthy and nutritious [50-59] Indigenous foods are made with natural ingredients, processed naturally and grown naturally [40-49]. Indigenous foods have health healing properties. Medicinal plants such as blue bush, kgalahari grewia, devil's claw were used both as beverages and as medicine [60+]. Indigenous foods occur nutritionally and produced from the farm [50-59]. Indigenous foods are naturally grown and processed naturally and in a way that doesn't put our health at risk [60+]. that's why some of us prefer indigenous foods because they grow naturally [40-49] and they are naturally grown [40-49]. Traditional foods are high in quality because they are produced locally and local means freshness [60+]. High in nutrients [40-49]. Indigenous foods are made with natural ingredients, processed naturally and grown naturally [40-49]. and natural in that they have not been exposed to chemicals [50-59]. Indigenous foods occurs naturally, abundantly and healthy [40-59]. because they are homemade [50-59]. They are naturally grown hence safe to eat [30-39]. they are home made, produced and processed naturally [40-49]. Indigenous foods are good in that they occur natural [50-59]. I think they are foods that are wholesome, a quality which makes them they may be more digestible and healthy, but [30-39] Indigenous foods are healthy foods [40-49]. Indigenous foods are healthy and nutritious [60+]. On the other hand traditional diet is nutritious; the food is not over processed and contains natural ingredients [50-59]. Indigenous foods are of high quality, they are fresh and produced locally [60+]. They are high in nutrients and also have healing properties and many uses [40-49]. Indigenous foods especially vegetables and fruits are healthy and contain vitamins and minerals. These vegetables help to digest a meal [50-59] mostly plant foods contain natural ingredients and therefore healthy [60+] we eat them fresh and process them our selves and therefore we know exactly what's going inside our food. They are natures food, not altered in anyway [40-49].

Sub-themes and concepts	Comments made by participants
Tradition and culture	
	they are our tradition/culture that we can't afford to loose [50-59] I love tradition. I wish we could go back to those olden days[60+]. I think about our culture. Indigenous foods have played a great role in our lives. We used to live in a traditional way, eating traditionally, doing things in a traditional way. Things have changed now [50-59].

	We have been brought up eating indigenous foods and therefore, we need to honour our culture. Tradition is just good [50-59]. Indigenous foods symbolises our culture, where we come from [60+]. They form part of our culture and signify where we come from [50-59]. They form part of our culture and we grew up eating them [50-59]. Indigenous foods are foods that have evolved from centuries, they form part of the tradition and we are content about them [50-59] In those olden days, everything used to revolve around tradition [60+]. I do feel offended sometimes when they make comments like that because this is tradition and without tradition we are lost [40-49]
Food safety	
	the food we eat nowadays is contaminated. Many people are sick due to diet related disorders [60+] I heard from my son that chicken and cows are injected with hormones and antibiotics to make them grow fast. I really feel sorry for these animals [50-59]. they spray them (modern foods) with chemicals [50-59]. The food we eat nowadays is not safe. It is contaminated by fertilizers and chemicals that have been sprayed on them. This chemicals and fertilizers can harm the body especially if one does not wash or boil her/his vegetables thoroughly [50-59]. Indigenous foods are healthy and safe to eat because they are no exposed to chemicals during production and processing [50-59]. they are even safer than modern foods because they are naturally grown. We grew up eating traditional foods and we never worry about what goes into our mouth because we believed that the food is safe [50-59]. they are safe to eat compared to modern foods [50-59]. Indigenous foods are made with natural ingredients, processed naturally and grown naturally. In general sense they are pure and therefore safe [40-49]. and natural in that they have not been exposed to chemicals [50-59]. They are naturally grown hence safe to eat [30-39]. Indigenous foods are safe to eat because they are home made, produced and processed naturally. They have not been exposed to chemicals like modern foods [40-49]. Indigenous foods are good foods in that they occur natural and therefore safe to eat [50-59] Indigenous foods are safe to eat than other foods because they are locally and home grown and not exposed to any chemicals [50-59]. The government encourages consumers to use bio gradable packaging to prevent damage to the environment. Therefore, the selling of indigenous foods without packaging supports the Government initiative to prevent harm to the environment [40-49]. we often hear of animals and plants being injected with chemicals in order to make them grow fast. Now I see why our kids grow so fast . This is not good at all [40-49] they have not been exposed to chemicals [50-59]. Indigenous foods are wholesome, natural, filling and they have not been exposed to chemicals [60+]. the food has not been exposed to chemicals and not imported like modern foods [50-59]. less harmful in terms of chemicals and pesticides [50-59]. they occur natural and therefore safe to eat [50-59] One thing I like about indigenous foods is that they are naturally grown in the farms without the use of pesticides or anything harmful [50-59]. Modern foods are contaminated with chemicals and not good for our health. Its something we can avoid and stick to indigenous foods [40-49].

