UNIVERSITY OF CAPE COAST

NUTRITIONAL VALUE OF TURKEY BERRY

MABEL OGAH

2015

UNIVERSITY OF CAPE COAST

NUTRITIONAL VALUE OF TURKEY BERRY

BY

MABEL OGAH

Thesis submitted to the Department of Vocational and Technical Education of the College of Education Studies, University of Cape Coast, in partial fulfilment of the requirements for the award of Master of Philosophy Degree in Home Economics.

JULY 2015

DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature:.....

Date:.....

Name: Mabel Ogah

Supervisors' Declaration

We hereby declare that the preparation and the presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature..... Date.....

Name: Prof. (Mrs.) Sarah Darkwa

Co-supervisor's Signature..... Date.....

Name: Prof. Joseph K. Ogah

ABSTRACT

The study determined the amount of selected nutrients in the fruits of Turkey berry*(Solanum torvum sw.)* and any significant difference(s) heathad on nutrient content. Samples of Turkey berries were bought from the market, cleaned, ground (raw, boiled or roasted) and tested. Results were then analysed using means, percentages and ANOVA. A survey was also conducted to ascertain the level of consumption and knowledge froma sample of pregnant women inCape Coast Metropolis. Proximate analysis of the Turkey berries showed high levels of minerals such as potassium, iron, calcium, phosphorus and magnesium but low levels of major nutrients such as carbohydrates, fats and protein. However,the percentages Daily Value of most nutrients were high with the exception of carbohydrate (3.86%). Boiling caused a significant decrease in most of the nutrients in the Turkey berries(potassium and iron decreased from 1673.67mg to 1527.87mg and 18.30 to 17.07mg subsequently) with the exception of Fibre (p=.06). From the survey, it was ascertained that 90% of pregnant women in the Cape Coast Metropolis consumeTurkey berries. However between 65% and 84% of the respondents reported have little knowledge on the nutritional value of Turkey berries.

A conclusion was drawn that Turkey berries is nutritious. It was also concluded that boiling affects the nutritional value of Turkey berry. Therefore it was recommended that 100g or more may be consumed daily and if possible in the raw state. Pregnant women should increase their consumption ofTurkey

berry in the right way to enable them meet their extra iron requirement.

ACKNOWLEDGEMENTS

I sincerely thank my mainacademic supervisor, Prof. (Mrs.) Sarah Darkwa for her immeasurable assistance and good guidance. Out of her very busy schedules, she still found time to give me the maximum attention I needed in the study. I am also grateful to Prof. Joseph Ogah of the Department of Health, Physical and Recreation and Mr Stephen Adu of the Agric Technology Village, UCC for their enormous support to me during the study. I extend my thanks to my husband Mr. Gabriel Apotey and my siblings for their moral and financial support during the study.

DEDICATION

To my entire family.

TABLE OF CONTENTS

		Page
DECLARATION		ii
ABSRACT		iii
ACKNOWLEDGMENTS		iv
DEDICATION		v
TABLE OF CONTENTS		vi
LIST OF TABLES		ix
FIGURE		x
LIST OF ABBREVIATIONS		xi
CHAPTER		
ONE:	INTRODUCTION	1
	Background to the Study	1
	Statement of the Problem	2
	Purpose of the Study	3
	Objectives of the Study	3
	Research Questions	4
	Significance of the Study	4
	Delimitation of the Study	5
TWO:	REVIEW OF RELATED LITERATURE	7
	Introduction	7
	Background of Wild Vegetables	7

	Turkey Berry as a vegetable	9
	Definition of Indigenous Vegetables	11
	Role of African Vegetables in Health Promotion and Protection	13
	Nutritional importance of African Vegetables	14
	Use of Indigenous Food Crops	16
	Patterns of Consumption of African Vegetables	18
	Proximate Compositions of Indigenous Vegetables	18
	Importance of some Macro and Micronutrients	25
	Mineral Component Derived From Commonly Consumed Ghanaian Foods	46
	Medicinal and Nutritional benefits of Turkey berry	58
	Chemical Constituents of Turkey berry	59
	The Percent Daily Value (%DV) of Nutrients	60
	Summary	62
THREE:	METHODOLOGY	65
	Research Design	65
	Study Area	65
	Population	66
	Sample and Sampling Procedures	67
	Instruments	69
	Data Collection Procedure	69
	Data analyses	81
FOUR:	RESULTS AND DISCUSSION	83

