PROMOTING TRADITIONAL AND INDIGENOUS FOODS IN SOUTH AFRICA: A DESKTOP REVIEW

by
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DECLARATION

By submitting this thesis electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the sole author thereof (save to the extent explicitly otherwise stated), that reproduction and publication thereof by Stellenbosch University will not infringe any third-party rights and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

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ABSTRACT

INTRODUCTION: One of the most pressing issues confronting South Africa is ensuring access to sufficient, nutritious, and affordable food that is produced in a sustainable manner. However, a significant proportion of the diverse foods available in our environment have been overlooked in favour of a few commercial staple foods, resulting in a food supply that is too limited. Growing population rates, urbanization, and persistently rising food prices have resulted in a shift in dietary patterns from more traditional to more westernized diets, where healthier food options have become a luxury and highly processed and refined convenience foods are marketed as less expensive options, all of which are contributing to the emergence of a nutrition crisis in SA. This has resulted in the displacement of traditional and indigenous food crops (TIF), as well as a change in the diet of South Africans. Current dietary patterns reflect an increased intake of a small number of domesticated plant staples, while the intake of TIF, which once sustained health and nutritional status, has decreased significantly. The goal of this study is to conduct a literature evaluation on the promotion of TIF in South Africa.

METHODOLOGY: This review was conducted using a systematic search of current academic literature from the following databases: Science Direct, Jstor, EBcohost, Bio-med and PubMed, and Google scholar. Abstract, title, keywords, and subject headings specific to each of the identified databases were searched. The review included studies with both analytical and descriptive study designs.

RESULTS: Of the 26699 titles and abstracts screened 103 were potentially eligible. The review included five studies that included TIF as part of the intervention strategy after examination of full texts. Of the total 5 studies included in the review, 2 were cross-sectional studies, 2 were randomized control trials and 1 was a pre-test post-test control group design. All of the studies were based in rural communities. All the interventions had children, ages 1-12 years, as the primary benefactors. The studies included in this review have indicated the promotion and consumption of TIFs resulted in improved nutritional status, particularly vitamin A, zinc, and iron status. The inclusion and promotion of TIF in nutrition messages can significantly improve diet quality and ensure dietary diversification. This is attributed to the various components that form part of successful community-based interventions.

CONCLUSION: The five studies discussed in the review are generally acknowledged to be successful in their own right. They have shown that the promotion, production and consumption of TIF in conjunction with nutrition messages and health-based caring practices does improve household food and nutrition security, particularly in vulnerable groups.

OPSOMMING

INLEIDING: Een van die mees dringende kwessies wat Suid-Afrika konfronteer, is om toegang te verseker tot voldoende, voedsame en bekostigbare kos wat op 'n volhoubare wyse geproduseer word. ‘n Beduidende proporsie van die diverse voedsel wat in ons omgewing beskikbaar is, word tot voordeel van 'n paar kommersiële stapelvoedsels oor die hoof gesien, wat gevolglik lei tot ’n té beperkte voedselvoorraad. Groeiende bevolkings koerse, verstedeliking en voortdurende stygende voedsel pryse het daartoe gelei dat dieet patrone verskuif van meer tradisionele tot meer verwesterde diëte. Gesonder voedsel opsies het 'n luukse geraak het, en hoogs verwerkte en verfynde geriefskos word as minder duur opsies bemark, bydraend tot die opkomstige voedingskrisis in SA. Dit het gelei tot die verplasing van tradisionele en inheemse voedsel gewasse (TIV), asook 'n verandering in die dieet van Suid-Afrikaners. Huidige dieet patrone weerspieël 'n verhoogde inname van 'n klein hoeveelheid verboude plant stapelvoedels, terwyl die inname van TIV, wat eens gesondheids- en voedingstatus volhou het, aansienlik afgeneem het. Die doel van hierdie studie is om 'n literatuur evaluering oor die bevordering van TIV in Suid-Afrika te doen.

METODOLOGIE: Hierdie oorsig is met behulp van 'n sistematiese soektog na huidige akademiese literatuur uit die volgende databasisse: Science Direct, Jstor, EBcohost, Bio-med en PubMed, en Google Scholar gedoen. Abstrakte, titel-, sleutelwoorde en vak opskrifte spesifiek tot elk van die geïdentifiseerde databasisse is gesoek. Die oorsig het studies met beide analitiese en beskrywende studie ontwerpe ingesluit.

Die **RESULTATE:** Van die 26 699 titels en abstrakte wat gekies is, kon 103 potensiëel ingesluit word. Die oorsig het vyf studies ingesluit wat TIV ingesluit het as deel van die intervensie-strategie na die ondersoek na volledige tekste. Van die totale vyf studies wat in die oorsig opgeneem is, was twee deursnee-studies, twee was ewekansige kontrole proewe en een was 'n voor-toets-kontrole-groep ontwerp. Al die studies was in landelike gemeenskappe gebaseer. Die primêre begunstigdes in al die intervensies was kinders van 1-12 jarige ouderdom. Die studies wat in hierdie oorsig opgeneem is, het aangedui dat die bevordering en verbruik van TIV's 'n verbeterde voedingstatus tot gevolg gehad het, veral vitamien A-, sink- en ysterstatus. Die insluiting en bevordering van TIV in voedingsboodskappe kan dieetkwaliteit beduidend verbeter en dieet diversifikasie verseker. Dit word toegeskryf aan die verskillende komponente wat deel uitmaak van suksesvolle gemeenskapsgebaseerde intervensies.

GEVOLGTREKKING: Die vyf studies wat in die oorsig bespreek is, word oor die algemeen erken as suksesvol in hul eie reg. Hulle het getoon dat die bevordering, produksie en verbruik van TIV gepaardgaande met voedingsboodskappe en gesondheidsgebaseerde versorgingspraktyke wel huishoudelike voedsel- en voeding sekerheid verbeter, veral in kwesbare groepe.

Keywords: traditional and indigenous foods; wild vegetables; household food insecurity; community–based interventions; malnutrition.

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CONTRIBUTIONS BY PRINCIPAL RESEARCHER AND FELLOW RESEARCHERS

The principal researcher Zizo Bobo developed the idea and the protocol. The principal researcher planned the study, undertook data collection with research assistant, captured the data for analyses, analysed and interpreted the dataand drafted the thesis. Mrs RA Beukes and Prof G Sigge (Supervisors) provided input at all stages and revised the protocol and thesis.

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ABBREVIATIONS

ALVs	African Leafy Vegetables
DOA	Department of Agriculture
DOH	Department of Health
DR-NCDs	Diet-related Non-Communicable Diseases
NDoH	National Department of Health
NEIP	Nutrition Education Intervention Programme
SA	South Africa
SAFBDG	South African Food-Based Dietary Guidelines
SAPFBDDG	South African Paediatric Food-Based Dietary Guidelines
StatsSA	Statistics South Africa
RCTs	Randomized Controlled Trials
TIF	Traditional and Indigenous Food
TIV	Tradisionele en Inheemse Voedsel
UNICEF	United Nations Children's Fund
VAD	Vitamin A Deficiency
WHO	World Health Organization

DEFINITIONS

Community-based interventions

Refer to multicomponent interventions that generally combine individual and environmental change strategies across multiple settings aiming to prevent dysfunction and to promote well-being among population groups in a defined local community (Petridou, Antonopoulos, & Alexe, 2008).

Dietary Diversification

An approach that aims to enhance the availability, access, and utilization of foods with high content and bioavailability of micronutrients throughout the year. It involves changes in food production practices, food selection patterns, and traditional household methods for preparing and processing indigenous foods (Gibson & Hotz, 2001).

Double duty actions

Interventions, programs, and policies that have the potential to simultaneously reduce the risk or burden of both undernutrition and overweight, obesity or diet-related NCDs (WHO, 2017)

Nutrition Transition

The shift in dietary consumption and energy expenditure coincides with economic, demographic, and epidemiological changes. The circumstantial changes usually associated with the nutrition transition are urbanization, modernization, and acculturation (Vorster & Bourne, 2008).

Traditional and indigenous foods

These are crops that have their origins in SA or were introduced into the country and are now recognized as naturalized or traditional crops (DAFF, 2013).

Wild Vegetables

Plants that grow spontaneously in self-maintaining populations in natural or semi-natural ecosystems and can exist independently of direct human action (Heywood, 1999).

CHAPTER 1
INTRODUCTION

1.1 THE NUTRITION TRANSITION IN SOUTH AFRICA

Countries undergoing an economic transition have also seen a rapid shift in diet and nutritional status which have resulted in changes in the health profiles of populations. This nutrition transition, often characterized by major dietary shifts from diets high in carbohydrates, fibre, and low in fat to inexpensive convenient, and highly processed foods that are high in saturated fats, cholesterol, sugar, and refined carbohydrates (Popkin & Shu, 2006; Popkin, 2015). This shift in dietary patterns is also accompanied by demographic and epidemiological shifts, urbanization, a shift in income per capita, and an expansion of global trade services. These factors have combined to create major shifts in dietary patterns (Popkin, 2015). An unintended consequence of rapidly transitioning countries is a double burden of morbidity and mortality, with the concurrent existence of persistent food insecurity and undernutrition with the emergence of diet-related non-communicable disease (DR-NCDS) (Vorster & Bourne, 2008). Historically, undernutrition and overnutrition have always been considered as two separate public health challenges, affecting different populations. Undernutrition is commonly associated with poverty, hunger, and high infection rates mostly prevalent in developing nations. Overnutrition has been attributed to affluence, sedentary lifestyles, and diets rich in highly processed foods, and high rates of DR-NCDs, mostly prevalent in developed nations (Popkin, Corvalan & Grummer-Strawn, 2020; Wells, Sawaya, Wibaek, Mwangome, Poullas, Yajnik & Demaio, 2020).

South Africa (SA), as in many other developing countries, has not been immune to the changes associated with rapidly transitioning countries. According to the National Department of Health in SA (NDoH), the rate of stunting among children younger than the age of 5 years has worsened from 24 per cent in 2004 to 27 per cent in 2016. This has been greatly linked to dietary intake whereby only 23 per cent of children age 6-23 months are fed a minimal accepted diet, which means feeding the child food from at least four of the standard seven food groups identified by the World Health Organization (WHO). Simultaneously, nearly 70 per cent of adult women and 31 per cent of adult men are overweight and 13 per cent of children under age 5 are overweight or obese (NDoH, Statistics South Africa, South African Medical Research Council, ICF, 2019). Dietary patterns have shifted from more traditional to more westernized as a result of rising population rates, urbanization, and constantly rising food prices. Highly processed and refined junk foods are being advertised as cheaper

alternatives, while healthier eating options have become a luxury (Schonfeldt & Hall, 2013; Pareira, 2013).

1.2 USE OF TRADITIONAL AND INDIGENOUS FOODS IN SA

Despite meeting all the criteria of being food secure at a national scale, with adequate nutrition accessible to all in SA, the reality remains that inter-household and as well as intra-household access to adequate food varies greatly. Approximately 20.2% of households and 23.8% of individuals have inadequate access to food. Moreover, almost 70 per cent of the poorest households reside in rural areas (Statistics South Africa, 2018). Although other factors such as high unemployment rates, inflated food prices, and ethnic disparities have contributed towards food insecurity and poverty in SA, access to food is the biggest challenge faced by these households (van der Merwe, Cloete & van der Hoeven, 2016).

The average home size in SA is 3.49 persons, however, it has been shown that in most rural and informal areas, the average household size can double to six or seven people due to extended family members. (Schonfeldt, Hall & Pretorius, 2017; Stats SA 2018). These are the households most vulnerable to food price rises, with food accounting for 31 per cent of total spending (Stats SA, 2012). Food affordability is a major challenge in South Africa. A minimum of $2.39 is required to achieve daily nutritional requirements (R34.94). Most vulnerable households have as little as $2.24 (R34.75) to spend on all members of the home due to the ongoing burden of poverty and increased food prices. This averages out to about $0.32 (R4.68) per household member. Consumer decisions are heavily influenced by the availability of suitable resources for such disadvantaged communities. The informal food sector plays a vital role in ensuring food security in disadvantaged areas. Food prices, on the other hand, are significantly higher, especially for fresh vegetables, animals and animal products. As a result, people resort to bad coping mechanisms such as eating highly refined and processed meals, which are less nutritious and have a lower nutritional value. (Schönfeldt, Gibson & Vermeulen, 2010; Schönfeldt et al., 2017; Pareira, 2013).