Sub-themes and concepts	**Comments made by participants**
Availability	
• Accessibility • plentiful	They are home/locally grown and thus make them plentiful [60+] We also hunt and gather them and so they are everywhere [60+]. One thing I like about indigenous foods is that they are easily accessible [40-49]
Sensory characteristics	
	as far as the taste is concerned, indigenous foods are tastier than modern foods as they are made with natural ingredients. It is its natural taste that makes it more distinctive than modern foods [60+]. I like the bean soup served with sorghum dumplings. They taste good and I always want to eat more [40-49]. Indigenous foods are tasty and the recipes are good and easy to follow [40-49]. Indigenous foods are nice and always bring the goodness in taste and I have to say that the chicken bought from the supermarkets, I mean the one scientifically bred and the Tswana breed chicken taste completely different. The Tswana chicken taste real good and appealing [50-59]. Indigenous foods are made with natural ingredients, processed naturally and grown naturally and therefore taste really good. [40-49]. Indigenous foods taste good and natural in that they have not been exposed to chemicals [50-59]. Indigenous foods are very special and often consumed on special occasions and bring in pleasure in terms of the taste and appearance [50-59] The food had its natural taste and simple and different from what we eat now [60+]. Indigenous foods taste better than exotic foods need no condiments to enhance the flavour [40-49] Indigenous foods have a natural taste and are easy to prepare [60+].

	They are tasty. I always enjoy the meals [40-49] value indigenous foods more than modern foods because they tasty [50-59] they are nature's foods and taste real good [40-49] The Tswana chicken taste real good and appealing [50-59].
Cost	
• Production cost • Price of food	the food we eat is expensive compared to indigenous foods [50-59] I like these foods as they make life easier in the sense that they are home or locally grown and thus make them plentiful and inexpensive [60+] They are not expensive compared to modern foods and they are naturally grown, cheap to produce and maintain. Modern foods require capital investment and a well developed infrastructure [40-49]. One thing I like about them is that they are inexpensive [40-49] Indigenous foods are inexpensive because they are homemade [50-59]. modern foods are expensive compared to traditional foods [60+] the local markets seem to be a lot cheaper [50-59]. I think I value indigenous foods more than modern foods because they are healthier, tasty and cheap to produce [50-59].
Convenience	
• Ease of preparation • Less time to prepare	Indigenous foods are easy to prepare [50-59] The food (modern foods) we eat is not easy to prepare, it's a lot of work [50-59]. Indigenous foods have a natural taste and are easy to prepare [60+]. Indigenous foods are easy to process and prepare [50-59] Indigenous foods are tasty and the recipes are good and easy to follow [40-49]. and the cooking is made easier [40-49]