What are the Nutritional Constituents of Turkey Berry 83

Does the form in which Turkey Berry is prepared and eaten affect the Availability of Nutrients? 88

What is the Consumption level of Turkey berryamong Pregnant Women? 92

What Knowledge do Pregnant Women have on Turkey Berry 97

FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary 104

Key findings 104

Conclusions 106

Recommendations 107

REFERENCES 110

APPENDICES 137

A (Questionnaire for Pregnant Women) 138

B (Introductory letter) 142

LIST OF TABLES

Table	Page
1: The Daily Values of Nutrients	61
2: Distribution of Educational level of pregnant women	69
3: Proximate Composition of Turkey berry	83
4: Mineral Composition of Raw Turkey berry	84
5: The Percentage Daily value of Nutrients in Raw Turkeyberry	85
6: Proximate Composition of raw, Parboiled and Cooked Turkey berry	89
7: Mineral composition of Raw, Parboiled and cooked Turkey berry	90
8: Distribution of how often Turkey berry is consumed by pregnant women who attend antenatal care in Cape Coast Metropolis	93
9: How Turkey berry is prepared before consumption	94
10: The amount of Turkey berry consumed in a day	94
11: Reasons why Pregnant women consume Turkey berry	95
12: What Nutrients can be found in Turkey berry	98
13: Pregnant women's perceived health benefits of Turkey berry	98
14: Pregnant women's perceived Medicinal Benefits of Turkey berry	99
15: Groups of people who should consume more of Turkey berry	100
16: The side effect of excess or overconsumption of Turkey berry	100

FIGURE

Figure Page

1: Age Distribution of Pregnant Women in Cape Coast Metropolis 68

LIST OF ABBREVIATIONS

AAS	Atomic Absorption Spectrophotometer
AFPA	African fitness professional and associates
AI	Adequate Intake
ALV	African leafy vegetables
ANOVA	Analyses of variance
AOAC	Association of Official Analytical Chemists
ATP	Adenosine triphosphate
AV	African vegetables
cAMP	Cyclic adenosine monophosphate
Conc	Concentration
CuZnSOD	Copper-zinc superoxide dismutase
DGA	Dietary Guidelines for Americans
DHSS	Department of Health and Social Security
DM	Dry matter
DNA	Deoxyribonucleic acid
DV	Daily Value
EBT	Erichrome Black T
EDTA	Ethylene diaminetetra-acetic acid
FAO	Food and Agriculture Organization
g	Grams
GABA	Gamma-aminobutyric acid
GhC	Ghana cedi
Gp	Ghana pesewas

GSS	Ghana statistical service
Hb	Haemoglobin
HIF	Hypoxia inducible factors
HSD	Honest significance difference
IAV	Indigenous African vegetable
IITA	International Institute of tropical Agriculture
ILV	Indigenous leafy vegetable
IOM	Institute of Medicine
Mg ATP	Magnesium Adenosine triphosphate
Ml	Millilitres
NADH	Nicotinamide adenine dicleotide
RDA	Recommended Dietary Allowance
RDI	Recommended daily intake
RNA	Ribonucleic acid
ROS	Reactive oxygen species
SSA	Sub Sahara African
TALV	Traditional African leafy vegetable
TAV	Traditional African vegetable
TDF	Total dietary fibre
TEA	Triethanolamine
TLV	Traditional leafy vegetables
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

In tropical Africa, especially among poor societies where the daily diet is often dominated by a limited number of starchy staples and coarse grains, African indigenous vegetables are the cheapest and most readily available sources of vitamins especially vitamin A, minerals and proteins from some nuts and legumes (Martin & Meitner, 1998; Bosland & Votava, 2000). Though staple foods are often low in fat and high in fibre and thus contribute to the health of individuals, they do offer less variety than vegetables do. Several different types of vegetables grow in the wild or are grown in home gardens and consumed in Ghana.

