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**COLLEGE OF TECHNOLOGY EDUCATION, KUMASI**

# ASSESSING THE HEALTH BENEFITS OF TURKEY BERRIES CONSUMPTION IN GHANA- CASE STUDY OF COMMUNITY 5 A SUBURB OF TEMA METROPOLIS

**LINDA GYIMAH**

**MARCH, 2021**

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# ASSESSING THE HEALTH BENEFITS OF TURKEY BERRIES CONSUMPTION IN GHANA- CASE STUDY OF COMMUNITY 5 A SUBURB OF TEMA METROPOLIS

**LINDA GYIMAH**

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**A Thesis in the Department of HOSPITALITY AND TOURISM EDUCATION, Faculty of VOCATIONAL EDUCATION, submitted to the school of Graduate Studies, University of Education, Winneba in partial fulfilment of the requirements for the award of the Master of Technology (CATERING AND HOSPITALITY) degree**

**MARCH, 2021**

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# DECLARATION

## STUDENT'S DECLARATION

I, LINDA GYIMAH, declare that this dissertation, with the exception of quotations references contained in published works which have been identified and duly acknowledged, is entirely the result of my own original research work, and it has not been submitted either in part or whole for another degree elsewhere.

SIGNATURE: …….

DATE: …….

## SUPERVISOR'S DECLARATION

I declare that, the preparation and presentation of this work was supervised in accordance with the guidelines on supervision of dissertation as laid down by the University of Education, Winneba.

SUPERVISOR'S NAME: DR. GILBERT OWIAH-SAMPSON

SIGNATURE:……

DATE: ……

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## DEDICATION

This work is dedicated to my late husband Emmanuel Ato Krampah Adubah and my children Maureen, Miguel and Marcel.

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## ACKNOWLEDGEMENT

I wish to thank the Almighty God for life, cognitive grace, His mercy, wisdom and strength that made this possible in accomplishing this project work. I am also highly indebted to my supervisor, Dr. Gilbert Owiah-Sampson for providing invaluable scholarly comments, guidance and support that greatly shaped my research work and for making time of his tight busy schedules. And for the fact that he has effectively combined his work as a lecturer, Head of Department, and as a supervisor. Many thanks.

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## ABSTRACT

The main objective of the study was to assess the health benefits turkey berries consumption in Ghana- case study of community 5 a suburb of Tema metropolis. This study used the descriptive research design. Quantitative research approach was used for the study. Questionnaires were used in collecting the data from the field. This research was carried out using selected vegetable sellers, spices and turkey berry consumers in the Tema Metropolis. The entire population of sellers in the selected area was ninety seven (97). The census sampling technique was used to select all the ninety seven (97) participants for the study. The study results indicate that there were significant differences between diseases or sicknesses turkey berries can cure including fever ($p <$ 0.792), epilepsy ($p = 0.543$), anaemia ($p = 0.612$), cough and cold ($p = 0.517$), while the other diseases cured asthma ($p = 0.004$*), and cancer ($p <0.001$*) were not significantly different (Table 4.3). There were significant differences between possible side effect of consuming too much of turkey berries diarrhoea ($p < 0.529$), toxicity/poisoning ($p < 0.621$), constipation ($p < 0.526$) and bitterness in mouth ($p <$ 0.742) (Table 4.3). The reasons why turkey berries are not cultivated for commercial purposes were lack of capital for turkey berry farming, and low knowledge on nutritional benefits of consuming turkey berries. Turkey berry were found to be rich sources of micronutrients and fibre. Therefore, the consumption of Turkey berry should be promoted by researchers, non-governmental organizations and other relevant government/non-governmental departments at all levels of the Ghanaian society.

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# CHAPTER ONE

# INTRODUCTION

## 1.0 Background to the Study

Turkey berries are related to eggplant, but are very small green berries that grow on tall thorny bushes all over the world. They are great tasting food and have many health benefits that are amazingly healing for kidney disease, ulcers, high blood pressure, anemia, cancer, colds, flues, gout, arthritis, asthma, and so much more. Turkey Berries or Solanum tovan and also called Plate Brush, Devils Fig, Pea Eggplant, Bhankatiya, Pea Aubergine, Wild Eggplant, Tekokak, Susumber, and many other names can be found in India, Africa, China, Thailand, The Caribbean, South America, Indonesia, Florida, Alabama, Brazil, Mexico, Ghana, Jamaica, Papua New Guinea, Puerto Rico (In the high mountains of Puerto Rico they grow thousands of pounds of Turkey Berries), and other places in US and the world.

The leaves look like eggplant leaves and the tall bush has thorns and grows to 3 to 6 feet tall. This bush has beautiful white flowers that eventually turn into green pea like berries. This plant grows like a weed and will last for 2 or 3 years before it needs to be replanted from seed. 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

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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 haemoglobin levels in the blood.

Arthan, Kittakoop, Esen & Svasti (2009), reported a moderate α-glucosidase inhibitory action of the berry, making it a possible anti-diabetic agent. They further explained that the turkey 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.

In Ghana, it grows wild and many who sell them pick them from wildly grown Turkey berry shrubs for sale. The harvesting of the berries are said to be an irritating experience for harvesters, considering the prickly nature of the shrub. In recent times, the demand for the berry has increased and led to its commercialisation. Many Ghanaians use it in palm nut soups. The boiled fruits are pounded together with the palm fruits before it is strained for soup. Others use it like garden eggs in stews. It is known as a very good booster of blood levels and many doctors recommend it in anaemic patients. Many blend the uncooked berries, strain, refrigerate and use it as a blood boosting drink. Its leaves, which are rich in alkaloids, could also be used for

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medicinal or ritual purposes in some cultures. The plant is cultivated in tropical countries for its sharp tasting immature fruits (Asiedu-Darko, 2010).

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 immuno modulators (Umamaheswari, Shreevidya & Nuni, 2008; Silva, Batista, Camara & Agra, 2015). Therefore, this study assessed the health benefits turkey berries consumption in Ghana-case study of community 5 a suburb of Tema metropolis.

### 1.1 Statement of the Problem

Turkey berries contain lots of iron and so very good for treating anemia. They stimulate the production of red blood cells. Turkey berries can be used in soups and consumed daily to increase red blood cell production. 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.

Despite the recognition of African vegetables to be beneficial to human health, dietary utilization of non-domesticated plants has received very little attention in economic development efforts. Attention is given to a limited number of cultivars of a few staple food crops, a vulnerable position is created, not only because diversification

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assures dietary balance and facilitates intake of micro-nutrients but through danger of domesticated crop destruction by drought or insect pests.