Sub-themes and concepts	**Comments made by participants**
Knowledge and skills on food preparation and nutrition information	
• Lack of nutritional information • Lack of preparation skills	We are always told that they are healthy, how do I notice that they are healthy and how do I know I am eating enough [20-29]. Indigenous foods are old fashioned in the sense that they are only prepared by old people who have the knowledge and skills to prepare them [20-29]. the main problem with indigenous foods is that there is limited information on the nutrient content and therefore difficult to know what contained in a particular food. More information is needed in this regard [30-39]. Nutrition composition of some indigenous foods is not always known. We don't know what we are eating and how much we should be eating. I think more research must be done so that we know what's contained in our food [30-39]. Nutrient composition of some foods is not known and that's why consumption has decline. It is important to know what's contained in the food so that we know exactly what we are eating [30-39]. There is lack of knowledge about how much to eat in terms of the size [20-29]. We are told that they are healthy, how does one know that they are healthy because there is no information to prove that [30-39]. We don't know how to cook them [20-29] If my mother has raised me up eating indigenous foods, I would have learnt to prepare and eat them [30-39]. I think parents should teach their children how to cook them [40-49].
Negative image and unfamiliarity	
	Indigenous foods are a thing of the past therefore it's important that we accept the changes brought in by urbanization. [20-29]. Our children are very picky and they won't eat food that they are not familiar with them [60+]. I was brought up here and I don't know anything about indigenous foods [20-29] I don't know much about these foods [20-29] They are low status and poor people's food because most of the households involved in the production of these foods are often poor who cannot afford to buy other foods [20-29]. I think indigenous foods are old fashioned and food for the older generation because they were more common in the past and that they are not known by the new generation [20-29]. I know nothing about indigenous foods. I think indigenous foods are a thing of the past. [20-29] I don't know much about indigenous foods [20-29]. They are termed poor people's food because most of the house holds involved in the production of these foods are often poor and cannot afford to buy other foods [20-29]. I am not a big fan of indigenous foods. I just don't like them [30-39]
Cost and availability	
• Food expensive • Lack of diversity • Not accessible	Because of the changing lifestyles, indigenous foods are not accessible and therefore limited availability [60+]. Indigenous foods are not easily accessible especially where I live [20-29]. Indigenous foods are not always available due to seasonality and markets are not accessible. This makes it difficult to consume them [40-49]. Indigenous vegetables have become more expensive than conventional ones due to limited availability and seasonality [40-49] there is no variety in the market place [20-29].

	Indigenous foods are not always available and it is not easy to get to the points of purchase [30-39] indigenous foods are often expensive [50-59] but they are often expensive and we end up giving up and eating what's available [40-49]. they have become more expensive and there is poor accessibility and availability in the markets [40-49]. the fresh vegetables and other foods are not always available when you want and when available they are not always in a fresh form [30-39]. Meals prepared with indigenous foods are monotonous because there's no variety of indigenous foods in the market place [50-59] Most of indigenous foods have disappeared and production of indigenous foods has declined [40-49] Indigenous foods are slowly disappearing due to various constraints including unreliable rainfall, diseases, poor soils and drought [60+] The food is slowly diminishing [60+] there is no variety in the market place [40-49]. Indigenous foods are becoming scares and therefore difficult to have them all year round. [40-49]. We don't have and eat indigenous foods anymore because of the changes brought up buy urbanization [40-49]
Sensory characteristics	
	The taste, smell and even the texture of these foods was awful. Even today I still don't like the sight of these foods [30-39]. Vegetables like thepe (amaranthus) and others have a bitter taste and that makes me hate them even more [20-29]. I don't just like the taste [20-29]. they are dull and therefore not appetizing [20-29] sorghum and some traditional leafy vegetables do not smell and taste so nice [20-29]. The taste, appearance and quality of indigenous foods is not as good as modern foods [20-29]. They make comments like "its boring; dull, bitter, not appetizing [40-49].
Inconvenience	
• To easy to prepare/cook • Take time to prepare	preparing a meal with indigenous foods can be a daunting task and time consuming especially when you have a busy lifestyle like me. We need foods that are easy to prepare [40-49]. they take time to process and prepare and therefore not suitable for a busy lifestyle like mine [30-39] the preparation methods are tedious and lengthy. For instance, if you want to prepare chicken for dinner, you first have to run after the chicken, slaughter it and prepare it for cooking. What I mean is it takes time and effort. One needs to be patient in order to prepare a good meal out of these foods [20-29]. With modern, one doesn't have to prepare food in a traditional way, take for example, the process of cooking sorghum porridge; it takes more time to prepare compared to rice and pasta [20-29]. traditional processing techniques are tedious and that's why most people have shifted to modern foods because there's less preparation and processing [40-49]. Indigenous foods are inconvenient and boring [30-39].