Background to the Study

Turkey berry is one vegetable that grows in the wild in Ghana and has been used in food preparation over the centuries. Traditionally, it is added to palm fruits to make soup. Although it has taken a while for its true nutritional and medicinal values to be recognized in Ghana (Asiedu-Darko, 2010), it has in recent times been vigorously sought after for its medicinal properties (Asiedu-Darko, 2010). Compared to other regions like Thailand, India, and South America, where it has been consumed for medicinal purposes for so long, (Agrawal, Bajpei, Patil & Bavaskar, 2010) there are hardly any documented recipes that use the Turkey berry in Ghana. The sale of Turkey berry in Ghana has moved from selling on tables in the market to being packaged in polythene bags and sold not just in the market but in stores and shopping malls. Packaging the berry and making them more attractive and

acceptable to the average Ghanaian consumer may help increase its consumption. Asiedu-Addo (2014), reports that Turkey berry is believed to boost blood levels and is often used in preventing and treating anaemia. The rise in the consumption of the berry has also been attributed to the fact that doctors, midwives and traditional healers often recommend it for patients who are anaemic to help improve blood haemoglobin levels and general immune function.

However, there is no documented scientific evidence in the Ghanaian literature that Turkey berry (*Solanum torvum sw.*) improves blood levels though research elsewhere has reported some health benefits of. Arthan, Kittakoop, Esen and Svasti (2009), reported a moderate α-glucosidase inhibitory action of the berry, making it a possible anti-diabetic agent. They further explained that the berry decrease postprandial hyperglycemia where glucose absorption is reduced by preventing carbohydrate hydrolysis through reduction of α-amylase and α-glucosidase in the digestive organs. Other studies also report the steroidal compounds and antiviral activities of Turkey berry as well as the anticancer properties of the glycoalkaloids and molluscidal activity of crude extract of the solanum fruits which make it act as potential immunomodulators (Umamaheswari, Shreevidya & Nuni, 2008; Silva, Batista, Camara & Agra, 2005).

Statement of the Problem

Although Turkey berry is often recommended to anaemic patients and pregnant women by doctors, midwives and traditional healers in Ghana (Asiedu-Addo, 2014), its therapeutic value is seen more as a myth than

documented scientific fact. The farthest some researchers in Ghana have gone is to report the beliefs and perceptions of consumers (Asiedu-Darko, 2010; Asiedu-Addo, 2014) about the nutritional and medicinal properties of the berry with very little documented scientific information on the constituents and the pharmacological elements.Whether it is a myth or not, coupled with the rising cost of medications in developing countries where majority of individuals still rely on traditional medicines, it is necessary to investigate the potential of using Turkey berry for the said medicinal purposes. This can be successfully done by identifying the chemical constituents of Turkey berry growing in Ghana. It will also be important to determine the level of consumption of the berry among the Ghanaian populace and also the various forms in which they eat the berry.

Purpose of the Study

The first purpose of this study was to determine the nutritional composition of Turkey berry grown in Ghana, specifically in the Cape Coast Municipality in the Central Region of Ghana, and ascertain how the identified nutrients relate to the stated medicinal and nutritional benefits. The second purpose was to explore the extent of knowledge and consumption of Turkey berry from a survey of a group of pregnant women living in the Cape Coast Metropolis and attending antenatal care in the Cape Coast metropolitan health care centres..

Objectives of the Study

The objectives of the study were to:

1. determine the nutritional constituents of Turkey berry

2. identify the form in which these berry present the optimal levels of nutrients (i.e. raw, parboiled and, boiled.)
3. what is the nutritional value of turkey berry as compared to other vegetables
4. find out from a sample of pregnant women their consumption levels of the berry
5. find out from a sample of pregnant women their knowledge of the uses and benefits of Turkey berry

Research Questions

The study addressed the following research questions:

1. What are the nutritional constituents of Turkey berry?
2. Does the form in which turkey berry is prepared and eaten affect the availability of nutrients?
3. What is the consumption level of Turkey berry among pregnant women?
4. What is the knowledge level of pregnant women on the uses and benefits of Turkey berry?

Significance of the Study

It is hoped that findings from this study will help:

1. promote consumption of these berry
2. compliment the scanty documented information on the nutritional and medicinal benefits of eating Turkey berry

3. consumers know the best form in which to prepare and consume turkey berry to obtain the maximum nutritional and medicinal benefits
4. highlight the need for further studies and form the basis on which other studies would build.