In years past, many ignored it as it grew wildly in their backyards. Some children even humiliated the berry and used them as “bullets” on broomstick guns. Neighbours who used them for food picked them from the backyards of friends. But in recent times, many have grown to love the berry. Those who love to use it would rather have its medicinal benefits and a little bit of bitter-sweet taste on their tongues for a short while. Others just love the bitterness it leaves in the mouth; bitter is better, they say. Yet others are irritated by the many seeds in the berry. The average berry has about 100 seeds.

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. Moreover, there is scanty literature regarding the consumption and the medicinal benefits of turkey berries 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.

## 1.2 Main Objective of the Study

The main objective of the study is to assess the health benefits turkey berries consumption in Ghana- case study of community 5 a suburb of Tema metropolis.

### 1.2.1 Specific Objectives of the study

The following specific objectives would be used for the study including;

1. To examine the perceptions of caterers on the food and nutritional value of turkey

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berries.

2. To examine the specific meals which make use of turkey berries as a spice.
3. To identify the reasons why turkey berries are not cultivated for commercial purposes.

### 1.3 Research questions

The research will be guided by the following research questions

1. What are the perceptions of caterers on the food and nutritional value of turkey berries?
2. What are the specific meals which make use of turkey berries as a spice?
3. What are the reasons why turkey berries are not cultivated for commercial purposes?

### 1.4 Significance of the study

It is anticipated that findings from this study will help:

- Promote consumption of these turkey berry. Consumption of turkey berries is recommended for people who want to put on weight more especially the extract from the leaves. The anti-inflammatory property of the turkey berries together with the soasoline availability make the consumption of turkey berries a pain reliever since it combats pains such as arthritis, back pain, swelling etc. The consumption of turkey berries is recommended for flushing our uric acid that help to prevent or minimize pain, redness and symptoms of gout. The regular consumption of turkey berries lowers sugar level in the blood which makes it good for fighting diabetes. The use of turkey berries is good for preventing and healing colds and flu. The consumption of turkey berries is important for promoting a healthy skin. The use of

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turkey berries is recommendable for treatment of Asthma. Due to the anti-bacterial, anti-fungal properties as well as stops the abnormal growth of cells, turkey berries is good for combat of cancer.

- Compliment the scanty documented information on the nutritional and medicinal benefits of eating Turkey berry
- It will also help to package and market the product internationally, and skills cooking competitions organized in the food industry. Considering the high medicinal value of the plant, its cultivation could not only help ensure a healthy nation but it could be marketed abroad to earn the much needed foreign exchange for the nation's development.

### 1.5 Scope of the Study

The main purpose of the study was to assess the health benefits turkey berries consumption in Ghana- case study of community 5 a suburb of Tema Metropolis. Moreover, the study will be geographically focused on the community 5 a suburb of Tema Metropolis. The study is theoretically, empirically and conceptually limited in scope to the following research objectives including to assess the perceptions of caterers on the food and nutritional value of turkey berries. Secondly, to explore caterers' selective practices/patterns of local spices in Ghana and to examine the specific meals which make use of turkey berries as a spice.

### 1.6 Organization of the Study

This study consists of five Chapters, Chapter one would deal with the background to the study, the statement of the problem, research questions and objectives of the study, significance and organization of the study. In Chapter two the researcher would

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review related literature whiles chapter three would deal with the research methodology used in the study. Other aspects of chapter three would describe the research design, the population sample and sample procedures, data gathering instruments and data collection procedures of the study, methods of data analysis. Chapter four would describe the research findings and the discussion of the main findings and chapter five would present the summary of the findings, conclusions and recommendations and suggestions for further research.

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# CHAPTER TWO

# LITERATURE REVIEW

## 2.0 INTRODUCTION

## 2.1 Theoretical Review

### 2.1.1 Functional Foods

In most countries there is no legislative definition of the term functional foods, thus drawing a border line between conventional and functional foods is challenging even for nutrition and food experts (Palou *et al.,* 2013; Mark-Herbert, 2014). An explorative analysis reported by Annumziata and Vecchio (2011a) revealed that even consumers themselves in some European countries were confused due to the ambiguity of what functional foods and products were, despite they having to recognize the close link between diet and health and a high level of interest in the nutritional and health aspects of their food choices.

Hilliam (2010) also found similar findings where, up to 75% of the consumers had not even heard of the term ―functional food. However, terms like ―nutraceuticals, ―pharma foods, ―designer foods, ―nutritional foods, ―medical foods or ―super foods have been used as well to describe the term functional food by consumers (Childs and Poryzees, 2018). To date, a number of national authorities, academic bodies and the industry have proposed definitions for functional foods ranging from the very simple to the more complex ones. Basically, Foods that may provide health benefits beyond basic nutrition‟ or Food similar in appearance to conventional food that is intended to be consumed as part of a normal diet, but has been modified to sub-serve physiological roles beyond the provision of simple nutrient requirements‟ are good examples for the two approaches (Bech-Larsen and Grunert, 2013).

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The International Food Information Council (IFIC); (2017) also defines functional foods as ―foods or dietary components that may provide a health benefit beyond basic nutrition‖. Better still a functional food is a branded food which claims explicitly or implicitly to improve health or well-being (Martijn and Nicole, 2014). Functional foods are foods with nutraceutical properties. Thus the term ―functional foods are used interchangeably with the term ―nutraceutical. However, ―nutraceuticals according to Shahidi, (2019) are foods or compounds derived from foods, but are used in the medicinal form of pills, capsules, potions and liquids and again render demonstrated physiological benefits.

The American Dietetic Association also added that ―nutraceutical‖ have recently been recognized as ―those diet supplements that deliver a concentrated form of a presumed bioactive agent from a food, presented in a non food matrix, and used to enhance health in dosages that exceed those that could be obtained from normal food‖. It could be said that functional foods are clearly under the broad topic of nutraceutical. There are also natural health products which does not only include nutraceutical, but encompass herbal and other natural products for the attainment of health and wellbeing.

According to Martijn and Nicole (2014), in some countries, functional foods and nutraceutical are used interchangeably; however, in all cases, the main focus is on improving health and reducing disease risk through, mainly, prevention. Carrillo *et al.* (2013), explains that functional food was described by Margaret, (2012) as ―a food that has been satisfactorily demonstrated to beneficially affect one or more target functions in the body beyond adequate nutritional effects in a way that is relevant to either an improved state of health and well-being and/or to a reduction of the risk of disease.