Modern foods consumption

Benefits

Sub-themes and concepts	Comments made by participants
Availability	
• Accessibility • variety	but I prefer modern foods over indigenous foods because there is a lot to choose from [30-39]. There is more choose from modern foods and these foods comes in different forms, shapes and colours [20-29]. but modern foods come in different forms such as ready to eat and some requiring minimal preparation or less time to cook. As old as I am and with no one to take care of me, I prefer convenience foods over indigenous foods because they make my life easier as they are quick to prepare [60+]. modern foods can be bought in supermarkets closer to where I live or work [30-39] with modern foods, you can get everything you want in terms of availability [30-39]. there's variety to choose from [30-39]
Sensory characteristics	
• taste, flavour, texture	the food we eat is palatable and irresistible, but I am worried about the long term effects of the ingredients used. That really scares me a lot [20-29] the food taste good and [30-39] the taste of food is what matters to me. The modern food production and processing techniques make the food tastier [20-29]. and has lots of chemicals (additives) added [40-49]
Cost	
• inexpensive	Modern foods are not expensive [30-39] Exotic vegetables and other food stuff are cheaper when in season [20-29]
Convenience	
• ease of preparation • less time to cook	but modern foods come in different forms such as ready to eat and some requiring minimal preparation or less time to cook. As old as I am and with no one to take care of me, I prefer convenience foods over indigenous foods because they make my life easier as they are quick to prepare [60+].

	with modern foods, one doesn't have to prepare food in a traditional way, take for example, the process of cooking sorghum porridge; it takes more time to prepare compared to rice and pasta [20-29].

Barriers

Sub-themes and concepts	Comments made by participants
Unhealthy	
• disease/health problems • low quality/refined/unwholesome/over processed • not fresh • less nutritionus • high calories and salty	We are now forced to eat modern foods which are often fatty, greasy and salty at all times. We are now sick because of eating these kinds of foods [50-59] Diseases we have nowadays are a result of consuming processed and industrialized foods [60+]. my grandchildren have developed allergies due to consumption of some modern foods something that we never had [50-59]. The food we eat is over processed [40-49] Many of the health problems we have today we never had in the past. I think this is because modern foods are overly processed and addition of chemicals makes it worse [40-49]. Modern foods were never existent in the past and so we did not experience health problems like we do now. We never heard of cases of people being hospitalised [50-59]. What we have now is over refined foods with fewer nutrients [60+]. In other words modern foods are not as fresh as indigenous foods because they have travelled a long distance before they reach their final destination [50-59]. Food we eat nowadays is fatty and contains a lot of sugar and salt. This contributes to ill health [60+] and has lots of chemicals (additives) added [50-59] The food we eat is high in fats, sugar, salt and that can put ones life in danger [30-39]. Most people who used to work far away from the village especially in towns have poor health due to consumption of modern foods which are often too oily, sugary and salty. They now have diabetes and high blood pressure and that's too bad (that's a shame) [60+]. Modern foods are not healthy because it is the fat, sugar and salt and chemicals added that makes us sick [50-59] Modern foods are fatty, salty and sugary and probably are the cause of many diseases [40-49]. I always find it difficult to follow the cooking instruction. My biggest worry is figuring how to fix a meal [50-59].
Cost	
• production costs • high food prices	I am told the price of food includes the packaging itself. Most traditional foods need no packing [60+]
Lack of knowledge and skills in food preparation	To cook a good meal, one needs to have the preparation skills and the know how [60+] I always find it difficult to follow the cooking instruction. My biggest worry is figuring how to fix a meal [50-59].
Food concerns	After I heard that farmers inject animals they breed with antibiotics to make them grow fast, I got so scared that I decided not to eat any of the animal products [60+]. The food doesn't taste like real food; it doesn't look natural food, its like food made in the laboratory with lots of chemicals added to enhance the taste [50-59]. and has lots of chemicals (additives) added [40-49] I read an article on how the food industry use the antibiotics to make plants and animals grow fast. This is a health hazard because it is the chemicals in food that make us sick [51-59]. I always question the safety of food prepared before hand, take for example the food in packets or in cans. What really keeps them longer, think about it [50-59]. The use of additives to enable increased shelf life of modern foods is another problem. These chemicals do not only affect us but our children too. My grandson had food allergies and he now doesn't eat any of diary products. In those days, milk and milk products we considered food for children and now look at what modernisation has done. It brought changes that complicate our lives [40-49]. again, packaging cannot be safe because we don't know much about the effects of chemicals used to make the packaging material [30-39].

CONSUMER QUESTIONNAIRE

Participant code			
Interview date			

SECTION A

Mark the appropriate square with a cross (X)

Particulars of the area

1.