Delimitation of the Study

Food contains a number of nutrients ranging from micro to macro nutrients including phytochemicals that are considered important in the metabolism of other nutrients. This research is delimited to the search of only the following nutrients: carbohydrate, protein, fibre, fats and oils, iron, calcium, potassium, phosphorus, magnesium, zinc and copper in turkey berry. In turkey berry preparation prior to consumption, it could be dried as used in sundakkai (an Indian food) or cooked fresh as well as eaten raw. For the purpose of this research, only the fresh raw and fresh cooked berry was tested. Even though Turkey berry grows wild and could sometimes be obtained from backyards or disturbed lands, the one used for the study was bought from the market at Abura in the Cape Coast Metropolis in the Central Region of Ghana. This is because a difference in agro-ecological zones, which includes differences in climate and soil fertility levels, has an influence on the level of various nutrients in vegetables grown in these zones.According to Chweya and Mnzava (1997), plant's nutritional value may vary with soil fertility, environment, plant type, plant age and the production techniques used. Also Soetan et al. (2010) stated that location has been reported to influence the mineral and trace element compositions of rice, wheat, oats and barley. These

are mainly attributed to the altered soil conditions and that the nature and chemical composition of the soil are also involved in location differences in mineral elements. The survey was also delimited to only pregnant women because it is believed it gives blood and pregnant women are one group that has high iron needs.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

Introduction

This chapter presents a review of literature related to the medicinal and nutritional benefits of Turkey berry. It also presents information on uses and consumption of the berry in other parts of the world where they have been used over the years in Ghana.

Background of Wild Vegetables

Knowledge of wild gathered foods has been passed on from previous generations. In different regions of the world, there is a great variation in species, in preparations and use of such foods. They can be used throughout the whole year, but more often they are used during a time of scarcity. They are important during periods of famine. Although there seems to be an increase in the interest for, and understanding of, wild gathered foods as an important resource, including as food, the potential nutritive values of most of these foods have not been analyzed systematically. It is difficult to find literature and food composition tables which include gathered wild foods (Nordeide et al., 1994). The first comprehensive composition tables of Australian Aboriginal foods have been reported by Miller et al. (1993). The information in Miller's book is not only used by Aborigines themselves but by a variety of professionals like dietitians, school teachers, anthropologists, epidemiologists and agricultural scientists (Nordeide et al., 1994).

Review of the literature reveals that there is some documentation on the use of wild foods in Africa. Grivetti et al. (1987) gives a systematic

assessment of published literature on the dietary use of wild plants in many African societies. From West Africa, Diarra (1977) lists more than 40 edible plants used in different seasons near Bamako in Mali. Glew et al. (1997) in a study of 24 indigenous plants of Burkina Faso found out that these plants were good sources of protein (some three plants had as high as 20-37 % protein), essential amino acids, essential fatty acids such as linoleic and linolenic acids and micronutrients such as iron and zinc. A study carried out by Kim and colleagues (1997) in the Republic of Niger on the seeds of *Boscia senegalensis*, which is used as a famine food, revealed that these seeds contain substantial quantities of arginine, tryptophan and essential fatty acids such as linoleic acid, as well as zinc and iron. Ogle and Grivetti (1985) in their articles on wild gathered foods discussed the dietary utilization of edible wild plants in the kingdom of Swaziland, Southern Africa. Salih et al. (1992) compared wild grasses with local staple cereals in an area of Western Sudan. They found that wild grains of *C. biflorus* were particularly high in protein concentration. Becker (1983; 1986) studied the contribution of wild plants to human nutrition in Northern Senegal and the Sahelian Zone. Among the plants growing in Northern Senegal, 50% have valuable edible parts. They also found out that these plants were important sources of vitamins A, C and riboflavin.

Despite all the documentation on the identity, distribution and uses of edible wild foods in Africa in general, and in Ghana in particular, there is a paucity of information on their chemical composition. Most of the work on wild foods documented from Ghana has been on edible wild fruits (FAO, 1983). Smith (2002), in her listing of 'useful plants in Ghana' does include

vegetables. *Solanum nigrum* is listed as being edible in some parts of the country. There is, however, no mention ofTurkey berry. In general, there is little, if any information on the wild fruit vegetable, Turkey berry, which is eaten widely in the southern part of the country. This study therefore, was undertaken to obtain basic data on the chemical composition for this wild vegetable, Turkey berry, and to begin the process of compiling data on the chemical composition of wild indigenous wild vegetables of Ghana.