Although consumer food choices are frequently hampered by a lack of knowledge, a lack of access to a diverse range of food options, and a lack of resources. In South Africa, public health messages encourage dietary diversification, with the goal of increasing the availability, accessibility, and utilization of safe and nutritious foods (Ruel, 2003). However, the emphasis has been primarily on encouraging the consumption of commercial staple foods as well as conventional vegetables, with little mention of wild vegetables, also known as traditional and indigenous foods (TIF) (Schönfeldt et al., 2017; Mabhaudhi, Chibarabada, Chimonyo,

Murugani, Pereira, Sobratee, Govender, Slotow & Modi, 2019). This has been a result of the post-colonial displacement of TIF and placing a greater emphasis on the production and consumption of cash crops, as well as the introduction of highly processed and refined junk food.

Over millennia, agriculture has been the backbone of food systems with traditional and indigenous foods as the main source of food for many rural communities (van der Hoeven, Osei, Greeff, Kruger, Faber & Smuts, 2013). TIF crops are defined as crops that either originated in the region or are exotic crops that have been incorporated over many decades of cultivation (Mabhaudhi et al., 2019). Their nutritional composition is typically superior to that of conventional vegetables, and they have been shown to provide essential nutrients required by human physiology (Bvenura & Afolayan, 2015). TIF are rich in nutrients such as protein, vitamin A, vitamin C, iron, zinc, and calcium (Johns, Powell, Maundu, & Eyzaguirre, 2013; Mbhenyane, 2017). Previously, these crops served as the foundation of local food systems, supplementing diets and providing much-needed relief during emergencies such as droughts. The displacement of TIF by a few major cash crops has contributed to the global food system's limited success, particularly in Africa. Current dietary patterns show an increase in the consumption of a small number of commercial plant staples, while the consumption of wild vegetables that maintain nutritional status has decreased (van der Hoeven et al., 2013; Mabhaudhi, Chibarabada, Chimonyo, Murugani, Pereira, Sobratee, Govender, Slotow & Modi, 2019

While agriculture is the primary source of income for the majority of rural households, it is frequently carried out in suboptimal conditions, making it unsustainable. Rural agricultural development has been prioritized by a national policy in South Africa in efforts to ensure food security and poverty eradication, with the emphasis primarily on producing commercial crops. However, these initiatives have had little success (van der Merwe et al., 2016; Mabhaudhi et al., 2019). The incorporation of TIF in the diet of South Africans can help to alleviate hunger and all forms of malnutrition. Some of these foods are actively cultivated, while naturally occurring ones are nurtured in food gardens (Hart, 2010). The majority of wild vegetables are typically available all year, implying a consistent supply of nutrient-dense food all year. They are typically prepared as a relish to accompany starch-based meals. The addition of other plant parts, such as the root and tuber, fruit and seeds, increases the nutritional content and contributes to dietary diversity and nutrient availability. Excess leaves are also dried and stored for use during the winter months (Bvenura & Afolayan, 2015; Hart, 2010).

Although some research indicates that there is a decline in knowledge and consumption of traditional and indigenous foods due to the perception of TIFs as poor people's food, the consumption of TIF in SA persists, implying that some traditional knowledge and production processes still exist (Mabhaudhi et al., 2019). This perception has been traced back to African consumers' historical food consumption habits when these crops were freely available in the bush and homesteads and were relatively inexpensive (Cloete & Idsardi, 2013). Other factors that have contributed to this decline include the westernization of the diet, the younger generation's lack of enthusiasm for identifying and preferring convenience foods, harvesting, and methods of preparation and preservation (Bvenura & Afolayan, 2015). Recent research, however, has shown that this is not the case. According to survey data from 600 households in South Africa's North West Province, approximately 52 per cent of households consumed TIF, and there was no significant difference in household income between TIF consumers and non-consumers of TIF. Therefore, the perception that they are for low-status people is unjustifiable (Cloete & Idsardi, 2013). Another survey conducted in the Limpopo Province revealed 95 per cent of households considered cultivated and naturally occurring vegetables as essential foodstuffs due to their nutritional value and they are easier to produce when compared to commercial vegetables, and 72 per cent of households reported regularly consuming TIF (Hart, 2010). Therefore, the promotion of TIF may help diversify the diet and make a considerable contribution towards ensuring food security.

1.3 IMPORTANCE OF TRADITIONAL AND INDIGENOUS FOODS IN MALNUTRITION AND NCDS

The persistent challenge of poverty and food insecurity and reliance on inexpensive convenient foods has resulted in the coexistence of overweight and obese adults and stunted, micronutrient deficient children within the same household. The first 1000 days concept highlights the profound effects that poverty and undernutrition play in poor health outcomes. Poor maternal and early child nutrition are important and preventable drivers of both overnutrition and undernutrition (WHO, 2017). This is because nutrition in the first 1000 days, in particular, plays a foundational role in a child’s survival, development and well-being right throughout life (Bamford, 2019). This directly poses major health and policy challenges, as children exposed to malnutrition in utero and early in childhood are not only more susceptible to DR-NCDs, they also have stunted mental and physical development resulting in decreased human capital later on in life. This creates an intergenerational vicious cycle of poverty and malnutrition (Vorster, Kruger & Margetts, 2011).

Current dietary patterns of the South African population reflect only 23 per cent of children aged 6-23 months are fed a minimal accepted diet, which means feeding the child food from at least four of the standard seven food groups identified by the World Health Organization (WHO). Half of the adult population regularly consume fruits and vegetables (NDoH et al., 2019). TIFs are known to contribute to human health through the provision of all the essential nutrients, thus improving the diet quality of the local diet. They can help alleviate hunger and malnutrition and contribute to dietary diversity due to their high nutritional value (Mayekiso,2016). They are important sources of nutrients such as vitamin A, C, iron, zinc, and protein, and are sometimes betters sources of nutrients when compared to conventional crops (Van de Hoeven et al., 2013; Mbhenyane, 2017).

The promotion of TIF will provide sustainable means as well as a long-term solution in eradicating all forms of malnutrition. This, however, can be achieved through a multisectoral approach, whereby nutrition and agriculture are integrated to potentially increase food production to increase household food consumption (Faber, Witten & Drimie, 2011).

1.4 MOTIVATION FOR THE STUDY

Growing population rates, urbanization and persistently rising food prices have resulted in a shift in dietary patterns from more traditional to more westernized diets, where healthier food options have become a luxury and highly processed and refined convenience foods are marketed as less expensive options, all of which are contributing to the emergence of a nutrition crisis in SA (NDoH et al., 2019; Schonfeldt & Hall, 2013; Pareira, 2013). Several studies have found that TIFs have a lot of potential for providing food and nutrition security. Their nutritional composition is usually superior to that of conventional vegetables, and it has been demonstrated that they provide essential nutrients required for human physiology. TIFs are consumed as an accompaniment to starch-based meals in South Africa, and thus play an important role in improving the nutrient density of starch-based diets. Furthermore, including a variety of TIF species in the diet increases dietary diversity by providing more food sources from the plant (Bvenura & Afolayan, 2015). TIF promotion and consumption can assist solve both undernutrition and overnutrition in the same community while guaranteeing food security. The goal of this study was to conduct a literature evaluation on the promotion of TIF in South Africa.

1.5 THE ORGANISATION OF THE STUDY

The study will be organised in the following way:

Chapter 1: Introduction

Chapter 1 consists of the introduction, which gives the background to the research, the problem statement, and the layout of the study.

Chapter 2: Literature review

Chapter 2 provides a background to the knowledge of TIF in SA, including some of the most common varieties of TIFS and the significance of TIF in ensuring food and nutrition security. The economic value of TIFs is also discussed.

Chapter 3: Research methodology

Chapter 3 outlines the study design to explain how the study was conducted. The information included will highlight data collection and extraction.

Chapter 4: Results

Chapter 4 presents the main finding of the study, which are analysed in consideration of the research aims and objectives.

Chapter 5: Discussion

Chapter 5 will present the discussion of the key finding of the study, with respect to the key finding and literature reviewed in the study.

Chapter 6: Conclusions and recommendations

Chapter 6 presents the conclusions drawn from the study and possible recommendations.

CHAPTER 2
LITERATURE REVIEW

2.1 INTRODUCTION

This review critically explores the promotion of traditional and indigenous foods in South Africa. One of the most pressing issues confronting South Africa is ensuring access to sufficient, nutritious, and affordable food that is produced in a sustainable manner (Kennedy, Stoian, Hunter, Kikulwe, Termote, Alders, Burlingame, Jamnadass, McMullin & Thilsted, 2017). However, a significant proportion of the diverse foods available in our environment have been overlooked in favour of a few commercial staple foods, resulting in a food supply that is too limited (Frison, Smith, Johns, Cherfas & Eyzaguirre, 2010). This has resulted in the displacement of traditional and indigenous food crops (TIF), as well as a change in the diet of South Africans. Current dietary patterns reflect an increased intake of a small number of domesticated plant staples, while the intake of TIF, which once sustained health and nutritional status, has decreased significantly. Despite significant progress in reducing hunger, malnutrition persists (van de Hoeven, Osei, Greeff, Kruger, Faber & Smuts, 2013). Diets that are primarily cereal-based and nutrient-deficient, with few foods of animal origin, vegetables, and fruit, are major contributors to the ongoing challenges of malnutrition and nutrient deficiencies (Faber, Oelefse, Van Jaarsveld, Wenhold & van Rensburg, 2010).

Agricultural development has been identified as key to achieving food security in several ways. It has the potential for poverty alleviation by reducing food prices, create employment and provide an income (HLPE, 2016). Agricultural investments which include food-based strategies such as dietary diversification can yield great results. Dietary diversification can widen its scope to include TIF, for example, such as wild green leafy vegetables and roots, however, this strategy requires the aggressive promotion of TIF (Frison et al., 2010).

The objective of this chapter is to present an overview of the current knowledge of TIF in South Africa and the significant contribution it has toward food and nutrition security. It will review the most common varieties of TIF consumed in SA. It will review the nutrient content, consumption patterns, and factors influencing TIF consumption. It will also review the economic benefits of incorporating TIF back into the local diet on a large scale. The basis of the argument for this chapter is that TIF has a role in the current food systems, however, due to industrialization and globalization they have been greatly displaced. The majority of TIF are available all year round providing a constant supply of nutrient-dense food. However, the

introduction of modern crops adversely affected their perceptions as “poverty foods” and food for the elderly, thus narrowing the food supply. Their nutritional composition is usually superior to modern crops, and the promotion of TIF could provide sustainable means of eradicating all forms of malnutrition.

2.2 DEFINITIONS AND TIF CONSUMPTION IN SOUTH AFRICA

Indigenous foods, according to the Department of Agriculture, Forestry and Fisheries (DAFF, 2012), are food crops that originated in South Africa as well as crops that were introduced into the country and are now recognized as naturalized or traditional crops. This definition includes a wide range of foods such as fruits, leafy and root vegetables, and grain crops. TIFs also cover annual crops, cultivated and collected crops, and plants are grown for home consumption (van der Merwe et al., 2016). They can be classified as conventional crops, such as sorghum, sweet potatoes, and cowpeas, or as less conventional crops, such as aramath, pumpkin leaves, and calabash (Cloete & Idsardi, 2013). TIFs have the potential to grow spontaneously and abundantly in the rural homestead or the wild, have a rich nutrient profile, and are well adapted to harsh conditions (Njume, Goduka & George, 2014). Different ethnic groups in South Africa prepare TIFs differently because there are many methods and ingredients used in preparing TIF meals. Methods of cooking include boiling, steaming and frying. Leafy vegetables can be prepared as a snack or as an accompaniment to starchy meals such as maize. Fruits can be eaten raw as soon as they are picked, while roots and tubers can be eaten raw or boiled. All of these different cooking methods can have an impact on the nutrient content and bioavailability of many nutrients. (Taleni, Nyoni & Goduka 2012; Mathenge, 2011).

Despite all of the above, the production and consumption of TIF have declined in South Africa. This has been driven by concerns about and nutrition, lack of awareness, tradition and culture, and the general labelling of TIFs as weeds. This has resulted in negative perceptions of the consumption of TIF. As a result, this has been the leading factor in the decline of TIF consumption (Taleni et al., 2012; van der Merwe et al., 2016). According to Matenge (2011), other factors associated with this decline have been due to modernization as the younger generations prefer fatty and salty tastes associated with fast food. Furthermore, the younger generations perceive TIF as old-fashioned and low-status foods that are consumed by the poor in rural communities as they are mostly prepared by the older generations who are custodians of TIFs. However, this intensifies the potential of TIFs in achieving food security as this suggests that knowledge, skills, and production processes exist. The local production of these crops implicates that they are more affordable and accessible, particularly in rural

communities. Despite all of the negative connotations associated with TIFs, Cloete and Idsardi (2013) found that approximately 52 per cent of households in Northwest Province South Africa still use TIFs, with only 6 per cent of households not using TIFs. Mbhenyane et al. (2005) discovered that 22 per cent of students consumed indigenous fruits and 89 per cent consumed indigenous vegetables in a study on the nutrient intake and consumption of TIFs by students in Limpopo Province.