Province	North West	

2.

Community	Potchefstroom	**1**	Ganyesa	**2**
	Tlakgameng	**3**		

Socio-demographic data

3.

Gender	Male	**1**
	Female	**2**

4.

Age	
20-30	**1**
30-40	**2**
40-50	**3**
50+	**4**

5.

Education	
Primary (up to Grade 7)	**1**
Secondary (up to Grade 12	**2**
Tertiary (above Grade 12	**3**

SECTION B

SENSORY EVALUATION OF THE ACCEPTABILITY OF PRODUCTS MADE WITH COWPEA LEAVES WITH RESPECT TO VARIOUS CRITERIA

6. Evaluate the acceptability of samples (in specific order) with respect to the given criteria by marking the appropriate square with a cross.

			Extent of acceptability				
Criteria		Sample codes	**1** Dislike extremely	**2** Dislike moderately	**3** Neither like/dislike	**4** Like moderately	**5** Like extremely
General appearance		1					
		2					
		3					
Colour		1					
		2					
		3					
Texture		1					
		2					
		3					
Flavor	Taste	1					
		2					
		3					
	Smell	1					
		2					
		3					

You have now evaluated all samples for acceptability according to certain criteria

7. Is one of the samples more acceptable in total?

Yes	No

8. If yes, which one? Write the code in the square

9. Please indicate how often you will be willing to eat the samples. Choose only one option under each code.

	Sample codes		
7. I would eat it everyday			
6. I would eat this very often (twice a week)			
5. I would frequently eat this (once a week)			
4. I like this and would eat it now and then (once a month)			
3. I would eat this if available but would not go out of my way			
2. I would eat this when no other food is available			
1. I will never eat it			

ADDENDUM D: RECIPES

MOROGO WA MANOKO (cowpea leaves with groundnut powder)

This recipe serves 3-4 people. Groundnuts can be substituted with ½ cup peanut butter. This dish can be served with papa, sorghum stiff porridge or melon porridge. The dried leaves can soaked for 10 minutes before cooking to soften and reduce the cooking time.

Ingredients

1 cup dried cowpea leaves
1 ½ cup of groundnut powder
6 cups of water
Salt taste
Measuring cups and spoons

Preparation

Step 1: Break or pound cowpea leaves into small pieces.
Step 2: Add the leaves to hot water, cover and boil for 20 minutes.
Step 3: Add groundnut powder and salt, stir well. Cover and simmer for 5 minutes.

MOROGO WA DINAWA/THEPE/ROTLHWE (cowpea leaves/spider plant/amaranthus stew)

This recipe serves 3-4 people. Vegetables such as carrots, garlic and peppers can be added to enhance the appearance and nutrient content. Also water used for cooking can be substituted with vegetable stock. The dried leaves can soaked for 10 minutes before cooking to soften and reduce the cooking time. This dish can be served with papa, sorghum stiff/fermented porridge or melon porridge.

Ingredients

1 cup dried/ 4 cups fresh cowpea leaves/spider flower/amaranthus
1 medium tomato (chopped)
1 small onion (chopped)
1 medium potato (chopped)
2 Teaspoons vegetable oil
Salt and pepper to taste

Preparation

Step 1: Break or pound cowpea leaves into small pieces.
Step 2: Add the leaves to hot water, cover and boil for 20 minutes or until water boils dry (for fresh leaves boil for 10 minutes).
Step 3: Sauté the onion and tomato in another pot and add tomatoes and chopped potatoes and simmer gently for 1minute.
Step 4: Add the sauté onion, tomato and potato mix to the leaves.
Step 5: Add the seasoning, cover the pot and simmer for 5mins
Step 6: Serve hot.

Alternative method

After boiling the leaves, mix the rest of the ingredients and simmer gentle for 10 minutes.

MOROGO WA DINAWA/THEPE/ROTLHWE (boiled cowpea leaves/spider plant/amanthus)

This recipe serves 3-4 people. This dish can be served with papa, sorghum stiff / fermented porridge or melon porridge. The dried leaves can soaked for 10 minutes before cooking to soften and reduce the cooking time.