Turkey Berry as a vegetable

According to Arthan, et al (2002), Turkey berry is also called pea aubergine or the Devil's Fig and scientifically called *Solanum torvum sw.* Turkey berry is widely used for culinary and medicinal purposes in Thailand (Arthan, et al 2002). There are several vegetables that grow in the wild in Ghana which are well patronized by individuals such as "kontomire' or Colossia leaves. There are others such as the Turkey berry which also grow in the wild but although eaten by individuals, has not been popular like 'kontomire'. It is usually the berry or fruits of the plant that are eaten, although some individuals pick the leaves, boil and drink. Vegetables in general and green leafy ones specifically are usually known to have higher concentrations of vitamins, minerals, fibre and other beneficial compounds which are used in addition to staple foods for a balanced meal. The use of turkey berry as vegetable in dishes may provide some nutrients derived from vegetables in general. Most green leafy vegetables are good sources of iron and when consumed with a variety of foods, help to achieve optimum body and brain growth, development and maintenance, and general good health (Beard

&Dawson, 1997). They also concluded that vegetables tend to reduce the glycemic load when eaten with high-energy foods like bread and polished rice making it ideal for weight loss. Knowledge of the health promoting and protecting attributes of some vegetables is clearly linked to their nutritional and non-nutrient bioactive properties. Vegetables are full of water, especially when eaten raw, and this water aids their digestion when eaten thus reducing the pressure often exerted on the digestive systems (Lussier, 2010). This implies that the body uses less energy and resources to digest and assimilate nutrients from vegetables easily. Vegetables are high in cellulose and fibres similar to fruits, thus help in the prevention of several diseases including colon cancer when consumed in right amounts repeatedly (Lussier, 2010). Kwenin, Wolli and Dzomeku (2011), report that Amaranthus leaves "Aleefu" an example of green leafy vegetable is grown for its leaves which are rich in beta-carotene, calcium, iron and vitamin C.

Green vegetables are also a source of minerals such as zinc, iron and potassium. In Willett(1995) and Liu (2003), there are reports of vegetables containing non-nutrient bioactive phytochemicals that have been linked to protection against cardiovascular and other degenerative diseases. Similarly, Kannan, Dheeba, Gurudevl and Singh, (2012) identified phytochemical, antibacterial and antioxidant properties of Turkey berry. Roger (2011), suggests that the role of vegetables and fruits in preventing heart disease is a protective one. Risk reduction has been estimated as high as 20-40% among individuals who consume substantial amounts of fruits and vegetables. People

living with coronary heart disease are able to reduce blockage modestly through exercise and an extremely low-fat, diet rich in fruits and vegetables.

Definition of Indigenous Vegetables

The word *indigenous* is used to describe vegetables that have their natural habitat in a country and those that were introduced from other regions of the world. The introduced vegetables due to long use became part of the food culture in that country (Chweya & Eyzaguirre, 1999**).** There are two main classes of vegetables in Sub Saharan Africa urban and peri-urban agriculture. One group is exotic vegetables that originate from outside of the continent, and the second group comprises indigenous or traditional African vegetables. Providing a single and widely accepted definition of a traditional African vegetable is fraught with difficulty, and is open to as much, if not more, debate than that surrounding definitions of urban agriculture. There are a host of terms describing traditional African vegetables, including indigenous African vegetable (IAV); indigenous leafy vegetable (ILV); African leafy vegetable (ALV); traditional African vegetable (TAV); traditional African leafy vegetable (TALV or TLV) – and all are subject to contested meanings (Odhav et al., 2007)

According to the United Nations Food and Agriculture Organization (FAO, 1988), traditional vegetables are all categories of plants whose leaves, fruits or roots are acceptable and used as vegetables by urban and rural communities through custom, habit and tradition. Before the introduction of exotic crops and associated weeds, traditional vegetables would have been found in the wild or were semi-domesticated varieties of the indigenous flora.