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Functional foods may be categorised as either improving the general conditions of the body (for example pre- and probiotics), decreasing the risk of some diseases (example cholesterol-lowering products), and for curing some illnesses (Sirò *et al.*, 2018). Many factors fuel interest in functional foods, such as rapid advances in science and technology, increasing healthcare costs, changes in food laws affecting label and product claims, an ageing population, and rising interest in attaining wellness through diet. It should be mentioned that not only food manufacturers, but also the pharmaceutical industry has become interested in this field (Sääksjärvi *et al.*, 2019).

Bernal *et al.* (2011), in a review on functional food and nutraceutical described the rising interesting these field of research and study as being an exponential growth over the last twenty years, thus contributing to a better and scientific understanding of this field of research and studies. Reports on functional food were however higher compared to that on nutraceuticals. According to Sirò *et al.* (2018), issues pertaining to these functional foods and their field of studies are not only of interest to food manufacturers but also to the pharmaceutical industry.

The functional food market is one of the fastest growing food sectors, with a compound annual growth rate of 8.6% in the last 10 years (Euromonitor, 2010). Different demographical studies have again revealed that due to the rather expensive nature of medical service of the aging population, there is increased interest in functional foods and products and they are also on high demand by consumers (Mark-Herbert, 2014).

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### 2.1.2 Categories and characteristics of functional foods

Food in one form or the other could be said to be functional depending on the reason behind its consumption. There are various functional foods among our diet. However Sääksjärvi *et al.,* (2019), reported that drinks, chewing gum, spreads, dairy (milk, prebiotics and probiotics), fruit and vegetables, spices and cereal products are some product categories in which consumers all over the world have a wide array of functional foods to choose from. The IFIC (2017) found that fruits and vegetables were the top functional foods category identified by consumers during a survey on _Consumer Attitudes Toward Functional Foods/Foods for Health' confirming that, the first thought that comes in mind when the term is mentioned is basically fruits and vegetables.

Functional food however does not only include fruits and vegetables but other staple food crops, edible herbs as well as processed food products. According to Dhanvijay (2013), functional foods groups may include roots and tubers; (onion, garlic and carrots), fruits; (tomato, lemon and guava), green leafy vegetables; (all green leafy vegetables), legumes: (soybean, sprouts, condiments and spices); and fermented or probiotic food; (curd, yoghurt and cheese) thus there exists not a single acceptable categorization of functional food.

Martijn and Nicole (2014) reported that, functional foods may include —those products created just so that they can be marketed using health claims. Thus it is likely to find a functional food product marketed under a health claim such as —cholesterol free, —good for the heart among other health claims. A food may also be made functional to play beneficial role in the body (Hasler, 2010). Roberfroid (2010a) explained that a food may be made functional by any of the processes below;

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 Eliminating a component known to cause or identified as causing a deleterious effect when consumed

 Increasing the concentration of a component naturally present in food to a point at which it will induce predicted effects (for example, fortification with a micronutrient to reach a daily intake).

 Adding a component which normally is not present in most foods; not necessarily functioning as a macronutrient or micronutrient but have been found through research to have some beneficial effects (for example, non-vitamin antioxidant or prebiotic fructans).

 Replacing a component, usually a macronutrient (example fats), whose intake is usually excessive and thus causes deleterious effects to the human system when consumed, with one for which beneficial effects have been shown (example chicory inulin such as Rafti cream).

 Increasing bioavailability or stability of a component known to produce a functional effect or to reduce the disease-risk potential of the food.

### 2.1.3 Functional foods, general wellbeing and health

Functional food and products according to Hearsman and Mellentin (2011) and Frewer *et al.* (2013) have been found to provide an added health benefit over and above their traditional counterparts especially their nutritional value. Today foods are not intended to only satisfy hunger and to provide necessary nutrients for humans but also to prevent nutrition-related diseases and improve physical and mental well-being of the consumers (Menrad, 2013). The main consumer motive for purchasing functional foods is the growing desire to use foods either to help prevent chronic illnesses such as cardiovascular disease, Alzheimer‘s disease and osteoporosis, or to optimize health, for

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example by increasing energy, boosting the immune system and generation of wellbeing.

Consumers continue to have increased believe that foods contribute directly to their health (Mollet and Rowland, 2012). According to the World Health Organization (WHO) 2004 reports, diet is widely sanctioned by the scientific community as a modifiable factor that could be used to restrain the escalating health care costs associated with non communicable degenerative diseases along with weight control and physical activities. According to Perkins-Veazie *et al.,* (2012), many countries have enormously been burdened health- wise with chronic diseases such as cancer, cardiovascular disease, obesity and diabetes.

The role of diet and nutrition as determinants of chronic diseases has been well recognized and established (CDCP, 2014). Chronic inflammation, which can include radical (pro-oxidant) formation, and cytokine production, is often an underlying cause of these diseases (WHO, 2014). Diet has been proposed to appear to play a large role in development and severity of these diseases, through generation of free radicals, up regulation of transcriptor molecules, and overproduction of cytokines (Kundu and Surh, 2018).

Health costs and decreased quality of life associated with chronic diseases have driven interest in the use of healthy diet targeted for specific problems. Emerging results indicate that fruits and vegetables for instance can work at numerous levels, including prevention of lipid oxidation, squelching of free radicals, and altering hormonal release (Roberfroid, 2010). Arvanitoyannis and Houwelingen-Koukaliaroglou (2015) also added that the increasing demand on healthy foods can be explained by the increasing cost of healthcare, the steady increase in life expectancy, and the desire of older people for improved quality of their later years.

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Fruits and vegetable, the most common functional food across the world also present an opportunity for the increase usage of food with health benefits. Fruits for instance contain glucose, fructose, sucrose and fiber, and are mostly relatively low in calories. In addition, fruits are important sources of at least eight additional nutrients, including vitamin C, folate, and potassium (which may help control blood pressure). Many vegetables provide only small amounts of sugars and/or starch and they all provide fiber.

According to Roberfroid (2010) and Hornick and Weiss (2011), vegetables are also important sources of 19 or more nutrients, including potassium, folate, and vitamins A and E and may provide antioxidant effect to the body. There is a belief that adults who increase their fruit and vegetable consumption in adequate quantities are associated with a decreased risk of chronic diseases as stroke and perhaps other cardiovascular diseases; (type 2 diabetes and cancers in certain sites) (Dhanvijay, 2013). Fruits and vegetables may also be useful in achieving and sustaining weight loss.