2.3 MOST COMMON TIFS OF SOUTH AFRICA

South Africa possesses a rich diversity of TIF which are not only high in nutrients but also contain health-promoting properties that help prevent chronic diseases (Department of Agriculture, Forestry & Fisheries, 2013). TIF includes grains, vegetables, and fruits and is found growing in various weather conditions. Their cultivation is mostly limited to rural farming communities on small-scale production. Numerous types of TIF have been documented in the country, however, only the most common varieties will be discussed below. Table 2.1 summarises the nutritional health benefits, main uses and production areas of the most common TIF's in SA, which will be discussed in detail below.

2.3.1 Traditional grain crops

Traditional and indigenous grain crops refer to any starch-yielding and protein-enriched seeds used for human and animal consumption. This definition further incorporates pulses and cereals. These grain crops are often suitable to dry weather conditions and are drought tolerant (DAFF, 2013). This section looks at traditional and indigenous grains namely: *Pennisetum glaucum, Sorghum bicolour, Vigna unguiculata, Vigna subterranean, Vigna radiate.*

Pennisetum glaucum: This crop is commonly known as pearl millet and is mostly produced in Limpopo, KwaZulu Natal, and Free State provinces (DAFF, 2013). Pearl Millet is a great alternative crop that constitutes approximately 70 per cent starch in its grain (Punia, Kumar, Siroha, Kennedy, Dhull & Whitseide, 2021). Pearl millet's physiological characteristics make it more advantageous than other cereals because it is resistant to drought, low soil fertility, high salinity, and high temperatures. (Punia et al., 2021; Dias-Martins, Pessanha, Pacheco, Rodrigues & Carvalho, 2018). Pearl millet can be processed and prepared in traditional dishes, as well as used as livestock feed. It is primarily used to make whole, cracked, or ground flour, dough, or grain-like rice. Because of its high fibre, protein, mineral, and fatty acid content, pearl millet is considered a nutri-cereal. They are also a great starch alternative for coeliacs

and gluten-sensitive people. Furthermore, because of its bioactive properties, it has health-promoting properties that can be beneficial (Dias-Martins et al., 2018).

***Sorghum bicolour*:** Most commonly known as sorghum, it is most valued in hot and arid regions for its resistance to drought and heat. It is fifth in importance among the cereals produced worldwide. In SA, the Mpumalanga and Free State provinces are the largest producers of this grain (ARC, 2014). The whole grain can be boiled, roasted, popped, or ground to make flour (DAFF, 2013). The nutritional composition is similar to maize; however, it is an important source of carbohydrates calcium, and small amounts of thiamine, niacin, and iron. It also has health-promoting benefits with anti-inflammatory and anti-cancer properties (Kulamarva, Sosle & Raghavan, 2009).

***Vigna unguiculata*:** This is a multipurpose crop, commonly known as cowpea. It is mostly grown in Limpopo, Gauteng, Mpumalanga, North-West, and KwaZulu Natal provinces (DAFF, 2013). The entire plant can either be used for human consumption or animal feed. This crop is grown mainly by smallholder farmers for its leaves and seeds (pulses). Cowpeas are the most preferred crops and a valuable component in the farming systems of the majority of resource-poor rural households due to their ability to grow in harsh conditions (ARC, 2014). It is high in energy, protein, fibre, minerals, B vitamins, vitamin A, vitamin C, iron, and is low in fat. The plant also has phytochemical compounds which have various health benefits that are protective against the development of several chronic diseases (Jayathilake, Visvanathan, Deen, Bangamuwage, Jayawardana, Nammi & Liyanage, 2018).

Vigna subterranean: Commonly known as Bambara groundnut, it is mostly produced for subsistence uses in Mpumalanga, KwaZulu Natal, and Limpopo provinces. It is related to cowpea and is used for both human and animal consumption (ARC, 2014). Because of its ability to grow in harsh environments such as poor soil quality and drought, Bambara groundnut is also climate-smart. Because of its macronutrient composition, Bambara groundnut is a completely balanced food, containing adequate amounts of starch, protein, and fat. Bambara groundnut contains more protein than other common legumes in Africa, making it an affordable source of quality protein, iron, and zinc in predominantly starch-based diets. (Tan, Azam-Ali, Von Goh, Mustafa, Chai, Ho, Mayes, Mabhaudhi, Azam-Ali & Massawe, 2020).

Vigna radiate: This fast-growing warm-season pulse is commonly known as mungbean, as is mostly produced in the Limpopo and Mpumalanga provinces. Mungbean is produced for both animal and human consumption. The principal domesticated use is the production of bean

sprouts in Asian cooking. Other uses include a base for soup or ground into flour (DAFF, 2013). Mungbean crops are highly nutritious and complete pulses containing all macronutrients. The protein content of mungbean is usually superior when compared to other pulses and the bioavailability of iron can be improved through cooking practices such as soaking and fermentation. The mungbean protein is also considered to be easily digestible and can complement starch-based diets well (Yi-Shen, Shuai & FitzGerald, 2018).

2.3.2 Traditional vegetable crops

Vegetable crops are fresh edible portions of certain herbaceous plants. The edible portion usually includes leaves, stems, roots, or tubers (DAFF, 2013). They are rich in nutrients, easy to grow, and are adaptable to local growing conditions. Numerous types of traditional and indigenous crops but the most common varieties are described below, namely: *Cleome Gynandra, Amaranthus, Bidens Pilosa, Corchorus Olitorius, Manihot Esculenta, and Colocasia Esculenta*.

***Cleome gynandra*:** This multipurpose plant is commonly known as the spider plant. The spider plant is consumed by both humans and animals and is thought to have insecticidal properties (Kujeke, Gonye, Edziwa, Ncube, Masekesa, Icishahayo, Matikiti & Chabata, 2017). Limpopo, Free State, KwaZulu Natal, Northern Province, and North-West Province are the major growing areas (DAFF, 2013). It is frequently prepared as a relish to accompany starch-based meals. It is high in mineral elements like calcium, iron, magnesium, and zinc. Furthermore, the spider plant is well adapted to dry and hot conditions, and it thrives during the summer months. (Omondia, Engels, Namabafu, Schreiner, Neugart, Abukutsa-Onyango & Winkelmann, 2017).

***Amaranthus*:** Amaranths is one of the most valued leafy vegetables in South Africa due to their high nutritional value. Amaranth is also the most popular and widely growing leafy vegetable in rural communities. The cooked leaves can be eaten in different ways including vegetables, or soup (DAFF, 2013). Amaranth leaves are important sources of iron, beta-carotene, vitamin A, vitamin C, and phytochemicals that have antioxidant properties (Sarker, Hossain & Oba, 2020). The leafy vegetable is traditionally harvested but in cultivation, it is quite a drought-tolerant and grows well under low input environments (ARC, 2014).

***Bidens pilosa*:** Most commonly known as blackjack, this is a widely distributed leafy plant in SA. It is mainly grown in the KwaZulu Natal and Limpopo provinces (DAFF, 2013). The plant prefers to grow in high temperature and semi-dry soil conditions (Kuo, Yang, Chen, Wu, Minh,

Chen, Chen, Huang, Liang & Yang, 2020). The tender leaves and shoots are used as vegetables and medicine in many rural communities (Njume et al., 2014). The plant is reported to have more than 40 bioactivities including antidiabetic, anticancer, anti-hypertensive, and anti-obesity making it a suitable plant in the management of chronic diseases. It is also rich in essential amino acids, iron, and zinc necessary for human nutrition (Kuo et al., 2020).

***Corchorus olitorius*:** A herb commonly known as Jew's mallow grows in fields and home gardens. Its leaves and stems are high in vitamin A and C, folic acid, beta-carotene, iron, calcium, and anti-oxidative compounds, making it superior to spinach and cabbage (Ndlovu, Pullabhotla & Ntuli, 2020). Jew's mallow is most commonly consumed in the provinces of Limpopo, Gauteng, Eastern Cape, and Mpumalanga (DAFF, 2013). Jew's mallow prefers warm, humid climates and thrives in areas with high rainfall and temperatures (Ndlovu et al., 2020). Jew's mallow is a leafy vegetable. To make a sauce, immature fruit is dried and ground into powder. The dried leaves can be used as a thickener in soups and tea can be made from the dried leaves (DAFF, 2012).

***Manihot esculenta*:** This root vegetable is commonly known as cassava. Cassava is the fourth major staple crop after wheat, rice, and maize (ARC, 2014). Cassava is primarily grown by smallholder farmers and requires adequate moisture during the first few months, but is drought resistant after that (Kolawole, Agbetoye & Ogunlowo, 2010). Cassava roots are high in starch and contain significant amounts of calcium, vitamin C, and phosphorus; however, the tuberous plant must be supplemented with other leafy vegetables. Cassava leaves can be consumed as a vegetable because they are nutrient-dense; however, there is concern about nutrient bioavailability (FAO, 2009).

***Colocasia esculenta*:** This is another tuberous vegetable commonly known as amadumbe, mainly produced in Mpumalanga and KwaZulu Natal provinces (DAFF, 2013). This root vegetable is an important source of starch and has significant amounts of thiamine, riboflavin, iron, phosphorus, and zinc and is a very good source of vitamin B6, vitamin C, niacin, potassium, copper, and manganese (Rashmi, Raghu, Gopenath, Palanisamy, Bakthavatchalam, Karthikeyan, Gnanasekaran, Ranjith, Chandrashekrappa & Basalingapp, 2018). Amadumbe corms and young shoots may be used in various ways including boiled as a vegetable, however, the corms are fried, baked, or roasted to be eaten alone or with a stew (DAFF, 2013).

2.3.3 Traditional fruit crops

Traditional fruit crops are edible fruit types found in the wild found in SA (DAFF, 2013). Indigenous fruits have diverse distribution, duration of fruiting, and occur in different regions. The fleshy and ripened edible seed-associated structure is usually consumed in its raw state (DAFF, 2013). In South Africa, the most common varieties include *Sclerocarya Caffra, Mimusops Zeyheri, Parinari Curatellifolia, Carissa Macrocarpa, Dovyalis Caffra, Strychnos Spinose.*

***Sclerocarya Caffra*:** A tree fruit commonly known as marula fruit. The marula tree is commonly found in game parks and rural areas of the South African provinces of Limpopo, KwaZulu Natal, the Eastern Cape, and Mpumalanga (DAFF, 2010). The drought-resistant marula tree grows well in poor soils and thrives in hot climates. The fruit that the tree bears is plum-sized, pale-yellow, and very aromatic when it's ripe. Nutritionally the fruit is very high in vitamin C as well as being rich in the minerals calcium, potassium, and magnesium. The pulp of the fruit can be used to prepare jam or wines. The kernel is also edible producing oil that is used in cooking (Ngemakwe, Remize, Thaoge & Sivakumar, 2017).

***Mimusops Zeyheri**:* This is a fruit tree that occurs in open, dry, and bushveld woodland. Its common names include red milkwood and it is found in the wild in various regions of South Africa. (DAFF, 2013). The tree can withstand various soil and climate conditions. The tree also produces a yellow-orange fruit when it's ripe that is high in vitamin C (Omotayo, Ijatuyi, Ogunniyi & Aremu, 2020). Ripe fruits are picked and eaten directly from the tree, sold in street and open markets, made into jams, jellies, and fermented juices, and used to make various beverages (Mngadi, Moodley & Jonnalagadda, 2019).

***Parinari Curatellifolia*:** Commonly known as mabolo plum. These fruits are often consumed in the Limpopo and Mpumalanga provinces in SA. The ripe fruit has a russet-yellow plum-like fruit with yellow edible pulp (Bvenura & Sivakumar, 2017). The ripe fruit is usually can be eaten raw, but it can also be cooked as porridge (DAFF, 2013). The fruit is a rich source of vitamin C and mineral calcium. The potential of the fruit is it might contribute significantly to the mineral requirement of rural communities (Muchuweti, Matongo, Benhura, Bhebhe & Chipurura, 2013).

***Carissa Macrocarpa*:** This fruit is native to the KwaZulu Natal province in SA where it's locally known as amatungulu or num-num (Louw, 2021). It has a spiky-stemmed, glossy star-shaped flower and sweet-tasting red fruit. The ripe fruit is traditionally eaten raw or used in the

preparation of jams and jellies. The fruit is high in vitamin C, iron, calcium and essential fatty acids (Souilem, Dias, Barros, Calhelha, Alves, Harzallah-Skhiri & Ferreira, 2019). The fruit is easily grown from seeds or cuttings. The seed can be soaked in warm water to speed up the germination process and the plant will start producing fruit after two years (Louw, 2021).