Ingredients

1 cup dried/4 cups fresh cowpea leaves/spider flower/amaranthus
6 cups of boiling water
2 teaspoon vegetable oil
Salt to taste

Preparation

Step 1: Break or pound cowpea leaves into small pieces.
Step 2: Add the leaves to boiling water, cover and boil for 20 minutes (for fresh leaves boil for 10 minutes).
Step 3: Halfway through the cooking time, add oil and salt.
Step 4: Serve hot.

MOROGO WA LEKGOMANE (Bottle goard leaves relish)

This recipe serves 3-4 people. Vegetables such as carrots, garlic and peppers can be added to enhance the appearance and nutrient content. This dish can be served with papa, sorghum stiff / fermented porridge or melon porridge.

Ingredients

4 cups bottle goard leaves
¼ cup boiling water
1 medium tomato (chopped)
1 small onion (chopped)
½ small cooked bottle goard
2 Teaspoons vegetable oil
Salt and pepper to taste

Preparation

Step 1: wash and drain the leaves
Step 2: cut the leaves into small pieces and add the leaves to hot water, cover and boil for 20 minutes or until water boils dry.
Step 3: Sauté the onion and tomato in another pot and add tomatoes and chopped potatoes and simmer gently for 1minute.
Step 4: Add the sauté onion, tomato and bottle goard mix to the leaves.
Step 5: Add the seasoning, cover the pot and simmer for 5mins
Step 6: Serve hot.

MOROGO WA DINAWA, MOROGO WA LEPHUTSHE, ROTLHWE AND THEPE MIX RELISH (cowpea leaves, pumpkin leaves, spider plant and amaranthus)

This recipe serves 3-4 people. This dish can be served with papa, sorghum stiff / fermented porridge or melon porridge

Ingredients

1 cup fresh leaves of cowpea, pumpkin, rotlhwe, and thepe

2 cup boling water

1 medium tomato (chopped)

1 small onion (chopped)

4 small mashrooms (optional)

1 small green pepper (optional)

2 Teaspoons vegetable oil

Salt and pepper to taste

Preparation

Step 1: wash and drain the leaves

Step 2: cut the leaves into small pieces.

Step 3: cook pumkin leaves for 15 minutes and add the rest of the leaves and cooking oil and cook for further 10 minutes until the water run dry

Step 4: add the rest of the ingredients and stew for 10 minutes.

Step 5: serve hot.

BOBOLA (pumpkin leaves cooked in wild water melon pulp)

This recipe serves 3-4 people. This dish can be served with papa, sorghum stiff / fermented porridge

Ingredients

3 cups fresh pumkin leaves
3 cups wild water melon pulp
2 cups boiling water
2 Teaspoons vegetable oil
Salt and pepper to taste

Preparation

Step 1: add the melon pulp in hot water and boil the mixture until the mixture is soft. Mash the pulp
Step 2: in the meantime wash the pumpkin leaves and cut the leaves into small pieces.
Step 3: add to the cooking pulp and cooking for 20 minutes until the water dissolves
Step 4: add the rest of the ingredients and simmer for 10 minutes
Step 5: serve hot

MONYAKO/MOTANTANYANE

This recipe serves 3-4 people. Vegetables such as carrots, garlic, tomatoes, onions and peppers can be added to enhance the appearance and nutrient content. The dish can be served with papa, sorghum stiff / fermented porridge

Ingredients

4 cups fresh leaves of motantanyane/monyako
2 cups boiling water
2 teaspons cooking oil
Salt and pepper to taste

Preparation

Step 1: wash the leaves and drain
Step 2: cut the leaves into small pieces and add to the boiling water
Step 3: cover the pot and cook for 20 minutes or until the water runs dry.
Step 4: half way through the cooking time, add the cooking oil, salt and pepper and boil for the next 10 minutes
Step 5: serve hot

MOPHANI WORMS' STEW

This recipe serves 3-4 people. Vegetables such as carrots, garlic, tomatoes, onions and peppers can be added to enhance the appearance and nutrient content. The dish can be served with papa, sorghum stiff / fermented porridge/ melon porridge

Ingredients

2 cups dried mopane worms

1 Yellow Onion, finely chopped

2 Green bell peppers, sliced

6 Medium tomatoes, diced

1 Tbsp curry powder

1 Chilli pepper, seeded and finely chopped

2 cups water

Preparation

Step 1: Wash the dried caterpillars and pat dry.