A report by Hill and Peters (2012) also suggested that diet, for that matter functional foods clearly play an important role in the prevention, development and management of obesity and diabetes especially type 2diabetes. Spices also constitute an important part of human nutrition and have played a role in all cultures of the world. Viuda-Martos *et al.* (2010) reported on the role spices play to impart flavour and reduce the need for salt and fatty condiments, improve digestion, and provide the organism with extra antioxidants that prevent the appearance of physiological and metabolic alterations. Thus spices as a category of food also play functional roles in the body and are highly importance in the consumers‘ diet in the attainment of optimum health.

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## 2.2 Origin of Solanum Torvum

The *Solanum torvum* (Solanaceae) plant, a common plant is geographically traced from Florida through southern Alabama and West Indies thus Mexico through Central and South America through Brazil. The plant is also found in numerous tropical nations in Africa (Little et al., 2014). It is additionally found in a few sections of Asia. With just a modest number in the calm zones, there are around 2000 types of *Solanum* on the planet that are for the most part appropriated in the tropical and sub-tropical regions (Jennifer et al., 2007). It is a little Solanaceous bush appropriated generally in Pakistan, India, Malaya, China, Philippines, and tropical America (Nasir, 2015) and has around 21 species and one assortment in this sort is utilized for home grown drug (Hu et al., 2009).

Pharmacological investigations show that the stem and foundation of S. *torvum* have hostile to tumor, against viral, hostile to bacterial, mitigating, and other restoratively crucial impacts. Among the major chemical components of *S. torvum* are steroids, steroid saponins, steroid alkaloids, and phenols. In Ghana, the *solanum torvum* is acquired from various forest zones especially in the Ashanti, Brong-Ahafo, and certain parts of central region and also in the backyards of most homes. *Solanum torvum* was widely naturalized in the hotter beach front areas in north and east of Australia (Batianoff and Butler, 2012). It was perhaps at the same time naturalized in the beach front areas northern New South Wales and in Tropical Africa, Asia and southeastern America (Cowie and Kerrigan, 2007).

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### 2.2.1 The S*olanum Torvum P*lant

*Solanum torvum* grows as a short (about 2-4 m tall), erect shrub with lots of branches and into large thorny impermeable undergrowth (Mohan & Bhandare 2012). The fruits of *Solanum torvum* are groups of little green berries (around 1 cm in breadth) that end up noticeably yellow when completely developed. The fruits come in various levels of thin skins, rounded in shape with darker seeds (Little *et al*., 2014; Howard 2009; Liogier 2015). *Solanum torvum* grows every year in height around 0.75-1.5m. The plant may be killed by within two years by bushes at which stage pruning wouldn't even help it survive (IPIF, 2007).

According to (Little *et al*, 2014), the *solanum torvum* plant is usually 2 or 3m in height and 2cm in basal diameter, but may reach 5m in height and 8cm in basal diameter. The shrub usually has a single stem at ground level, but it may branch on the lower stem. The stem bark is gray and nearly smooth with raised lenticels. The inner bark has a green layer over an Ivory color while the roots are white. According to Tu Forest and Kim Starr, Starr Environmental, turkey berry is a broadleaved, evergreen shrub that can grow to about 16 ft. (4.9 m) in height. The stems are armed with stout, straight, or lightly curved prickles (Van Brakel, 2008).

According to the USDA (2007), the more youthful stems are green or purplish in shading and now and then meagerly canvassed in thistles of about 3-7mm. More established stems end up plainly darker or greenish-dark colored and in the long run lose their covering of hairs. The similarly huge, on the other hand orchestrated leaves are usually borne on stalks of 1 - 5 cm long and the leaves are extensively egg-molded in layout (i.e. applaud) or practically adjusted fit as a fiddle with whole to shallowly-lobed edges. In any case, the leaves of more youthful plants might be all the more profoundly lobed (i.e. pinnatisect).

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Whenever exhibited, the tips leaf and flaps might be pointed or adjusted and that of grown-up plants don't have any prickles. The seedlings and youthful plants may have some little prickles on their upper surfaces. More so the surface and whitish undersides, are shrouded in star-molded hairs. Likewise, the little, white blossoms happen in huge, spread groups. Plants bloom ceaselessly in the wake of achieving a stature of 3.3 to 4.9 ft. (1 to 1.5 m).

The flowers of the plant sprout in bunches on a single stalk of about 2-17mm long holding about 15-100 flowers on a single stalk with about five white petals (9-12 mm long), combined at the base with green sepals of about 2.5-6 mm. As indicated by Bostock and Holland (2007), the plant is viewed as ecological weed in Queensland, and lately recorded as a need ecological weed in no less than one Natural Resource Management locale.

### 2.2.2 Varieties

There are other species which belong to the genus Solanum, and they are, *Solanum ficifolium*, *Solanum ferrugineumgiant*, *Solanum chrysotrichum, Solanum lycocarpum, Solanum grandiflorum, Solanum bahamense* of Carl Linnaeus (as var. *persicifolium*) *Solanum chrysotrichum* of von Schlechtendal (as var. *pleiotomum*) *Solanum ferrugineum* (as var. *ferrugineum*, var. *hartwegianum*) *Solanum lanceolatum* of Cavanilles (as var. *schiedeanum*) *Solanum macaonense* (as var. *lasiostylum*), *Solanum rudepannum* (as var. *fructipendulum*, var. *ochraceo-ferrugineum*), *Solanum scuticum* (as ssp./var. *brasiliense*, var. *daturifolium*, var. *genuinum*) (Langeland and Burks, 2008).

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## 2.3 Turkey Berry as a vegetable

According to Arthan, et al (2012), 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 2012). 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, 2007).

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

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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 betacarotene, calcium, iron and vitamin C. Green vegetables are also a source of minerals such as zinc, iron and potassium. In Willett (2015) and Liu (2013), 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.

## 2.4 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, 2009**).** 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.

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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, 2008), 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. (2013) 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 al., 2007).

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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., *2009*; Shackleton, 2013; 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 periurban vegetable

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production in most Sub Sahara African (SSA) cities has turned to the production of exotic crops and varieties.

## 2.5 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, 2015). 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., 2014).

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 (2015), 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.

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## 2.6 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., 2011). 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., *20*12). 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, 2007).