Dovyalis Caffra: Commonly also known as kei apple, is known as a deciduous fruit predominantly found in the wild in the Limpopo, Mpumalanga, Eastern Cape, and KwaZulu Natal (DAFF, 2013). Despite its subtropical origins, it can thrive in temperatures as low as -6 °C. It is also capable of growing in a variety of soil types. Kei apple contains a wide range of nutrients, including macronutrients as well as micronutrients. The fruit's juice is a good source of vitamin C, comparable to strawberry and orange juice (Ngemakwe et al., 2017).

Strychnos spinose: Most commonly known as monkey orange, is a fruit, predominately found in the wild in the Eastern Cape, KwaZulu Natal, and Limpopo province (DAFF, 2013). The tree grows well in tropical climates and prefers well-drained soil (Louw, 2021). The grapefruit-sized monkey orange fruit has a sweet aroma with a sweet and sour taste. The is high in fibre, vitamin C, and B vitamins, and the edible fruit can be eaten raw or dried to make fruit rolls, jams, and wine (Louw, 20201; Ngemakwe et al., 2017).

2.4 NUTRITIONAL BENEFITS OF TIF

South Africa is undergoing a nutrition transition contributing to undernutrition that concurrently co-exists with over-nutrition and NCDs. The persistence of malnutrition in SA has been exacerbated by the poor quality of dietary intake. TIFs are rich in both macro and micro-nutrients and as well as other health-promoting phytochemicals when compared to commercial crops (Pichop, Abukutsa-Onyango, Noorani & Nono-Womdim, 2016; Ochieng, Afari-Sefa, Karanja, Rajendran, Silvest & Kessy, 2016). These nutrient-dense crops complement staple foods and improve overall diet quality by increasing variety, thus improving food security (Ochieng et al., 2016). They are important sources of energy, protein, fibre, vitamin A, vitamin C, iron, zinc, calcium, and magnesium (Mbhenyane, Mushaphi, Mabapa, Makuse, Amey, Nemathaga & Lebese, 2013; (Mbhenyane, 2017; Akinola, Pereira, Mabhaudhi, de Bruin & Rusch, 2020).

Flyman and Afolayan (2006) discussed the importance of eating wild vegetables to combat micronutrient deficiencies, as well as the impact of different processing methods on the nutrient content of wild vegetables. The study described specific processing and storage techniques to demonstrate how these methods can contribute to conserving the micronutrient

content of wild vegetables to improve nutrient intake all year round, as these vegetables are seasonally available. When micronutrients are not consumed raw, their bioavailability can be preserved by blanching them before consumption. Blanching is the process of heating vegetables to a high enough temperature to destroy enzymes in leaf tissue, prevent enzymatic-induced colour changes, and shorten drying and dehydration time. This is the first step in the processing of wild vegetables before drying and storing the finished product. This process is typically performed in hot water or steam to improve the palatability of wild vegetables by reducing the bitterness and acid component present. Although different processing and cooking methods affect different vitamins and minerals, this study found that wild vegetables cooked in this manner have the potential to supply bioavailable micronutrients such as iron, vitamin A, riboflavin, thiamine, folic acid, vitamin C, zinc, and copper while also reducing antagonistic nutritional factors in wild vegetables. According to Njume et al. (2014), different processing methods such as microwave-steaming and stir-frying with oil offer greater retention of vitamin A than boiling and stir-frying with water, and steam blanching followed by dehydration are the most effective preservation methods in retaining vitamin C.

Kasimba et al. (2019) investigated the consumption and contribution of TIF to the dietary intake of energy, protein, vitamin A, iron, and zinc in Botswana women and children from low socioeconomic households. TIF was defined in the study as foods that are native to or were introduced to Botswana a long time ago, including plant and animal sources, whether produced locally or obtained from the wild. TIF, according to the authors, contributes significantly to nutrient intake among children and women in Botswana. Despite the increased availability of highly processed foods, the Botswana diet still contains a relatively high percentage of TIF nutrient intake. Sorghum was found to be one of the best sources of energy, protein, and iron, while pumpkin and aramath leaves were among the best sources of vitamin A. TIF increased vitamin A intake in children and zinc intake in women compared to non-TIF. TIF, according to Akinola et al. (2020), has the potential to provide children and women with vitamin and mineral levels that exceed WHO recommendations.

Table 2.1: Most Common traditional and indigenous foods of South Africa

Main categories	Scientific name	Common name	Nutritional/Health benefits	Main uses	Main Production areas
Grain crops	*Pennisetum Glaucum*	Pearl millet	High in fibre, protein, minerals, and fatty acids. Gluten-free	Ground flour, grain-like rice. Feed for poultry	Limpopo, KZN, Free State
	Sorghum Bicolour	Sorghum	High in carbohydrates. Small amounts of micronutrients. Anti-inflammatory and anti-cancer properties.	Ground flour	Mpumalanga, Free State
	Vigna Unguiculata	Cowpea	High in energy, fibre, protein, vitamin A, C, B vitamins. bioactive compounds protective against chronic diseases	Leaves and pods are eaten as vegetables.	Mpumalanga, Limpopo, KZN, Gauteng, North-west
	Vigna Subterranea	Bambara groundnut	High in starch, protein, iron, zinc	Ground flour	Mpumalanga, KZN, Limpopo
	Vigna Radiate	Mung bean	High in starch, protein, zinc, high in bioavailable iron	The base for soup, flour, bean sprouts	Limpopo, Mpumalanga
Vegetable crops	*Cleome Gynandra*	Spider plant	High in calcium, iron, magnesium, and zinc	Leaves are eaten as a vegetable	Limpopo, Free State, KwaZulu Natal, Northern Province, and North-West
	Amaranthus	Aramanths	Rich iron, beta-carotene, vitamin A, vitamin C, and	Leaves are eaten as vegetables or soup	Limpopo, North West,

Main categories	Scientific name	Common name	Nutritional/Health benefits	Main uses	Main Production areas
			phytochemicals that have antioxidant properties		Mpumalanga and KwaZulu-Natal.
	Bidens Pilosa	Black jack	Rich in essential amino acids, iron, and zinc more than 40 bioactivities protective against chronic disease	Leaves and shoots are eaten as a vegetable. Medicine	KZN, Limpopo
	Corchorus Olitorius	Jew's mellow	Rich in vitamin A and C, folic acid, beta-carotene, iron, calcium	Leaves are eaten as a vegetable	Limpopo, Gauteng, Eastern Cape, and Mpumalanga
	Manihot Esculenta	Cassava	High in starch, calcium, vitamin C	Roots are eaten as a vegetable	Mpumalanga, KZN
	Colocasia Esculenta	Amadumbe	Significant amounts of B vitamins iron, phosphorus, zinc, vitamin C, niacin, potassium, copper, and manganese	The root is eaten as a vegetable	Mpumalanga, KZN
Fruit crops	*Sclerocarya Caffra*	Marula fruit	Rich vitamin C, calcium, potassium, and magnesium.	Eaten raw Products made include jams and wines	Limpopo, KZN, Eastern Cape, Mpumalanga
	Mimusops Zeyher	Red milkwood	Vitamin C	Eaten raw	Limpopo, Gauteng, North West, Mpumalanga, KZN, Free State

Main categories	Scientific name	Common name	Nutritional/Health benefits	Main uses	Main Production areas
				Used for making jams, jellies, and fermented juices,	
	Parinari Curatellifolia	Mabolo plum	Rich vitamin C, calcium	Eaten raw, cooked as porridge, fermented into beer	Limpopo, Mpumalanga
	Carissa Macrocarpa	Amatungulu, num-num	High in vitamin C, iron, calcium, and essential fatty acids	Eaten raw Used for making jam	KZN
	Dovyalis Caffra	Kei apple	High in vitamin C	Eaten as fruit Fruit juice	Limpopo, Mpumalanga, Eastern Cape, KZN
	Strychnos Spinos	Monkey orange	Rich fibre, vitamin C, and B vitamins	Eaten raw, dried to make fruit rolls, jams, and win	Eastern Cape, KwaZulu Natal, and Limpopo

2.5 HEALTH BENEFITS OF TIF

WHO recommends a healthy diet to protect against all forms of malnutrition, as well as against NCDs. To achieve this, individuals need to consume a diet that is balanced, diversified, and healthy, and that includes consuming at least 400g of fruits and vegetables per day (WHO, 2020). According to NDoH et al., (2019), in South Africa, only 23 per cent of children aged 6-23 months are fed a minimally accepted diet, and 59 per cent of adults consumed vegetables and 49 per cent consumed fruit daily. There is no doubt about the potential of TIF to meet full nutrient requirements. Even when consumed in small amounts, there is a significant benefit when the rest of the diet is starch-based (Ochieng et al., 2016; Kasimba et al., 2019). The health benefits of TIF's go beyond meeting daily nutrient requirements. TIF's contains health-promoting phytochemicals that contribute to antioxidant activity in the body. Phytochemicals are known to have antioxidant, anti-proliferative, and anti-inflammatory properties, and bioactive compounds are potentially protective against NCD's such as diabetes, hypertension, stroke, and cancer. (Mbhenyane et al., 2013; Kasimba et al., 2019).

TIF is known to have healing properties in addition to its inherent nutritional quality. TIFs have a high concentration of phytochemicals. TIF contains a lot of these non-nutritive plant chemicals that have protective or disease prevention properties (Omatayo, 2020). Many people in South Africa, particularly in rural areas, still rely on traditional medicine. TIF is believed to be used as a medicinal remedy by approximately 70 per cent of South Africans (Matenge, 2011). Many indigenous fruit trees' fruit, seed, leaf, tuber, root, and flower are used for medicinal purposes. For example, aramanthus has been reported to cure constipation. In addition, the fruit is also curative for rheumatism, syphilis, and the common cold (Mathenge, 2011). TIF also have high antioxidant activity, making them useful medicinally. Antioxidants are chemicals that can bind to free radicals preventing these radicals from damaging healthy cells, protecting against most cancers. Free radicals are naturally produced by the body through normal physiological functions. These free radicals are unstable and have the potential to damage healthy cells (Mavengahama, McLachlan & de Clercq, 2013). Antioxidant activity among the indigenous fruit, kei apples have been shown to have some of the highest antioxidant activity. According to Ngemakwe et al. (2017), kei apples have higher antioxidant activity when compared to conventional fruits. The promotion and consumption of TIF can provide an intrinsic buffer against disease and ensure optimal health outcomes.

2.6 THE ECONOMIC ROLE OF TIF IN AGRICULTURAL-BASED COMMUNITIES

There's is no doubt that TIF could potentially contribute towards playing a significant economic role in agricultural-based communities together with improving food security. TIFs make the most significant contribution to rural communities in terms of nutrition and income generation, particularly for households involved in collection or sales (Mungofa, 2016). TIFs are widely available to

consumers because they are gathered and processed locally, which may be viewed as a significant advantage. They do not, however, have effective and efficient processing and preservation technologies. Poor households typically have low skills, poor educational backgrounds, and few employment opportunities, limiting their access to formal markets. These households have limited abilities to negotiate for fair prices and are usually price takers (Mwema, Mutai, Lagat, Kibet & Maina, 2012). Some of these households may be able to benefit from collaboration within the indigenous foods network to improve value chain governance. Stakeholder engagement with farmer's cooperatives, women's groups, community seed banks, and consumer organizations can help achieve this (Bvenura & Aflayan, 2015). TIF have a high economic value in rural communities where sales generate a high income, and it has the potential to reduce poverty (Pichop et al., 2016). Many of these crops are already grown at home and sold in informal markets, but supplies reaching cities are generally thought to be far insufficient to meet natural demand (Mwema et al., 2012). This is because they are undervalued and ignored by government decision-makers, and they have even been ignored by official statistics on natural resource economic values (Kasimba, 2018). Increased marketing of the crops is one method of promoting TIF consumption. This has the potential to help empower the growers, producers, and processors of TIF, particularly women who engage in their collection and sales (Mungofa, 2016).

Seven transdisciplinary projects in Sub-Saharan Africa investigated the challenges and opportunities in the production, processing, and marketing of indigenous vegetables and other plants, fermented dairy foods, and infant formulae made from local plant and animal resources. According to the findings of this study, the promotion of TIF provides opportunities for significant economic benefits, primarily through the development and optimization of value chains. When compared to their commercial counterparts, TIF can have higher and more reliable yields in the primary production part of the value chain (Rampa, Lammers, Linnemann, Schoustra & de Winter, 2020). Marketing, distribution, and awareness can increase product availability and utilization to a wider range of consumers. This can be realized even if small measures are put in place, they can have a relatively large impact (Pichop et al., 2016; Rampa et al., 2020).