For some academics and practitioners, this means that 'traditional African vegetables' are defined as 'wild' plants, or semi-domesticated species that are part of traditional diets and may often be relied on as foods during periods of crop failure or famine. Gockowski et al. (2003) define traditional leafy vegetables as those leafy green vegetables that have been originally domesticated or cultivated in Africa for the last several centuries. As time has passed, however, those vegetables which are now used 'according to custom and tradition' may include introduced species, so that for some people the term African traditional vegetables goes as far as including exotic produce such as tomatoes which are now customarily used by African populations. The distinction continues to be made with separate green leafy vegetables, casually referred to as 'African spinaches', as a particular group with stronger ties to the indigenous flora and with specific nutritional characteristics(Ejoh et., 2007).

African indigenous vegetables or traditional African vegetables as names that refer to those plants which originate on the continent, or those which have such a long history of cultivation and domestication to African conditions and use that they have become 'indigenized'. To be specific, the predominant exotic vegetables found in SSA metropolitan areas are carrot (*Daucus carota var.*), tomato (*Lycopersicon esculentum var.*), green beans (*Phaseolus vulgaris*), onions (*Allium spp.*), cabbage (*Brassica oleracea*), lettuce (*Lactuca sativa*), and chard (*Beta vulgaris var.*). Important indigenous or traditional African vegetables include okra (*Abelmoschus esculentus*), sweet

potato (*Ipomoea batatas*), cowpea (*Vigna unguiculata*), yams (*Discorea spp*.), and taro tubers (*Colocasia esculenta and Xanthasoma spp*.).

In terms of the leafy species alone, a range of species from several major families of plants are used, with the genera *Amaranthus, Agathosma, Bidens, Cleome, Chenopodium, Corchorus, Crotalaria, Cucurbita, Ipomoea, Solanum, Vernonia* and *Vigna* being the most conspicuous (Coetzee et al*.,* 1999; Shackleton, 2003; Pichop, 2007). There is variation in the dominant plant families and species utilized by region and country according to the interplay of ecology and cultural preference. In West and Central African cities, the most common and popular leafy vegetables are sweet potato leaves (*Ipomoea spp*.), pumpkin (*Cucurbita spp*.) and wild spinach (*Amaranthus spp.*); in East and Southern Africa the African nightshades (*Solanum spp*.), wild spinach (*Amaranthus spp*.), spider plant (*Cleome spp*.) and pumpkins (*Cucurbita spp.*) predominate (Pichop, 2007). It is also worth noting the increasing significance of Ethiopian kale (*Brassica carinata*), which is being promoted in urban agriculture across the continent as a more nutritious indigenous alternative to exotic cabbage. Despite this variety of African indigenous vegetables, the focus of contemporary urban and peri-urban vegetable production in most Sub Sahara African (SSA) cities has turned to the production of exotic crops and varieties.

Role of African Vegetables in Health Promotion and Protection

Quite a large number of African indigenous vegetables have long been known and reported to have health protecting properties. Several of these indigenous vegetables continue to be used for prophylactic and therapeutic

purposes by rural communities (Ayodele, 2005). Indigenous knowledge of the health promoting and protecting attributes of African Vegetables (AVs) is clearly linked to their nutritional and non-nutrient phytochemical properties. AVs have long been, and continue to be reported to significantly contribute to the dietary vitamin and mineral intakes of African populations (Mulokozi et al*.,* 2004).

More recent reports have shown that African indigenous vegetables also contain non-nutrient bioactive phytochemicals that have been linked to protection against cardiovascular and other degenerative disease. However, Orech, Akenga, Ochora, Friis and Aagaard-Hansen (2005), observed that some of these phytochemicals found in some African vegetables consumed in Western Kenya may pose toxicity problems when consumed in large quantities or over a long period of time. In spite of this body of evidence confirming the nutritional contribution of African vegetables to local diets, and their health maintenance and protective properties, there has been very little concerted effort towards exploiting this biodiversity nutritional and health resource to address the complex food, nutrition and health problems of Ghana.