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., *20*10; Zamede et al., 2011). Guerreroet al. (2008) 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 (2013) 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 (2012) and Freyre et al. (2010) 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. (2008) and Vainio-Mattila (2010) in Tanzania underscored the wild plants' significant contribution as sources of micronutrients.

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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., *2008*). 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, 2017).

### 2.6.1 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 nondomesticated 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 micronutrients but through danger of domesticated crop destruction by drought or insect pests (Ogle & Grivetti, 2015). 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, 2014). Turkey berry for example, suffers relatively few diseases and pests, is tolerant to soil moisture stress and has excellent storage qualities (Barbeau & Hilu,

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2013). 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, 2008).

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, 2013). Carr (2008), 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, 2017).

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., *2007*). 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 sources.

This change has led to substantial losses in knowledge about edible wild resources. Rapid economic and technological development may further contribute to a decline in

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the customary use of indigenous dietary resources. When this occurs, lost is both the knowledge and skills of recognition and identification of climatically adapted food resources that have previously sustained societies (Ogle & Grivetti, 2015).

## 2.7 Medicinal and Nutritional benefits of Turkey berry

In Ghana and many other countries, the fruits and leaves are used for food and many traditional medical practices respectively (Adjanohoun *et al.*, 2016). *Solanum torvum* are utilized as a part of conventional drug as tonic and haemopoietic operators and for the treatment of torments. Generally, in the North-West Province of Cameroon, the juice of natural product is utilized for the treatment of jigger wounds, abscesses, skin contaminations, for example, ringworm and competitor's foot in man and dermatophilosis in creatures (Siemonsma & Piluek, 2014).

Research shows that the natural products contain phytoconstituents, for example, steroid glycosides and saponins, settled oil; vitamin B gathering; vitamin C; press salts: saponins and steroidal alkaloids. In Ghana, a few sections of the plant have been utilized either as a haemostatic after labor or as a wellspring of saponin for the hemi union of cortisone and sex hormones or for exacerbating tranquilizers, diuretics or stomach related tonics. Its organic products are utilized as a part of the treatment of weakness, wounds, snakebites, inciting lactation, and as hors d'oeuvres though the leaves are utilized as a part of the treatment of stomach torment, whitlow, colds and whooping hack.

It has pain relieving and calming (Ndebia *et al*., 2007), antimicrobial (Ajaiyeoba, 2009; Chah *et al*., 2010), antiviral (Arthan *et al*., 2012), antiulcer (Nguelefack *et al*., 2008a), immuno-secretory (Israf *et al*., 2014), anti-oxidant (Sivapriya and Srinivas, 2007), cardiovascular and anti-platelet aggregation properties. *S. torvum* contains a

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number of pharmacologically active chemicals like isoflavonoid sulfate and steroidal glycosides (Yahara *et al*., 2016; Arthan *et al*., 2012). For a long time, diverse ethnic gatherings have utilized the dried stem and foundation of this plant for treatment of different illnesses.

Its Chinese therapeutic name is Jinniukou. As indicated by Chah *et al*. (2010), the methanol concentrate of S. *torvum* natural product exhibited intriguing development restraining action against microscopic organisms generally connected with pyogenic contaminations. The watched exercises may offer a help for a portion of the employments of the organic product squeeze in ethnomedicine.

Diabetes mellitus is a standout amongst the most genuine unending infections around the world. It is caused by ceaseless hyperglycemia and creates alongside increments in stoutness and maturing in the general populace. (Lord *et al*., 2008). One of the therapeutic methods to decreasing postprandial hyperglycemia is to retard the absorption of glucose by the inhibition of carbohydrate hydrolyzing enzymes -amylase and glucosidase in the digestive organs. The fruit of *Solanum torvum* is an inhibitor of sucrose and maltase. Screening experiments for rat intestinal glucosidase (sucrose and maltase) inhibitors in 325 plants cultivated in Japan's southern island, Tanegashima, marked reserve against both sucrose and maltase in the extract of the fruit of *Solanum torvum*.

Yahara *et al*. (2016) indicates that *solanum torvum* fruits are moderate inhibitors against glucosidase which provides a prospect for anti-diabetics. In any case, S. torvum displayed some level of cell reinforcement action and DNA repair ability on oxidative DNA harm caused by free radicals (Abas *et al*., 2016). In a distributed novel, protein was disconnected from the water concentrate of S. *torvum* seed and that ended up being successful cell reinforcement, even at low measurement, when contrasted with

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prestigious standard manufactured cancer prevention agents (Sivapriya and Srinivas, 2007).

Be that as it may, fluid concentrate of S. *torvum* uncovers intense calming and pain relieving properties (Ndebia *et al*., 2007). In Ghana, the leaves are utilized to treat frosty; the natural products are utilized to upgrade the hemoglobin in pregnant ladies, lactating moms and people experiencing sickness.

### 2.8 Nutritional Composition of S*olanum Torvum*

*Solanum torvum* is composed of the following vital minerals and nutrients which are very supportive in curing and averting diseases. Vitamin A, Iron (24.5 mg), Calcium (0.28 mg), Fat (1.7 mg), Fiber (56.9 mg). According to Akoto *et al.* (2015), the fruits of *Solanum torvum* possess very high moisture content (86.230%), carbohydrates 7.033%, proteins 2.322%, fats 0.278%, ash 0.143% and crude fiber 3.993%. They also did an analysis for essential metal contents and had following outcomes; iron 76.869mg/kg, manganese 19.466 mg/kg, calcium 221.583 mg/kg, copper 2.642mg/kg and zinc 21.460mg/kg.

In the determination of the vitamins, it contains 0.078mg/100g and 2.686 mg/100g for vitamins A and C respectively. There was similar study conducted in India where proximate composition analysis revealed a lower moisture percentage (80.5 %) but much higher ash content (12.3 %). Iron, copper and manganese were found to be below 0.5 µg/mL (which is equivalent to mg/kg or ppm). Calcium was the most predominant mineral as well in that study (Bhagyashree *et al*., 2012).

Prior to the recent sale of packaged Turkey berry in stores and malls, Ghanaians consumed turkey berry as a vegetable for its nutritional properties and not necessarily for its medicinal properties as is being promoted now. Turkey berry is an ancient herb

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used in many Ayurvedic treatments. It has sedative, diuretic and digestive properties, stimulating regular bowel movement and killing harmful bacteria in the stomach and intestines. Turkey berry is also used worldwide to treat various ailments like piles, asthma, chest phlegm, tuberculosis and severe cough. Cook et al. (2007), reports that asthmatic children in Britain who consumed vegetables and fruits more than once a day had better lung function.