Similarly, in Limpopo, South Africa a cross-sectional study observed the consumption, cultivation, and trading of TIFs. Out of those who cultivated TIF 69.6% indicated that they sold them at passers-by at roadsides, 20.2% at local markets, and 8.3% in townships, and very few (1.8%) sold to shopkeepers. The low supply of indigenous leafy vegetables to the local market is an indication of limited access to the mainstream supply chain. Therefore, commercialization can provide employment opportunities and generate income for rural communities (Mungofa, Malongane & Tabit, 2018). Generally, they need fewer inputs but can achieve higher yields, thus a higher profit margin is obtainable. Additionally, TIF provides a significant opportunity for the poorest people living in rural areas without requiring large capital investments (Rampa et al., 2020).

2.7 CONCLUSION

Food insecurity and malnutrition are highly prevalent in South Africa and Africa at large. Food systems are changing and there are decreased uses of traditional and indigenous foods from the local diet to a reliance on supermarkets for non-traditional foods. Many studies reviewed have shown the importance and suitability of TIF in the local diet. TIF's are an important part of agricultural-based communities and consumption systems. TIF's are valuable sources of both macro and micronutrients and have the potential to contribute to the dietary intake of various nutrients even if consumed in small amounts. TIF's considerably improve dietary diversity through the different varieties available in SA, significantly improving diet quality. In addition, have nutraceutical effects with a potentially positive effect on health beyond basic nutrition. TIF's appear to be secondary foods in the local diet. Not a lot of input is required to grow it, as it spontaneously grows in the rural homestead and the wild.

TIF's are of extreme importance to improving livelihoods, reducing poverty, and ensuring food security. However, there needs to be a shift to how TIF's are perceived and people need to be educated about the importance of TIF's in ensuring food security and combatting malnutrition. The negative perceptions surrounding the consumption of TIF such as 'poverty foods' and 'older people food' need to be addressed. To achieve this, meaningful value chains need to be developed. This can only be successful if there is a collaboration between stakeholders to develop and optimize value chains.

CHAPTER 3
METHODOLOGY

3.1 STUDY DESIGN

This is a desktop review employing a systematic search strategy.

3.2 AIM OF THE REVIEW

The aim is to review the literature on the promotion and consumption of traditional and indigenous foods and their contribution to food and nutrition security in South Africa.

3.3 OBJECTIVES

- Identify and describe interventions promoting Traditional and Indigenous foods in South Africa.
- Determine pathways on how the promotion of traditional and Indigenous foods contributes to food and nutrition security.
- Identify successes and challenges encountered through the promotion of traditional and Indigenous foods.

3.4 SEARCH STRATEGY

The review was conducted via an electronic desktop review. The following relevant scientific electronic databases were included: PubMed, Bio-Med Central, Science Direct, EBSCOhost, JSTOR, and electronic non-scientific databases, for grey literature, such as Google Scholar were also included. Abstract, title, keywords, and subject-specific headings to each of the identified databases were searched for the following keywords*: traditional and indigenous foods; wild vegetables; household food insecurity, community-based food, and nutrition interventions*. Reference lists of included studies were examined for additional relevant studies.

For tracking purposes for the project, all articles will be recorded on a storage data form, that will be managed in Excel (Appendix 1). This will provide details about the title of the article, authors, year of publication, keywords, and database.

3.5 INCLUSION AND EXCLUSION CRITERIA

The following criteria were used to determine whether a study would be included in the review to review of literature on the promotion of traditional and indigenous foods and their contribution to household food security:

(1) Types of Studies: The review included studies with both analytical (cohort, randomized controlled, and cluster-randomized) and descriptive (ecological and cross-sectional) study designs.

(2) Types of interventions: This review included food-based and nutrition-based interventions addressing household food insecurity through the promotion of traditional and indigenous foods at a community level. Interventions addressing household food insecurity based in facilities were excluded from the review

(3) Types of participants: Data focusing on the promotion of traditional and indigenous foods in South African communities.

(4) Types of outcomes measured: The review includes studies that measure the effectiveness of community-based interventions aimed at reducing household food insecurity in South Africa. Outcome measures include describing how food-based and nutrition-based interventions promote traditional and indigenous foods, and the successes and challenges encountered through the promotion of traditional and indigenous foods.

(5) Time frame of studies: There were no limitations placed on the publication year.

(6) Minimum score: Only studies scoring a minimum of 60% will be included in the review.

3.6 DATA EXTRACTION

A data extraction form was adapted from the Joana Briggs Institute (JBI) data extraction tool of observational research and Randomized Control Trials (RCT's). A spreadsheet was created and managed in an Excel spreadsheet (Appendix 2). Data extracted included:

- Setting
- Study Method
- Population
- Duration of study
- Sample size
- Intervention
- Main outcome Measure
- Results
- Limitations

All included studies are referred to by the author's last name for conciseness.

3.7 QUALITY ANALYSIS

The RE-AIM appraisal tool was used to evaluate the quality of the studies (Appendix 3). RE-AIM is an acronym that consists of five elements, or dimensions, that relate to health behaviour interventions i.e., Reach, Effectiveness, Adoption, Implementation and Maintenance (Glagow, Harden, Gaglio, Rabin, Smith, Porter, Ory & Estabrooks, 2019). The RE-AIM tool is a planning and evaluation framework that encourages program planners, evaluators, researchers, and policy-makers to pay more attention to essential program elements including external validity that can improve the sustainable adoption and implementation of effective, generalizable, evidence-based interventions to produce public health impact. The tool provides 15 yes / no questions which are scored by either a 1 or 0. The scores are totalled and divided by the total number of applicable items and multiplied by 100 to get to a final percentage. To be included in the review, eligible articles had to score a minimum of 60 per cent. By choosing a minimum score of 60%, this expands the RE-AIM concept by ensuring all dimensions that apply to the different settings in which the research is conducted completely characterize the public impact of an intervention. Failure to adequately evaluate the programs on all five dimensions can lead to poor representation of both population and settings, thus limiting the public health significance of the intervention (Glagow, Vogt, & Boles 1999). This is to ensure the interventions included in the review are designed to enhance the quality and impact of efforts in their respective communities by effectively applying the RE-AIM elements.

Table 3.1: Scoring method: total score divided by the total number of all applicable items

Score	0-30%	30-59%	60-100%
Ratings	Bad	Satisfactory	Good

Adapted from: Glasgow. R, Vogt. T, & Boles. S, (1999). *Evaluating the Public Health Impact of Health Promotion Interventions: The RE-AIM Framework*

3.8 ETHICAL CONSIDERATIONS

The research proposal was submitted to the Division of Human Nutrition for internal review and approval. The research study did not require approval from the Health Research Ethics Committee of the Faculty of Medicine and Health Sciences, Stellenbosch University as it was a desktop review and did not involve human participants.

CHAPTER 4
RESULTS

4.1 RESULTS OF THE SEARCH

A systematic search of current academic literature from the following databases: Science Direct, Jstor, EBcohost, Bio-med and PubMed, and Google scholar were conducted for the following keywords: “wild vegetables’’, “TIF”, “household food security’’, “nutrition interventions’’ and “food-based interventions”. The flow of the search process is illustrated in Figure 1. Table 4.1 indicates what search engines and search items were used, as well as the results of the search and how many publications were included. To access grey literature, a Google Scholar search with the same parameters was conducted. Grey literature refers to a “range of documents not controlled by commercial publishing organisations” (Adams, Hillier-Brown, Moore, Lake, Aruajo-Soares, White & Summerbell, 2016). Due to its nature, grey literature is difficult to locate and can be abundant, which would have exceeded the time range of this review. Therefore, only the first 10 pages of hits were reviewed. Reference lists of studies found relevant for this review as well as related studies were examined for further sources of further relevant data. The initial search yielded 26 699 hits. The titles, subject-specific headings, and abstracts were screened for all potentially relevant articles and a sample of 117 was attained. The next phase was to remove all duplicates from the data and the articles were further reduced to 103. Using the inclusion and exclusion criteria based on the relevance to the review’s question, full texts of the potentially eligible articles were retrieved and the final five articles were selected, provided they met the minimum scoring of 60% after the articles were appraised using the RE-AIM tool, of community-based food and nutrition interventions conducted in SA promoting TIF.

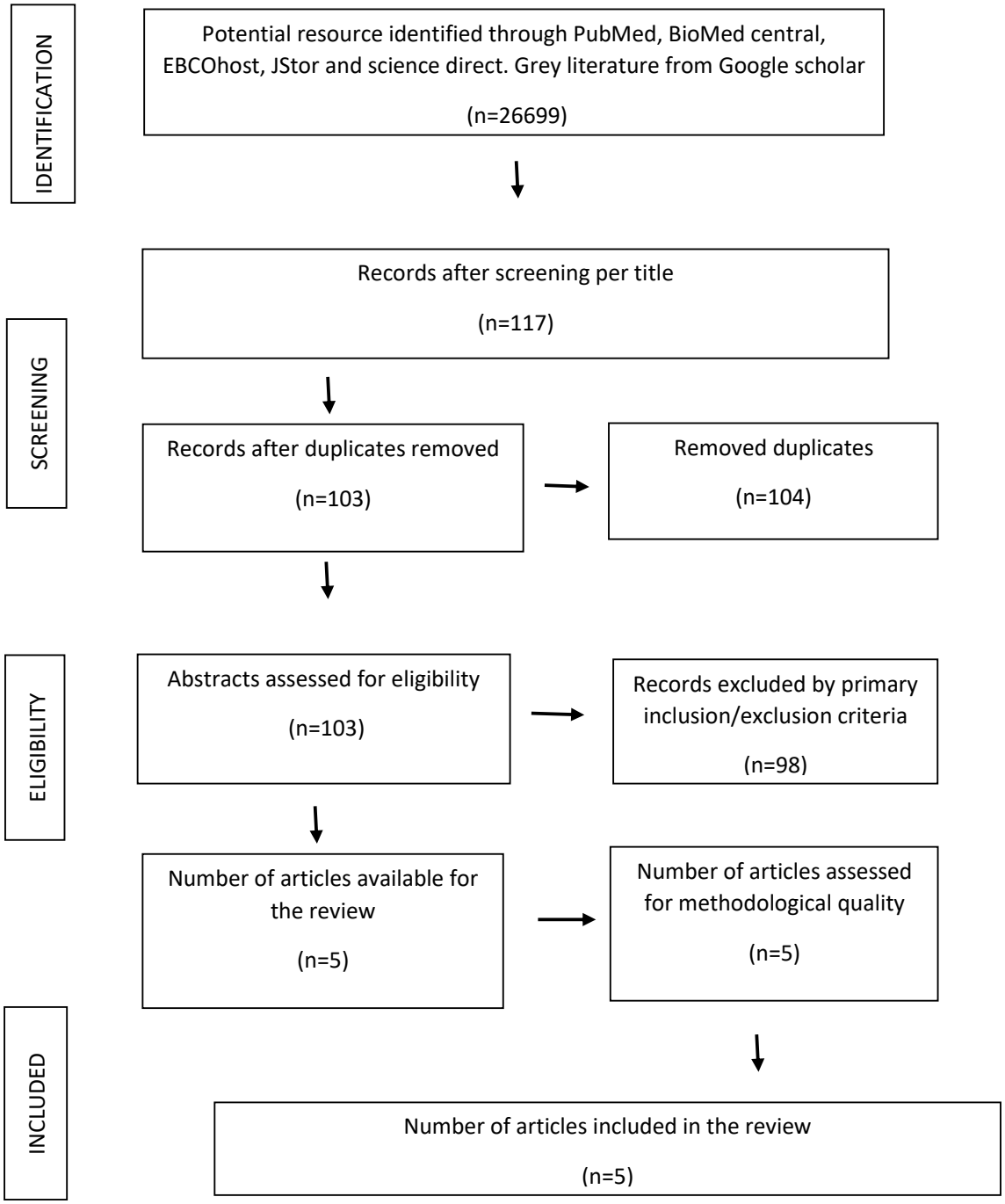

Figure 4.1: A flow chart of the process is presented

Table 4.1: Electronic databases searched

Search engine	Search terms	Results	No. included
PubMed	"wild vegetables " "South Africa" "nutrition-based interventions"	43	5
	"traditional and indigenous foods" "food-based interventions" "South Africa"	31	
Science Direct	"wild vegetables" "Household food insecurity in South Africa"	900	39
	"indigenous foods" "household food insecurity"	3223	
Biomed central	"traditional and indigenous foods" "food-based interventions" "South Africa"	266	4
	"wild vegetable" "nutrition interventions"	102	
EBCOhost	"wild vegetables" "South Africa"	46	20
	"traditional and indigenous foods" "household food insecurity" "South Africa"	46	
Jstor	"traditional and indigenous foods" "household food insecurity"	9769	21
	"wild vegetables " "South Africa" "household food insecurity"	11622	
Google Scholar	"traditional and indigenous foods in South Africa" "nutrition interventions"	100	27
	"wild vegetables" "household food security" "South Africa"	100	
Total		**26699**	**117**

4.2 DATA EXTRACTION

To extract data from the relevant literature, the criteria for the data extraction form was adapted from the Joana Briggs Institute (JBI) data extraction tool (Appendix 2) (Aromataris & Munn, 2020). Data extracted was organised according to the type of design, study population, interventions, and study outcomes. Following this data extraction form, each article was screened for the relevant information, which eliminated the need to read all papers completely. Table 4.2 shows the data extracted from the final selection of articles.