Step 2: Place in spring water to cover in a pot and boil with a pinch of salt for 30 minutes to plump.

Step 3: Drain the pot of water and add all remaining ingredients.

Step 4: Bring mixture to the boil and then immediately reduce heat to a simmer; cook 30 minutes.

Step 5: Remove from heat and serve hot.

CHICKEN PEANUT STEW (groundnut stew)

This recipe serves 4-8 people. The dish can be served with rice, pap or sorghum stiff porridge. .

Ingredients

1 chicken, cut into about 8 pieces

1 Tbsp vegetable or olive oil

1 Yellow onion, chopped coarse

1 Green bell pepper, chopped coarse

1 Cup water

1/2 Cup each of Peanut butter and Tomato paste

1 teaspoon Grated ginger

2 Tablespoon brown sugar

1/2 teaspoon chilli flakes or ground red pepper

Preparation

Step 1: Take a large cooking pot or mixing bowl and make a sauce by combining sugar, chilli flakes, ginger, peanut butter and tomato paste.

Step 2: Slowly stir in water, constantly stirring until smooth.

Step 3: Pour the oil to a hot skillet and fry chopped onion to translucense.

Step 4: Add chicken parts and fry in same pan until the chicken has begun to brown.

Step 5: Add bell pepper and continue cooking until chicken is completely browned.

Step 6: Pour in the peanut sauce and stir well in the frying pan.

Step 7: Cover and reduce the heat to simmer; cook 60 minutes, stirring occasionally.

ROASTED PEANUTS AND SEEDS

This dish serves 3 people. The groundnuts can be oven or pot roasted

Ingredients

1 Cup groundnuts

1 Cup pumpkin seeds

Salt to taste

Preparation

Step 1: witch on the oven to 350 °C

Step 2: Place the peanuts and seeds in a shallow oven dish and cook for 15-20 minutes or until golden brown

PUMPKIN SMOOTHIE

Ingredients

1 cup boiled pumpkin
½ cup milk
½ tsp sugar

Preparation

Step 1: blend all ingredients to a very smooth consistency
Step 2: serve chilled

KABU BEAN MEAL

This dish serves 4 people. The dish can be served with gravy and any vegetable dish

Ingredients

1 cup dried maize (Kabu)

1 cup cowpea

Hot water to cook

2 teaspoon cooking oil

I carrot

½ green pepper

½ onion

Salt and pepper to taste

Preparation

Step1: soak maize and cowpeas overnight

Step 2: drain water from the cowpea and maize and transfer the mixture into a shallow sauce pan, add water and cook until soft.

Step 3: just 10 minutes before the end of cooking, sauté onions and green pepper. Add tomatoes and diced carrots and cook until done

Step 4: add salt and pepper and mix the gravy mixture and the bean and maize mixture together and serve hot or cold

MOSUTLHWANE CHICKEN STIR FRY

This dish serves 4-6 people. The dish can be served with boiled pumpkin and green vegetables

Ingredients

2 cups cooked mosutlhwane
2 tablespoon cooking oil
4 gloves garlic minced
1 medium onion thinly sliced
1 teaspoon salt
4 boneless skinless chicken breast cut into strips
1 cup sliced cabbage
1 small red pepper sliced
1 cup chicken broth
1 tablespoon flour
1 tablespoon sugar

Preparation

Step 1: heat oil in a frying pan until hot
Step 2: add garlic, onions and salt
Step 3: add chicken and stir-fry until chicken is brown
Step 4: add red peppers, cabbage, and ½ chicken broth. Stir fry for 2 minutes
Step 5: In a small bowl, add soy sauce, sugar, flour and ½ cup chicken broth
Step 6: add sauce mixture to the frying pan. Stir fry for 2 minutes
Step 6: serve immediately over hot mosutlhwane/rice/papa/sorghum/millet porridge

MOROGO WA DELELE (delele relish)

This recipe serves 3-4 people. This dish can be served with papa, sorghum stiff / fermented porridge

Ingredients

4 cups fresh delele leaves
2 cups boiling water
Salt and pepper to taste
1 small tomatoe (optional)
1 small onion (optional)

Preparation

Step 1: wash and drain the leaves
Step 2: Add the leaves to boiling water, cover and boil for 20 minutes (for dry leaves boil for 30 minutes).
Step 3: Halfway through the cooking time, add vegetables and salt.
Step 4: Serve hot.