The higher intake of vegetables and fruits seemed to increase the ventilation function of the lungs. A powder made out of dried heated Turkey berry mixed with little oil is used in treating people who cough or habour excessive mucus in their respiratory track (Royal Horticultural Society, 2011). Asiedu-Addo (2014) reports the use of turkey berry in soups, sauces and stews by Ghanaian consumers. This report also highlights the use of Turkey berry in healing night blindness when roasted and mixed with food grains such as millets. Kannan et al. (2012) reports of antibacterial properties of the berry and its potential to remove bacterial infestations in the intestine, and take care of regular bowel movement. The green fresh fruits are edible and used by Ghanaian women in preparing palm nut soup and "kontomire" stew (Royal Horticultural Society, 2011).

Similar uses of the berry have been reported in other West African countries such as Ivory Coast where the fruits are also incorporated into soups and sauces (Gautier-Béuin, 2011). In parts of Asia, specifically India, the berry is consumed either raw or cooked. It is usually soaked in curd, dried and fried to make sundaikkai vattral which is known to improve digestion. Vegetables do impart their own characteristic flavour, colour, and texture to diets and undergo changes during storage and cooking.

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## 2.9 Chemical Constituents of Turkey Berry

Phytochemical screening of methanolic extract of sun dried Turkey berry (Turkey berry) tested positive for alkaloids, flavonoids, saponins, tannins, glycosides, fixed oil, vitamin B group, vitamin C and iron salts (George, Patrick & Terrick, 2011). They further report a number of chemical constituents like neochlorogenin 6-O-β-D-quinovo pyranoside, neochlorogenin 6-O-β-D-xylopyranosyl-(1→3)-β-D quinovopyranoside, neochlorogenin6-O-α-L-rhamnopyranosyl-(1→3)-β-Dquinovopyranoside,sola-genin6-O-β Dquinovopyranoside, solagenin6-O-α-Lrhamnopyranosyl-(1→3)-β-Dquinovopyranoside, isoque-rcetin, rutin, kaempferol and quercetin. Other studies report that the flavonoid content of Turkey berry is mainly responsible for its antioxidant, antihypertensive, metabolic correction and nephro protective activities.

### 2.9.1 The Percent Daily Value (%DV) of Nutrients

There are two sets of reference values for reporting nutrients in nutrition labeling: 1) Daily Reference Values (DRVs) and 2) Reference Daily Intakes (RDIs). These values assist consumers in interpreting information about the amount of a nutrient that is present in a food and in comparing nutritional values of food products. The daily values for the required nutrients are shown in Table 1 below. DRVs are established for adults and children four or more years of age, as are RDIs, with the exception of protein.

DRVs are provided for total fat, saturated fat, cholesterol, total carbohydrate, dietary fibre, sodium, potassium, and protein. RDIs are provided for vitamins and minerals and for protein for children less than four years of age and for pregnant and lactating women. In order to limit consumer confusion, however, the label includes a single term (i.e., Daily Value (DV)), to designate both the DRVs and RDIs. The Food and Drug Administration, USA, has not set a Daily Value for trans-fat, and health

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experts recommend/ avoiding trans-fat to lower the risk of cardiovascular disease. Similarly, there is no established DV for sugar because there is no recommended amount of sugar for a healthy population.

**Table 2.1: The Daily Values of Nutrients**

| **Food Component** | **DV** |
|---|---|
| Total Fat | 65 (g) |
| Saturated Fat | 20 g |
| Cholesterol | 300 (mg) |
| Sodium | 2,400 mg |
| Potassium | 3,500 mg |
| Total Carbohydrate | 300 g |
| Dietary Fiber | 25 g |
| Protein | 50 g |
| Calcium | 1,000 mg |
| Iron | 18 mg |
| Iodine | 150 µg |
| Magnesium | 400 mg |
| Zinc | 15 mg |
| Copper | 2 mg |
| Manganese | 2 mg |

Source: USA FDA (2013)

The Percent Daily Value (% DV) of foods is a guide to the nutrients in one serving of food. It is calculated by dividing the amount of the nutrient contained in the serving size of a food product by its Daily Value and then multiplying that number by 100. For

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example, if a food product has 3 mg of iron and the Daily Value for iron is 18 mg, the % DV for iron would be 16%, that is, (3 mg ÷ 18 mg) × 100 = 16% DV. Likewise, if a food contains 15% of calcium, it means that one serving provides 15 percent of the calcium needed each day. The Percent Daily Values are based on a 2,000-calorie diet for healthy adults.

The % DV shows the specific amount of nutrient a food contains (whether a little or a lot). For example, it helps in determining whether a food is high or low in specific nutrients: If a food has 5% or less of a nutrient, it is considered to be low in that nutrient. If it has 20% or more, it is considered to be high in that nutrient. The % DV is not meant to track total nutrient intake for the day. This is because some of the foods eaten (like vegetables, fruit, and fresh meat) do not have a Nutrition Facts table. To get the most benefit from Percent Daily Values, one has to use it to choose foods that are higher in the nutrients that must be consumed more, that is vitamins, minerals and fiber and to limit foods high in fat, cholesterol and sodium (Zeratsky, 2013).

It is also used to compare two different food products to make healthier food choices. The % DV column on the Nutrition Facts table does not add up to 100%. Each nutrient in the Nutrition Facts table has its own Daily Value. The Daily Values for nutrients are based on the highest recommended intakes. They apply to most people ages 2 and over, but do not include extra nutrient needs for women who are pregnant or breastfeeding.

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## 2.10 Conclusion

Turkey berry consumed mainly by the people in southern part of Ghana. There are a number of pharmacological and health benefits associated with turkey berries. Despite the recognition and consumption of turkey berries in Ghana there is limited literature on the nutritional value of it. It is believed to boost haemoglobin levels. Turkey berries contain phytochemicals like steroids, polyphenols, tannin, phytic acids, anti-inflammatory substances, antioxidants that render its potency of curing diseases like cough and cold, asthma, anaemia, cancer diabetes etc. There is some documentation on the use of wild foods as medicine and as food in Africa.