Table 4.2: Data Extraction of selected articles

Reference	*van der Hoeven et al., 2014*	*Faber et al., 2002*	*Van Jaarsveld et al., 2005*	*Musaphi et al., 2017*	*Laurie & Faber, 2008*
Setting	Rural	Rural	Rural	Rural	Rural
Study Method	RCT	Cross-sectional survey	RCT	Pre-test-post-test control group design	Cross-sectional survey
Population	School learners	Children 2-5 years	5-10 year (primary school children)	Caregivers and children 3-5 years	Households with children 1-5 years
Duration of study	3 months	2 years	3 months	12 months	3 years
Sample size Intervention 1:	*n*= 86	*n*=129	*n*= 90	*n*= 66 children *n*= 65 caregivers	*n*= 219 households
Intervention 2:	*n*=81	*n*=85	*n*= 90	*n*= 63 children *n*= 60 caregivers	*n*= 223 households
Intervention 1 (experimental)	Learners received 300g cooked with African leafy vegetables (ALVs) with the starch of the school meal for 62 days	Households participated in project gardens producing beta-carotene-rich fruits and vegetables to address vitamin A deficiency in children integrated with a community-based growth monitoring system and linked nutrition education. The consumption of	Learners consumed 125g boiled and mashed orange-flesh sweet potato (OFSP) for 53 days	Caregivers participated in a Nutrition Education Intervention Programme (NEIP) comprised of ten topics emphasising healthy eating, hygiene, and sanitation.	Households participated in project gardens producing beta-carotene rich fruits and vegetables which were integrated with community-based growth monitoring and linked to nutrition education.

Reference	*van der Hoeven et al., 2014*	*Faber et al., 2002*	*Van Jaarsveld et al., 2005*	*Musaphi et al., 2017*	*Laurie & Faber, 2008*
		pumpkin leaves and *imifino* was also promoted			
Intervention 2 (Control)	Learners received normal school meal	Control households had the same community-based growth-monitoring system as that of the experimental village but no household food production, nutrition education, or promotion program.	Learners consumed 125g white-flesh sweet potato (WFSP)	Care-givers received no nutrition educations	Control households had the same community-based growth-monitoring system as that of the experimental village but no household food production or nutrition education
Main outcome measure Description:	Vitamin A, iron, and zinc status	Vitamin A status Production and knowledge of beta-carotene rich fruits and vegetables Consumption of beta-carotene rich vegetables	Vitamin A status	Feeding practices Dietary intake	Consumption of beta-carotene rich fruits crops Production and knowledge of beta-carotene rich crops
Measure:	Serum ferritin, retinol, zinc, and haemoglobin,	Serum retinol	Liver vitamin A stores		Interviews on gardening practices,

Reference	*van der Hoeven et al., 2014*	*Faber et al., 2002*	*Van Jaarsveld et al., 2005*	*Musaphi et al., 2017*	*Laurie & Faber, 2008*
		Maternal knowledge regarding vitamin A Dietary intake assessment	Serum retinol	Interviews on nutritional practices and 24-hour recall	production, consumption, and knowledge regarding beta-carotene-rich crops.
Results	ALVs were able to improve serum retinol, serum ferritin or haemoglobin and zinc if there are only mild deficiencies present.	Home-gardening program that was integrated with a community-based growth monitoring system and focused on the production of yellow and dark-green leafy vegetables significantly improved the vitamin A status of 2–5-y-old children	Consumption of OFSP improves vitamin status and can play a significant role in developing countries as a viable long term food-based strategy for controlling vitamin A deficiency in children.	The impact of nutrition education was only observed in some feeding practices, since the majority of caregivers were usually including most foods items, including indigenous foods, on the child's plate daily at baseline, which left little room for improvement as a result of the NEIP	The agricultural intervention, combined with nutrition education and community-based growth monitoring showed a favourable effect on child morbidity, nutritional knowledge and dietary intake of βcarotene-rich vegetables
Limitations	Sample size too small to adequately detect the impact of an intervention		The low percentage of children with inadequate vitamin A liver stores at baseline was a limitation of the study		Lack of financial support and lack of resources

4.3 DESCRIPTION OF STUDIES

***Study design*:** An examination of full texts of 103 potentially relevant articles resulted in five articles being included. These were van der Hoeven (2014); Faber (2002); Van Jaarsveld (2005); Musaphi (2017) and Laurie (2008). Of the total five studies included in the review, two were cross-sectional studies (Faber, 2002; Laurie, 2008), two were randomized control trials (van der Hoeven, 2014; Van Jaarsveld, 2005) and one was a pre-test post-test control group design (Musaphi, 2017).

***Types of interventions*:** Van der Hoeven (2014) randomly assigned school learners to either receive 300g cooked African leafy vegetables with the starch of the school meal or the normal school meal for 62 days. Faber (2002) utilized community-based monitoring activities as a platform to promote home-gardening projects promoting the production of yellow and dark green leafy vegetables. Demonstration gardens were established and used as training centres for all mothers in the participating households. The consumption of pumpkin leaves and *imifino* was promoted. Van Jaarsveld (2005) randomly assigned primary school learners to either receive 125g orange-flesh sweet potato or white-flesh sweet potato for 53 days. Musaphi (2017) randomly eight assigned villages into an experimental and control group. Caregivers and children from the experimental groups received nutrition education focusing on ten topics emphasizing healthy eating, hygiene, and sanitation. The nutrition education program also encouraged the consumption of TIF during the education sessions. Laurie (2008) examined the impact of home-garden projects which also utilized community-based monitoring activities. Demonstration gardens were established and served as training centres for participating households. The production and consumption of beta-carotene-rich vegetables and fruit were encouraged including orange-flesh sweet potato and paw-paw.

***Location of studies*:** All of the studies were based in rural communities around South Africa. Study locations included a rural farm near Potchefstroom, North-West Province (van der Hoeven, 2014). Two of the studies took place in rural KwaZulu Natal Province (Faber, 2002; Van Jaarsveld, 2005), and one study each was in Limpopo (Musaphi, 2017) and Lusikisiki (Laurie, 2008)

***Participants*:** All the included studies involved children aged 1- 12 years in the interventions. Two of the articles involved primary school students (van der Hoeven, 2014; Van Jaarsveld, 2005). Three of the articles targeted households and caregivers that had young children aged 1- 5 years.

4.4 QUALITY ANALYSIS

The RE-AIM appraisal tool was used to evaluate the quality of the five final studies selected, by evaluating the extent to which the program is implemented consistently across different settings. The five dimensions that the framework focuses on include Reach, Effectiveness, Adoption,

Implementation, and Maintenance. The tool focuses on issues, dimensions, and steps in the design and dissemination of programs. The implementation process can either facilitate or impede the success in achieving equitable impact (Glagow et al., 2019). Table 4.3 shows the final scores of selected articles.

Table 4.3: RE-AIM scores of selected articles

	RE-AIM Questions															
Author	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Score
Van der Hoeven et al	1	1	1	0	1	1	1	1	0	1	1	1	1	0	0	11/15= 73%
Faber et al	1	0	1	1	0	1	0	1	1	1	1	1	1	1	1	12/15= 80%
Van Jaarsveld et al	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	13/15= 86%
Musaphi et al	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	13/15= 86%
Laurie & Faber	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	14/15= 93%

4.5 EFFECTS OF INTERVENTIONS

Van der Hoeven (2014) assessed vitamin A, iron, and zinc status in all participants by measuring serum retinol, haemoglobin, ferritin, and zinc levels at baseline and post-intervention. Children with haemoglobin concentrations less than 8 g/dL were excluded from the study and referred for medical care. Children who were taking micronutrient supplements were also barred from participating in the study. According to the results of the interventions, African leafy vegetables were unable to improve serum retinol, serum ferritin or haemoglobin, or zinc if only mild deficiencies were present.

Faber (2002) assessed vitamin A status as well as knowledge, production, and consumption of beta-carotene-rich fruits and vegetables by testing serum vitamin A levels in all participating children and conducting a dietary assessment and maternal survey regarding intake and knowledge of beta-carotene-rich fruits and vegetables. The results showed that a home-gardening program that was integrated with a community-based growth monitoring system and focused on the production of yellow and dark-green leafy vegetables significantly improved the vitamin A status of 2–5-year-old children.

Van Jaarsveld (2005) measured serum retinol and liver vitamin A stores to determine the vitamin A status of participating students. Outcomes measured indicated that the consumption of Orange-Flesh sweet potato improves vitamin status and can play a significant role in developing countries as a viable long-term food-based strategy for controlling vitamin A deficiency in children.

To determine nutrition practices, Musaphi (2017) conducted interviews as well as 24-hour recalls for caregivers on feeding practices and dietary intake. In the experimental group, consumption of indigenous vegetables such as blackjack, spider flower, and wild jute increased significantly. Furthermore, the experimental group's intake of baobab fruit, pawpaw, termites, and Mopani worms increased significantly. The authors concluded that the impact of nutrition education was only seen in some feeding practices because, at baseline, the majority of caregivers included most food items, including indigenous foods, on the child's plate daily, leaving little room for improvement. This was attributed to the fact that when the intervention was implemented the TIF was in season making them easily accessible and available. This was attributed to the fact that the TIF was in season at the time the intervention was implemented, making them easily accessible and available.

Laurie (2008) interviewed participating households about their gardening practices, production, consumption, and knowledge of beta-carotene-rich crops. The agricultural intervention, in combination with nutrition education and community-based growth monitoring, improved child morbidity, nutritional knowledge, and dietary intake of β carotene-rich vegetables.

4.6 PROMOTION OF TIF

Van der Hoeven (2014) compared cooked African leafy vegetables (ALVs) to the normal school lunch vegetables. The following African leafy vegetables were used to prepare the intervention dish: *Amaranthus Cruentus* (amaranth), *Cleome Gynandra* (spider plant)*, Cucurbita Maxima* (pumpkin), and *Vigna Unguiculata* (cowpea). These ALVs were discovered to be the most consumed and used in North-West Province's urban and rural areas. The intervention dish was served alongside the starch provided by the school meal. Faber (2002) established project gardens in the experimental villages to promote the production of vitamin A-rich crops. The orange-flesh sweet potato and paw-paw were among the crops grown in the experimental gardens. Pumpkin leaves and imifino production and promotion were promoted, but these two crops were not planted in the demonstration gardens because they were already produced locally prior to project implementation. In 2005, Van Jaarsveld compared orange-flesh sweet potato to white-flesh sweet potato. Both varieties were grown at the Agricultural Research Council's Vegetable and Ornamental Plant Institute in Roodeplaat, Gauteng Province, to ensure high-quality crops. Both varieties were served for 5d/w before the school meal. Musaphi (2014) created a Nutrition Education Intervention Programme (NEIP) based on the South African Food-Based Dietary Guidelines (SAFBDG) and the South African Paediatric Food-Based Dietary Guidelines (SAPFBDDG).

The intervention also emphasized hygiene and sanitation as part of a healthy lifestyle. Each topic was taught twice on different days and three months apart. At baseline, the majority of children were given indigenous foods, such as vegetables, fruit, mixed dishes, and edible insects. After the

intervention, the percentage of children who consumed TIF increased significantly in the experimental group indicating the improvement observed shows that targeted nutrition education of caregivers can improve the feeding practices of children. In Laurie and Faber (2008) established a crop-based intervention combined with nutrition education and community-based growth monitoring; the focus of the intervention was the promotion of beta-carotene-rich crops through home gardening projects in the experimental villages. Among the crops produced in the home gardens were orange-flesh sweet potato, *miroho,* pumpkin, and paw-paw. Demonstration gardens were also established which served as training centres for the promotion of beta-carotene-rich crops.

4.7 SUCCESS FACTORS IDENTIFIED

4.7.1 Community participation

Two studies had full community participation at all levels in the implementation of the interventions (Faber, 2002; Laurie, 2008). The interventions encouraged community-level organization through the strengthening of existing community structures and leadership. The studies had a high participation rate due to the spill-over effect of the interventions. This resulted in the increased awareness that was created by the high visibility of the demonstration gardens and home gardens (Faber, 2002; Laurie, 2008). Community forums were also established in both intervention programs where decision-making and problem-solving were addressed with support from technical advisors.