CHIMONI (Samp, bambara groundnuts and groundnuts dish)

This dish serves 4-6 people. It can be served with gravy and green vegetables

Ingredients

1 ½ cup samp
1 cup bambara groungnuts
1 cup ground nuts
Boiling water to cook
2 table spoon cooking oil
Salt and pepper to taste
1 beef stock (optional)
1 teaspoon curry powder (optional)

Preparation

Step 1: soak bambara groundnuts and samp overnight
Step 2: in a shallow saucepan, add the groundnuts, bambara groundnuts and samp and bring to the boil. Reduce heat and simmer until soft.
Step 3: add cooking oil, salt, beef stock, and curry powder and simmer gently for 20 minutes.
Step 4: serve hot.

PHANE AND MABOA PIZZA (mophani worm and wild mashroom pizza)

This dish serves 2-4 people. It can be served with mixed vegetables

Ingredients

Basic bread dough (flour, yeast, salt)

Topping:

½ cup cheese

1 Tsp tomato puree

1 Tsp tomatoe paste

1 cup Maboa (wild mashroom)

2 cups chopped phane

1 small onion

½ green peppers

Preparation

Step 1: preheat oven to 180^0C

Step 2: Make basic bread dough

Step 3: roll dough and fit in greased baking tray

Step 4: Chop maboa, onion, pepper. Mix well with chopped phane. Mix with other ingredients

Step 5: Spread over dough. Sprinkle with cheese.

Step 6: bake for 20-25 mins until well cooked

FRESH FISH (Fish from the river, streams, dams etc)

This dish serves 2-4 people. This dish can be served with fried/baked potatoes or sorghum and millet porridge or papa

Ingredients

2 whole fish

3 tsp salt

½ cup cooking oil
1 large egg
¼ cup seasoned flour
½ Tsp lemon juice

Preparation

Step1: clean the fish (remove insides and scales with a knife)
Step 2: wash fish and prepare coatings.
Step 3: heat oil in a pan and coat fish with seasoned flour, egg and lemon juice.
Step 4: gradually add fish to oil. Fry under moderately high temperature until golden brown
Step 5: garnish with lemon wedges
Step 6: Serve warm

CREAMED THEPE (amaranthus)

This dish serves 2-3 people and can be served with porridge or any other starchy dishes.

Ingredients

I cup dried or fresh thepe
¼ cup milk or grated cheese
1 Tsp cooking oil
Salt and pepper to taste

Preparation

Step 1: was the fresh thepe leaves. Boil the leaves for 5 minutes. Add milk/cheese.
Step 2: Stir to desired consistency
Step 3: season well
Step 4: serve hot.

PHANE ACHAR (Mophani worm achar)

The achar can be served with vegetables, starchy foods, meat dishes etc. it makes 100g achar.

Ingredients

½ cup phane
1 small carrot
½ green pepper
¼ small cabbage
4 fresh chillies
½ cup cooking oil
½ red pepper
½ yellow pepper
1 cup water
Salt and pepper to taste

Preparation

Step 1: remove phane heads and tails. Boil phane for 10 minutes
Step 2: cut other vegetables into strips and slice chillies
Step 3: stir fry chillies for 1-2 mins in oil. Add remaining vegetables and stir fry for 4 minutes
Step 4: add phane and remaining oil to the stir fry. Cook for 2-4mins. Add seasoning
Step 5: put in a sterilized bottle with an air-tight seal

MOROKO AND LENGANGALE MUFFINS (Bran and dried melon)

Spread with butter/cheese/ or any spread of your choice and serve with a beverage. It makes 6 muffins

Ingredients

1 cup bread flour
1 cup moroko (bran from sorghum)
2 tsp baking powder
1 cup lengangale
½ cup cooking oil
2 cups milk
2 Tsp brown sugar
1 large egg

Preparation

Step 1: pre-heat oven and grease muffin tin
Step 2: dice lengangale
Step 3: mix all dry ingredients together
Step 4: add lengangale and oil
Step 5: mix with milk to a thick pouring consistency
Step 6: spoon into muffin tins
Step 7: bake for 10-15mins
Step 8: cool and serve warm or cold