Nutritional Importance of African Vegetables

Wild food plants play a very important role in the livelihoods of rural communities as an integral part of the subsistence strategy of people in many developing countries (Zamede et al*.,* 2001). Locally available wild food plants serve as alternatives to staple food during periods of food deficit, are a valuable supplement for a nutritionally balanced diet and are one of the

primary alternative sources of income for many poor rural communities (Scoones et al., 1992). Millions of people in many developing countries do not have enough food to meet their daily requirements and a further more people are deficient in one or more micronutrients (Campbell, 1987). In most cases, rural communities depend on wild resources including wild edible plants to meet their food needs in periods of food crisis. The diversity in wild species offers variety in family diet and can contribute to household food security (Zinyama et al., 1990; Zamede et al., 2001). Guerreroet al. (1998) compiled a comprehensive nutrient report of wild vegetables consumed by the first European farmers, and nearly all the species had significant amounts of several micronutrients such as copper, magnesium, zinc, iron, vitamin E, carotenoids and vitamin C. Turan,et al (2003) reported that the potassium, calcium, magnesium and protein contents of wild vegetables in Turkey were all higher than cultivated species. The cultivated species analysed and compared to the wild vegetables were spinach, pepper, lettuce, and cabbage. Concentrations of iron, manganese, zinc and copper were similar in both vegetable types. Studies conducted by Booth,et al (1992) and Freyre et al. (2000) in South America have confirmed the importance of wild vegetables as sources of micronutrients. Studies conducted on wild South African vegetables by Freiberger et al. (1998) and Vainio-Mattila (2000) in Tanzania underscored the wild plants' significant contribution as sources of micronutrients. However, the nutritional quality of four wild vegetables analysed in Ghana was found to be in the same range as conventional vegetables (Wallace et al., 1998). All the researches showed that wild plants are essential components of

many Africans' diets, especially in periods of seasonal food shortage. A study conducted in Zimbabwe revealed that some poor households rely on wild plant foods as an alternative to cultivated food for a quarter of all dry season meals (Kabuye, 1997).

Use of Indigenous Food Crops

Although modern agriculture and the food supply of industrial societies is based on a handful of plant species, traditional agriculturalists, pastoralists and hunters/gatherers in most African countries use a myriad of plants for food, medicine, construction, etc. Central to such practices is the exploitation of wild food resources. However, dietary utilization of non-domesticated plants has received very little attention in economic development efforts. Paralleling this omission has been the revelation that despite increased food production in some sectors, there has been a drastic narrowing of the food base in many traditional societies. By focusing on a limited number of cultivars of a few staple food crops, a vulnerable position is created, not only because diversification assures dietary balance and facilitates intake of micro-nutrients but through danger of domesticated crop destruction by drought or insect pests (Ogle & Grivetti, 1985). Although indigenous crops may not be as high yielding as crops of global importance, they can provide stable production under adverse ecological conditions, such as high aridity. Alternatively, they may be harvestable during seasons when other foods are scarce (Johns, 1994). Turkey berry for example, suffers relatively few diseases and pests, is tolerant to soil moisture stress and has excellent storage qualities (Barbeau & Hilu, 1993). It also has a growth cycle of only three months and

thus can provide two harvests a year if cultivated.

Although nutrient composition of most indigenous crops has not been analyzed, these species may be rich sources of vitamins, minerals or amino acids that complement other components of the diet. (FAO, 1983). The nutrient data on those species that have been analysed, reveal that they are often comparable, superior in some instances, to most staple foods. For example, finger millet has been found to be a good nutrient source with relatively high calcium content (Barbeau & Hilu, 1993). Carr (1958), reported high calcium and phosphorus values for *Adenia gummifera, Amaranthus gummiferria, Amaranthus thunbergii, Bidens pilosa, Corchorus tridens and Gynandropsis gynandra.* Some indigenous leafy vegetables have been found to be particularly valuable sources of provitamin A, vitamin C, folate, iron and protein. Examples include *Amaranthus caudutus, Amaranthus gracilis, Amaranthus thunbergii, Bidens pilosa, Corchorus tridens*, *Momordica balasania and Gynandropsis gynandra* which provide a complement to diets high in carbohydrate (Akhtar, 1987). It has also been found that an increased incidence of chronic diseases, such as diabetes, is experienced by many indigenous people as they adopt western diet and lifestyles. Plant foods in traditional diets are higher in fibre than western diets and the carbohydrates they contain are digested more slowly (Thorburn et al*.,* 1987). Hence, dietary incorporation or maintenance of indigenous food crops could be highly advantageous to marginal populations or to specific vulnerable groups within populations. In addition, researchers have, during the last 20 years, documented declining interest among younger people for traditional food