4.7.2 Intersectoral collaboration

Four of the studies involved multiple sectors in program implementation (Faber, 2002; Van Jaarsveld, 2005; Laurie, 2008; van der Hoeven, 2014). Two of the studies had multiple role players in the implementation of the program (Faber, 2002; Laurie, 2008). They worked with other stakeholders and leveraged existing infrastructure to implement the food-based approach. School gardens, clinic gardens, crèche gardens, community gardens, and institutional programs such as sustainable land-use programs or agricultural assistance programs were among the entry points investigated. The extension officers from the local department of agriculture office, representatives from the local department of health, and community members from the participating villages were all key players in one study (Laurie, 2008).

Two of the studies used the National School Nutrition Programme as the entry point for the intervention. The interventions were delivered through the daily school meals provided to the participants (Van Jaarsveld, 2005; van der Hoeven, 2014).

4.7.3 Capacity building

Three of the studies included training and educational sessions as part of the program implementation (Faber, 2002; Laurie, 2008; Musaphi, 2014). Faber (2002) and Laurie (2008) used the demonstration gardens as platforms to provide and training for the mothers attending the growth monitoring sessions. The mothers were provided with nutrition education and also allowed to practice what they learned under supervision during the growth monitoring days. The mothers were further encouraged to plant the vegetables produced in the demonstration gardens in their home gardens. One study had the researcher facilitating nutrition education sessions for participating mothers and caregivers focusing on healthy eating practices, hygiene, and sanitation. Small group discussions of the participants were encouraged in efforts to promote group interactions and active participation from all group members (Musaphi, 2017).

4.7.4 Women's status

Three of the studies involved women in various aspects of the programs (Faber, 2002; Laurie, 2008; Musaphi, 2014). All three studies targeted mothers and caregivers with young children to receive nutrition education and training.

4.7.5 Technical knowledge

Most of the studies had the technical capacity to manage the programs (Faber, 2002; Laurie, 2008; Musaphi, 2017). In Faber (2002), the nutrition monitors attended a 5-day training course presented by the Agricultural Research Council (ARC). Additional on-the-job training was done as a continuous process. The participating mothers were supervised by the nutrition monitors, who also continually monitored the progress of the home gardens. In Laurie (2008), extension officers from the local Department of Agriculture (DOA), trained on a 5-day training course, served as agricultural advisors and the local Department of Health (DOH) provided the health volunteers with growth monitoring and nutrition education. Musaphi (2017) recruited and trained field workers to collect data at baseline and post-intervention and all the educational sessions were supervised by the researcher.

4.7.6 Socio-political context

Two of the studies explored social relations and power arrangements (Faber, 2002; Laurie, 2008). Faber (2002) invited community representatives to participate in the formulation of the intervention. A garden committee was established, and together with nutrition monitors, they formed a food garden production forum. In Laurie (2008), monthly forum meetings were established where planning and decision-making took place.

4.8 LIMITATIONS

4.8.1 Financial factors

Two of the studies reported on financial factors. Laurie (2008) explored the various factors affecting the program. These included a lack of supplies and resources needed to provision and preparation activities during the growth monitoring sessions. The health volunteers were not remunerated. One of the studies also withdrew funding when the research team exited the community and therefore the community ended experiencing a variety of challenges as a result.

CHAPTER 5
DISCUSSION

5.1 INTRODUCTION

The purpose of this study was to describe the promotion and consumption of traditional and indigenous foods and their contribution to food and nutrition security. This was accomplished by conducting a desktop review of the literature. Because access and affordability to food is the biggest challenge faced by vulnerable households, interventions promoting TIF have the potential to alleviate hunger and the different forms of malnutrition. The majority of TIF naturally occur in the wild or homesteads and are usually available all year round, indicating a constant supply of nutrient-dense food all year round (Hart, 2010). They are important sources of nutrients such as vitamin A, C, iron, zinc, and protein, and are sometimes better sources of nutrients when compared to conventional crops (Van de Hoeven et al., 2013; Mbhenyane, 2017). This chapter will discuss the findings involving the promotion and consumption of TIF and describe the effectiveness and limitations of TIF interventions.

The review included five studies that included TIF as part of the intervention strategy. Of the total five studies included in the review, two were cross-sectional studies, two were randomized control trials and one was a pre-test post-test control group design. All of the studies were based in rural communities. All the interventions had children, ages 1-12 years, as the primary benefactors. Two of the articles involved primary schools. Three of the articles targeted households and caregivers that had young children aged 1- 5 years. Households, parents, and caregivers were also targeted as secondary benefactors as their involvement was critical in the success of the interventions. Two of the studies utilized community-based monitoring activities as a platform to promote home-gardening projects promoting the production of TIF. Two of the studies integrated their intervention with the NSNP by serving TIF as part of the school lunch to determine the nutrient contribution of TIF. One of the studies implemented a nutrition education program that also encouraged the consumption of TIF during the education sessions.

5.2 PROMOTION OF TIF THROUGH COMMUNITY-BASED INTERVENTIONS

The most outstanding feature of community-based interventions is not only on improving access to health services and resources to nutritional status but further addressing the underlying factors that are related for example behaviour change and poor caring practices. The success of these programs depends on active community involvement and social mobilization for services and may lead to strategies that may influence policy (Mason, Sanders, Musgrove, Soekirman & Galloway, 2006;

Puoane, Sanders & Mason, 2008). The majority of community-based interventions in SA have primarily focused on communicable disease and poverty alleviation, however, times are changing. South Africa is currently experiencing a double burden of malnutrition of obesity and diet-related diseases concurrently existing with undernutrition and micronutrient deficiencies within the same household level (Setorglo, Steiner-Asiedu, Puoane, Sanders & Asare Pereko, 2016). Addressing this challenge requires strategies that both influence the adoption of healthy lifestyles and the consumption of healthy food.

Promoting healthier diets requires access to fruits and vegetables, which are often displaced by fast foods. The promotion of TIF is an effective strategy in programs that advocate for health and lifestyle improvements. The nutritional composition of TIF is usually superior to conventional vegetables and has been proven to provide essential nutrients necessary for human physiology (Bvenura & Afolayan, 2015). Their consumption of TIF contributes greatly to the dietary intake of vitamins and minerals including vitamin A, zinc, iron, calcium, and fibre. For example; a study done by the Department of Food Science at the University of Pretoria determined the nutrient content of five ALV. The nutrient analysis revealed that ALVs is a good source of protein, and minerals such as iron, calcium, phosphorus, magnesium, and beta-carotene (Schönfeldt & Pretorius, 2011). The studies included in this review have indicated the promotion and consumption of TIFs resulted in improved nutritional status, particularly vitamin A, zinc, and iron status. Similar results have been reported in Ghana. A community-based intervention targeting post-partum women indicated that the consumption of ALVs resulted in a significant improvement in vitamin A status (Tchum, Newton, Tanumihardjo, Fareed, Tetteh & Agyei, 2009). The promotion and consumption of TIF can be an important strategy combating micronutrient deficiencies.

The potential contribution of TIF to healthy diets is significant. The majority of TIFs are usually available all year round, indicating a constant supply of nutrient-dense food all year round. They have health-promoting benefits that go beyond meeting nutrient requirements. TIF's also have antioxidant, anti-proliferative, and anti-inflammatory properties. These, together with bioactive compounds in TIF's are potentially protective against NCD's such as diabetes, hypertension, stroke, and cancer (Mbhenyane et al., 2013; Kasimba et al., 2019). Although the consumption of TIF in SA is relatively low, consumption persists. The inclusion and promotion of TIF in nutrition messages can significantly improve diet quality and ensure dietary diversification as was shown by Musaphi. Faber and Laurie also demonstrated the importance of nutrition education; mothers were not only given gardening skills but were also educated on the importance of micronutrients in child development and the role of fruits and vegetables in providing micronutrients. Strategies that encourage increased household production of micronutrient-rich foods are more effective when combined with a nutrition education component, which ensures that increased household production translates into improved dietary diversity. Kajjura, Veldman & Kassier (2019) found that nutrition education improves

knowledge, feeding, and hygiene practices of mothers with infants and young children diagnosed with moderate acute malnutrition. Dietary modification and targeted nutrition education to include TIF may provide a long-term solution to prevent malnutrition and micronutrient deficiencies (Tchum et al., 2009).

5.3 SUCCESS FACTORS AND LIMITATIONS

Success factors are those that help achieve the program objectives. Focussing on successful programs helps to identify success factors, some of which are programmatic while others are contextual (Sanders, 2008). Several factors were identified that related to the success of the programs implemented namely; community participation, Intersectoral collaboration, capacity building, women's status, technical skills, and socio-political context. Limiting factors included financial support. These will be discussed separately.

5.3.1 Community participation

Genuine community involvement is a key feature of successful programs. It helps to enhance accountability, transparency and ensures the sustainability of programs. This ideally involves communities assuming responsibility for their welfare and develop a capacity to contribute to their own and the community development (Puone et al., 2008). To achieve this community sensitization and mobilization is an essential step. Community sensitization and mobilization are essential to creating supportive environments for change. Suggestive practices include identifying influential community members to promote participation and empowerment, and ensuring key community leaders are included in training sessions in monitoring and performance evaluation of community workers as was shown by Faber (2002) and Laurie (2008) (UN, 2016).

A commitment to improved outcomes at all levels was found to be a significant factor in both these studies. Another key factor was the training of village volunteers in both interventions, which represents a major opportunity for improving impact, through retraining and support for the front−line people (Gillespie, Mason & Martorell, 1996). Even effective programs improve health and nutrition outcomes only of those they reach. Expanding the programs to reach most of the communities within the targeted areas demands increased coverage rates and adequate resources. To improve coverage community-based programs need to integrate their activities with existing structures and services (Mason et al., 2006). For example, in both the studies the participation rate was high since these studies extended and complemented the growth monitoring activities that were already established in the communities. This resulted in a spill-over effect of the interventions due to the raised awareness created the increased visibility of the interventions. An evaluation of both studies showed that even non-participating caregivers and households also benefitted from the programs.

Community participation also reduces dependency on external assistance and the promotion of self-help in addressing community problems (Sanders et al., 2008).

5.3.2 Intersectoral collaboration

The need for multiple sectors and stakeholders to work together in a truly systematized approach, combining high-level political commitment, effective laws and policies, coordinated actions from all parts of society, and sustainable resources are broadly recognized (UN, 2016). The success of multi-sector involvement is best achieved when it builds on existing structures in sectors, that are already implementing programs at community levels. For example, in the review four of the studies involved multiple sectors in program implementation (Faber, 2002; Van Jaarsveld, 2005; Laurie, 2008; van der Hoeven, 2014). Two of the studies used a community-based growth-monitoring program as an entry point for the program (Faber, 2002; Laurie, 2008). Demonstration gardens, which served as training centres for gardening activities, were established at each growth monitoring site. The growth monitoring sites included local homesteads, clinic gardens, crèche gardens, and community gardens. In these studies, the involvement of multiple sectors in the assessment, planning, and implementation of the intervention helped to raise awareness about the extent of the problem and motivated the communities to take action.

Two of the studies collaborated with the Department of Education and utilized the National School Nutrition Programme as the entry point for the intervention. The school meals were used as the delivery platform for participating students (Van Jaarsveld, 2005; van der Hoeven, 2014). This indicates that Intersectoral collaboration should also include linkages to an organization and other platforms with similar objectives. These linkages may help provide technical skills and sharing of resources. As shown by Laurie (2008), the researchers collaborated with the local department of agriculture to serve as agricultural advisors and the local department of health to provide training to the health volunteers. Therefore, multisector collaboration provides spaces to develop policies and plan with all relevant stakeholders represented (Puaone et al., 2008).

5.3.3 Capacity building

The effectiveness of community-based interventions promoting nutrition and health depends upon the capacity of the program to deliver a high-quality intervention (Baillie, Bjarnholt, Gruber & Hughes, 2009). High-quality interventions should provide training that is task-oriented for community volunteers, provide ongoing professional development for the program staff, training that is offered to all stakeholders at all levels, and the inclusion of a hands-on component such as demonstration centres, as was shown by Faber, Laurie and Musaphi (Shantha & Vaidyananthan, 2017). For example, in Faber (2002), the chairperson of the food garden production forum and nutrition monitors

attended a training course presented by the ARC. Additional on-the-job training was done as a continuous process. The ability of the above studies to provide training and technical support in the delivery of the interventions was a key feature. Training and support provided by the relevant stakeholders help to improve impact and enhance the sustainability of the intervention. However, one of the biggest challenges that programs face remains access to human, organizational and financial resources. This is often worsened by a lack of extension services, lack of access to health facilities, and inadequate prioritization of child and maternal nutrition. Other challenges encounter result from poor integration of services by various sectors. This tends to promote the continuation of single-sector programs. Therefore, learning across sectors may require additional education and training (Iannotti & Gillespie, 2002) With that in mind, a livestock transfer program among impoverished households in Zambia coupled livestock donations with appropriate extension services. Training on various social issues such as sharing and caring, self-help group formation, the benefits of collective action, group self-reliance, and business management were among the services provided.