These plants are good sources of protein, essential amino acids, essential fatty acids such as linoleic and linolenic acids and micronutrients such as iron and zinc.Several of these indigenous vegetables continue to be used for prophylactic and therapeutic purposes by rural communities. Indigenous knowledge of the health promoting and protecting attributes of African Vegetables (AVs) is clearly linked to their nutritional and non-nutrient phytochemical properties. Despite the recognition of African vegetables to be beneficial to human health, dietary utilization of non-domesticated plants has received very little attention in economic development efforts. Attention is given to 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.

In order to ascertain how much nutrients are in a particular food being eaten a number of dietary references are used. One of such dietary reference is the % DV which indicates the percentage of nutrient in a particular portion size of a food in relation to the daily nutrient requirement. This helps in deciding on which nutrients are more or

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less in a particular food in order to combine and eat variety of dishes to meet the nutritional requirement. Having nutritional knowledge is essential in choosing and eating right.

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# CHAPTER THREE

# METHODOLOGY

## 3.0 Introduction

This chapter would deal with the methods used to obtain information for the study. These include research design, population, sampling technique and sampling size, data collection instruments, data analysis, and ethical consideration.

## 3.1 Research Design

The researcher used descriptive survey design to collect quantitative data for the study. According to Pilot and Hungler (1995), a descriptive survey aims primarily at describing, observing and documenting aspects of a situation as it occurs rather than explaining them. A descriptive survey involves asking a large number of individuals the same set of questions either by mail, telephone or in person. It is appropriate when a researcher attempts to describe some aspects of a population by selecting unbiased samples who are asked to complete questionnaires, interviews and tests. Gay (1992) stated that, a descriptive survey method is useful for investigating a variety of educational problems including assessment of attitudes, opinions, demographic information, conditions and procedures. Descriptive data are usually collected through questionnaires. Information would be gathered from vegetables and spice sellers, and consumers of turkey berries in the Tema Metropolis. Osuala (1987) also stated that descriptive surveys interpret, synthesize, and put together data, point to implications and relationships.

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### 3.2 Population

According to Kusi (2012), population is a group of individuals or people with the same characteristics and in whom the researcher is interested. It may also be described as the study of a large group of interest for which a research is relevant and applicable.

The target population of the study was some selected vegetable sellers, spices and turkey berry consumers in the Tema Metropolis. In all the entire population of sellers in the selected area would be ninety-seven (97).

### 3.3 Sampling Technique and Sample size

The census sampling technique would be used to select all the ninety seven (97) participants for the study. Census method refers to the complete enumeration of a universe. A universe may be a place, a group of people or a specific locality through which we collect the data. Census method is necessary in some cases like population census, for gaining vast knowledge. But in contrary this & method is not applicable as well as needed to some social problems because it is costly and time consuming. It is difficult to study the whole universe because financially aid requires for it to complete the study.

For this purpose, we use sampling method to pick up a simple from the whole universe. Census method is perplexing and take more time in data collection. The researcher would use census method because data collection through census method gives opportunity to the investigator to have an intensive study about a problem study about a problem. The investigator gathers a lot of knowledge through this method. In this method there would be higher degree of accuracy in data.

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### 3.4 Data collection Instruments

Data would be collected using a structured written questionnaire and interview guide as instruments in gathering information for the study.

#### 3.4.1 Questionnaire

Questionnaire was designed and personally distributed by the researcher. Primary data would be collected by the use of close and open ended questionnaires. This is because it has been proven to be reliable in data collection. Questionnaires would be designed for the consumers of turkey berries in the Tema Community 5. The questionnaires would cover items which would help the researcher to get information regarding the evaluation of the nutritional benefits of consuming turkey berries.

Structured questionnaire would be used and the importance of it was to make discussion and analysis of the information given by the respondents easier. The structured questionnaires would be put into four main sections. The section 'A' of the questions centered on the background information of respondents. Some of the items included age, sex and educational level among others. Section 2 of the questionnaire would examine the perceptions of caterers on the food and nutritional value of turkey berries. Section 3 would examine the specific meals which make use of turkey berries as a spice. The analysis of the study would be based on the above mentioned issues. Questionnaire would be used for data collection because it is not affected by problems of no-contacts and its uniformity in questions as well as greater assurance of it anonymity.

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### 3.5 Data Analysis

The data would be organized into tables and figures based on the questionnaire given to respondents. The result would then be analyzed and converted into percentages. Quantitative and qualitative methods would be employed in the analysis of the data. The result would be subsequently computed into percentages. Percentage (%) values, which were not round figures, would be approximated to the nearest whole numbers. Diagrammatic representations of the statistical summaries of the result will be presented in the form of frequency tables.

Computer data analysis such as SPSS and other relevant software such as Microsoft excel would be the main tools employed to analyse the data in order to help interpret results. The statistical package for social scientist (SPSS version 20) would also be used to analyze the pre-coded questions. This packaged would be used to compute the percentages because it is easier to use. It can also be used to make tables needed for discussions of the results. The other questions that were open-ended would be analyzed by listing all the vital responses given by the respondents. They would be considered based on their relevance to the research.

### 3.6 Ethical consideration

For ethical reasons the researcher negotiated with participants for their voluntary participation. Permission would be sought from the turkey berry consumers and vegetable/spice sellers to undertake the research. The respondents would be informed of the purpose of the research to seek the consent to participate in the research process. The respondents would be assured that the use of the response were for academic purposes only. In particular, the researcher would assure them that:

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1. All information collected will be purely for study purposes and would be strictly confidential;

2. All information used in the dissertation would be checked for accuracy;

3. All audiotapes and notes of interviews would be destroyed at the end of the research;

4. Names of the respondents (turkey berry consumers and vegetable/spice sellers) would not be revealed.

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# CHAPTER FOUR

# RESULTS AND DISCUSSIONS

## 4.0 Introduction

The main objective of the study is to assess the health benefits turkey berries consumption in Ghana- case study of community 5 a suburb of Tema metropolis. The following specific objectives were used for the study including to; examine the perceptions of caterers on the food and nutritional value of turkey berries. Secondly, examine the specific meals which make use of turkey berries as a spice and thirdly, identify the reasons why turkey berries are not cultivated for commercial purposes.

The researcher administered 97 questionnaires to the consumers of turkey berries, out of the 89 questionnaires were properly answered and returned, while 8 questionnaires were not returned. Therefore, the analysis of the study was based 92% response rate.