Other forms of assistance include regular monitoring and evaluation, ongoing training, the establishment of basic veterinary service providers, the formation of cooperatives, and marketing agent intermediation. Furthermore, the requirement that beneficiaries pass on livestock and knowledge strengthens social capital for long-term impact. As a result, the individual families and groups of families that embody social capital were able to provide these services to other members even after the formal closure of the program (Kafle, Winter-Nelson & Goldsmith, 2016). Programs that integrate their services with different sectors will ensure delivery of quality services and will build the capacity for communities to be able to sustain program impacts even after the program team has exited the communities, thus empowering the communities to take ownership of these services (Delisle, Shrimpton, Blaney, Du Plessis, Atwood, Sanders & Margetts 2017).

5.3.4 Women’s status

The empowerment of women is widely recognized as a strategy to enhance household food security and nutrition. Women are key players in food systems, producing approximately 60-80 per cent of food in the developing world. Empowering women encourages cooperative membership to enhance power decision-making and management of household resources. However, the women’s role is barely recognized. There are still significant challenges regarding access to resources and asset ownership by women, which often negatively affect women’s empowerment and, consequently, household food security (AED & UN, 2011). In the review, three of the studies considered women's status and education (Faber, 2002; Laurie, 2008; Musaphi, 2014). Interventions that link agriculture and nutrition should invest in women by addressing gender constraints. While both men and women are involved in agricultural activities, it is usually women who are responsible for family nutrition.

Interventions should take into account factors such as women's roles as agricultural producers and caregivers, and their time and labour constraints (Wenhold, Faber, Van Averbeke, Oelofse, Van Jaarsveld, Jansen Van Rensburg, Van Heerden & Slabbert, 2007).

Agricultural interventions that include gender issues have a greater likelihood of affecting a positive nutritional change and can be sustained by local communities. A project in Kenya, for example, demonstrated that promoting TIF can empower women, who are the primary producers of these foods. This is due to the fact that the production of indigenous vegetables and town-market sales in Kenya are primarily led by women; thus, strengthening the processing of TIF towards value addition leads to a more stable and consistent income. This exemplified the significant empowerment potential of indigenous vegetable value chains for women. To have a significant impact, programs must actively plan gender-sensitive and gender-transformative activities to ensure that women are not left behind (cited in Rampa et al., 2020).

5.3.5 Technical skills

It is widely acknowledged that community-based programs have the greatest potential of addressing inequality and vulnerability but they need to be carefully considered, measured and implemented. Having professionals who have the technical capacity to design, initiate, manage and evaluate the program is essential (Setorglo et al., 2016). For example, in Laurie (2008), the local Department of Agriculture had extension officers, trained on a 5-day training course presented by the ARC providing, as agricultural advisors. The advisors were also supported by the research technicians from the ARC during the monthly visits. In Musaphi (2017), fieldworkers were trained and supervised to collect data at baseline and post-intervention. All of the educational sessions were also facilitated by the researcher in small group sessions. In the above programs support, supervision, and provision of resources have been important in the success of programs. This has been also indicated by the Child Nutrition Program in Vietnam. This program was created to improve the nutritional status of children under the age of two by combining two components: child nutrition and HHFS. At the provincial, district, and community levels, project steering committees were formed. Training and technical assistance activities were provided by project steering committees at the district and provincial levels to support those at the village and commune levels (Phu, Hanh & Canh, 2016). Qualified and well-trained human resources are required at all levels; however, in many developing countries, governments lack the human and financial resources to implement all aspects of community programs within a short period. To avoid this challenge technical capacity can be supported by NGOs and civil society organizations, however, it is important to note that this may lead to difficulties with adequate supervision and poor quality control (Shantha & Vaidyananthan, 2017).

5.3.6 Socio-political context

Socio-political context is the overlapping of both social and political spheres. Socio-political factors influence the decisions taken in development to initiate or support community programs. This is a complex concept as it involves both the intent and motivation of individuals or communities. There is a strong association between active community participation and positive community development. Community-oriented programs promote empowerment, which is realized when stakeholders share priorities, gain knowledge and acquire resources (Gillsepe et al., 1996). In Faber (2002), the researchers held a sensitization and skills workshop attended by community representatives. The representatives were further invited to participate in the formulation of the intervention. Communities are complex entities, with pre-established hierarchies and linkages, through friendships, historical events, and experiences. A major flaw that programs may have is attempting to superimpose new structures and new organizations for program implementation. Given the fact, community participation does not always guarantee sustainability. Working with existing community groups and leadership and strive to transform and improve them slowly through capacity building and other program activities may improve chances of institutionalization of the activities, community ownership of the program, and ultimately, sustainability. Therefore, allowing community members to be part of the formulation of programs will help them exercise political will (Ismail, Immink, Mazar & Nantel, 2003).

5.3.7 Limitations: Financial factors

All nutrition programs are initially externally funded, but their sustainability is dependent on internal capacity. This necessitates government response to the community's needs so that communities are not negatively affected when external funds are stopped (Puoane et al., 2008; Setorglo et al., 2016). Funding from external organizations will eventually have a specified time frame, often too short to have a meaningful impact as shown in Faber (2002) (Ismail et al., 2003). The program was externally funded but once the researchers withdrew, the communities were unable to maintain all the activities necessary for the gardening activities. Adequate resources and supplies also are necessary for the activities carried out during implementation; without which they are unlikely to be successful. For example, Laurie (2008) faced various challenges including the health volunteers were not remunerated, lacked funds to procure a sustainable supply of the seedlings and materials necessary for the growth monitoring activities during the monthly growth sessions. If funding is from external sources, local administrative offices need to have a mutually acceptable schedule for the gradual handover of financial responsibility, with targets and time frames (Ismail et al., 2003). The above programs can serve as pilots which include plans for transformation into national programs, however, substantial investment is needed to up-scale these programs. According to the Global Nutrition Report (2015), an estimated US$7 billion above existing levels of spending would be required over

ten years to finance the scale-up of evidence-based interventions, but the allocation of scarce public resources between nutrition and other activities is usually guided by political considerations. Hence the need to build leadership, commitment, and accountability at national levels as well as leveraging private-sector resources to bridge the gap (Global Nutrition Report, 2015). The substantial additional funding required to meet global nutrition targets must be met through a combination of national and international investments; however, evidence suggests that spending on high impact nutrition interventions is falling short of targets. Due to a lack of global agreement on a prioritized nutrition-sensitive package for governments and partners, the data available to assess financing needs and track investments is insufficient. As a result, efforts to direct resources to the areas where they are most needed are severely hampered (Global Nutrition Report, 2020).

CHAPTER 6
CONCLUDING REMARKS AND RECOMMENDATIONS

6.1 CONCLUSION

The majority of community-based interventions in SA have primarily focused on communicable disease and poverty alleviation, however, times are changing. South Africa is currently experiencing a double burden of malnutrition of obesity and diet-related diseases concurrently existing with undernutrition and micronutrient deficiencies within the same household level. The success of community programs is determined based on their impact on the community. Overall, the five programmes discussed above are generally acknowledged to be successful in their own right. They have shown that the promotion, production and consumption of TIF in conjunction with nutrition messages and health-based caring practices does improve household food and nutrition security, particularly in vulnerable groups. This is attributed to the various components that form part of community-based interventions, which without programs would fail. The most conveniently and practised strategies to address malnutrition are generally implemented independently by a single sector, inadvertently failing to address the primary causes of malnutrition particularly food insecurity and poverty. However, the programs included showed that to provide functional and sustainable community-based programs, intervention activities need to interact with other sectors to have a meaningful impact. To accomplish this, an enabling environment should be shaped, where an enabling environment is defined as “Political and policy processes that build and sustain momentum for the effective implementation of actions that reduce undernutrition” (Gillespie, et al 2013). But it is also important to keep in mind that intersectoral collaboration should include linkages to an organization and other platforms with similar objectives. These linkages may help provide technical skills and sharing of resources.

Nonetheless, this would not be possible without genuine community commitment and participation. Community participation encourages communities to take responsibility for their own well-being and to develop the ability to contribute to their own and the community's development. This enhances accountability and transparency contributing to the sustainability of programs. This necessitates the integration of health and agricultural systems; however, the main issue is that governments underinvest in programs and efforts to reduce food insecurity. Most community-based programs are externally funded, which presents a significant challenge because the researchers formally leave communities, and the funding is typically limited. Local administrative offices must resume responsibility, but in most cases, this is not possible.

Nevertheless, by leveraging existing food systems, some of these challenges can be mitigated. This is the TIF value. Some of these foods are actively cultivated, while others grow naturally in food gardens. The majority of wild vegetables are typically available all year, implying a consistent supply of nutrient-dense food all year. TIFs, as demonstrated by the programs in the review, significantly improve dietary diversity through the various varieties available, thereby significantly improving diet quality. TIFs are critical for improving livelihoods, reducing poverty, and ensuring food security. Although TIF is still consumed in South Africa, owing to a lack of crop cultivation, they have been largely ignored by food and nutrition-based interventions. This is demonstrated by the scarcity of data on food and nutrition-based interventions. The inclusion of TIF in nutrition messages may also help to dispel the myth that they are secondary foods. The time has come to put the evidence and knowledge gained to good use and invest in appropriate systems to address food insecurity and poverty.

6.2 RECOMMENDATIONS

The recommendations were based on the information coming out of all studies in the review:

- Increased investment in interventions that will equip the poor to follow healthy diets and improve food and nutrition security. The diet of the poor is typically monotonous, consisting mainly of staple foods. They often lack access to nutrient-dense foods such as fruits and vegetables.
- Intersectoral collaboration between different sectors that have overlapping objectives with context-specific solutions. It is much simpler to design programs for single sectors but these fail to tackle complex problems that involve gender and resources among others.
- Communities play a very important role. By giving communities the skills, knowledge and resources to make informed choices will build sustainable food and nutrition systems promoting economic self-reliance and social well-being
- Creating an enabling environment for the alleviation of food- and nutrition insecurity. Allocation of public resources between nutrition and other activities is usually guided by political considerations. This call for new political incentives and institutional arrangements between sectors including but not limited to Health, Agriculture and Education.

6.3 LIMITATIONS

This study has certain limitations. The existence of a single reviewer is the primary limitation of this review. In the presence of additional reviewers, the additional researcher would conduct a search to see if any additional studies should be included, as well as assess the quality of the studies that were already included. Furthermore, because the review had a small sample size, the research objectives may not have been adequately addressed, particularly which intervention components

are most effective. Another limitation is the potential for data relevancy and validity. Because there were no time constraints imposed on the information gathered, some of the data may be out of date.

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APPENDICES

APPENDIX 1: DATA STORAGE TOOL

Title	Author	Year	Database	Keywords

APPENDIX 2: DATA EXTRACTION TOOL

Reference		
Setting (Rural/Urban/Informal)		
Study Method (including methodological limitations reported)		
Population		
Duration of study		
Sample size	**Intervention 1**	**Intervention 2**
Intervention 1		
Intervention 2		
Main outcome measures:	**Description**	**Measure**
Results		
Limitations		

Adapted from: Pearson, A., Field, J., & Jordan, Z., Joanna Briggs Institute (2007). *Evidence-based clinical practice in nursing and health care: assimilating research, experience and expertise.*

APPENDIX 3: CRITICAL APPRAISAL TOOL

Re-Aim Dimensions	Question	Score
REACH	Does the article indicate who the program is aimed for (Inclusion and exclusion criteria)?	Yes=1/No=0
	Does the article report on the representativeness of the target population?	Yes=1/No=0
	Does the article report on the participation rate	Yes=1/No=0
Effectiveness	Did the program achieve the intended objectives?	Yes=1/No=0
	Do they report of the limitations of the interventions?	Yes=1/No=0
	Reports on at least one outcome of the intervention	Yes=1/No=0
	Reports on attrition	Yes=1/N=0
Adoption	Is the setting clearly described?	Yes=1/No=0
	Does the evaluation report on the adoption of the interventions by the participants or the organization?	Yes=1/No=0
	Report on who delivered the program	Yes=1/No=0
Implementation	Describes the duration and the frequency of the interventions	Yes=1/No=0
	Has the staff/participants of the organization/intervention been involved in delivering the program (cost implication)	Yes=1/No=0
	Reports on intended and delivered interventions	Yes=1/No=0
Maintenance	Does the article report on the long-term effectiveness of the interventions (after 6 months)	Yes=1/No=0
	Do they report on the indicators used for intervention follow-up?	Yes =1/No=0
TOTAL		**/15*100**