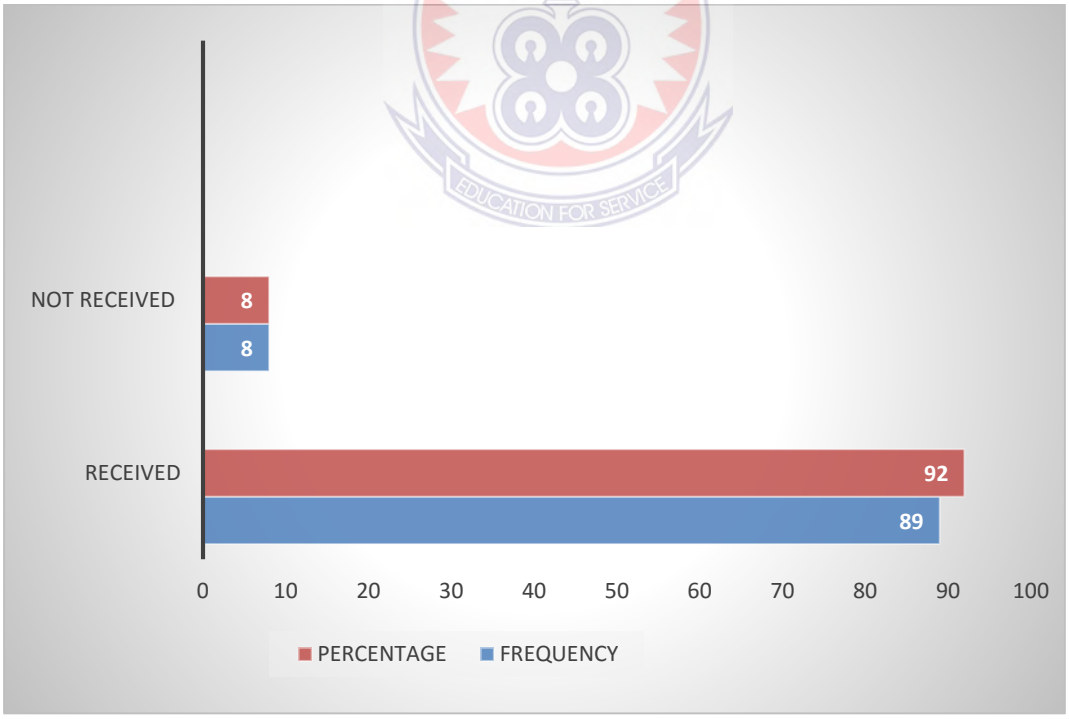


**Figure 4.1: Response rate of the questionnaires**

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**Table 4.1: Demographic information of the respondents**

| **Gender** | **Frequency** | **Percent (%)** |
|---|---|---|
| Male | 25 | 28.1 |
| Female | 64 | 71.9 |
| Total | 89 | 100 |
| Age category of respondents | | |
| 19-25 years | 26 | 29.2 |
| 26-35 years | 21 | 23.6 |
| 36-45 years | 22 | 24.7 |
| 46-55 years | 8 | 9 |
| Above 56 years | 12 | 13.5 |
| Total | 89 | 100 |
| Educational level attained. | | |
| Basic school | 42 | 47.2 |
| Senior High School/Vocational | 35 | 39.3 |
| Tertiary | 12 | 13.5 |
| Total | 89 | 100 |
| Marital status | | |
| Single | 21 | 23.6 |
| Divorced | 25 | 28.1 |
| Married | 43 | 48.3 |
| Total | 89 | 100 |

**Source: Field survey, 2019, N= 89**

Table 4.1 shows that the majority (71.9%) were males while 25 respondents representing 28.1% were males. Moreover, 26 respondents representing 29.2% were

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between the age category 19-25 years, 22 respondents representing 24.7% were between the age ranges 36-45 years, 21 respondents representing 23.6% were between the age ranges 26-35 years, 12 respondents representing 13.5% were above 56 years, while 8 respondents representing 9% were between the age ranges 46-55 years.

Furthermore, 42 respondents representing 47.2% possess Basic school certificates, 35 respondents representing 39.3% hold Senior High School/Vocational certificates, while 12 respondents representing 13.5% have tertiary education. Also, 43 respondents representing 48.3% indicated that they were married, 25 respondents representing 28.1% were divorced, while 21 respondents representing 23.6% were single.

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## 4.1 Analysis of Results

### 4.1.1 The perceptions of caterers on the food and nutritional value of turkey berries.

Table 4.2 assessed the perceptions of caterers on the food and nutritional value of turkey berries.

**Table 4.2 Perceptions of caterers on the food and nutritional value of turkey**

| *Statement(s)* | *1* *n(%)* | *2* *n(%)* | *3* *n(%)* | *4* *n(%)* | *5* *n(%)* | *M* *X* | *SD* |
|---|---|---|---|---|---|---|---|
| Turkey berries are eaten, although some individuals pick the leaves, boil and drink. | 9 (10.1) | 8 (9) | 6 (6.7) | 59 (66.3) | 7 (7.9) | 4.81 | 0.65 |
| 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. | 4 (4.5) | 4 (4.5) | 4 (4.5) | 67 (75.3) | 10 (11.2) | 4.76 | 0.69 |
| The use of turkey berry as vegetable in dishes may provide some nutrients derived from vegetables in general. | 6 (6.7) | 6 (6.7) | 5 (5.6) | 57 (64) | 15 (16.9) | 4.73 | 0.73 |
| 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. | 9 (10.1) | 6 (6.7) | 4 (4.5) | 55 (61.8) | 15 (16.9) | 4.65 | 0.76 |

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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Turkey berries tend to reduce the glycemic load when eaten with high-energy foods like bread and polished rice making it ideal for weight loss. | 4 (4.5) | 4 (4.5) | 2 (2.2) | 69 (77.5) | 10 (11.2) | 4.52 | 0.79 |
| Knowledge of the health promoting and protecting attributes of some vegetables is clearly linked to their nutritional and non-nutrient bioactive properties. | 7 (7.9) | 5 (5.6) | 4 (4.5) | 65 (73) | 8 (9) | 4.43 | 0.82 |
| 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. | 4 (4.5) | 12 (13.5) | 3 (3.4) | 56 (62.9) | 14 (15.7) | 4.41 | 0.86 |
| Green vegetables are also a source of minerals such as zinc, iron and potassium. | 9 (10.1) | 6 (6.7) | 4 (4.5) | 59 (66.3) | 11 (12.4) | 4.37 | 0.89 |
| Turkey berries contain phytochemical, antibacterial and antioxidant properties of Turkey berry. | 4 (4.5) | 5 (5.6) | 2 (2.2) | 70 (78.7) | 8 (9) | 4.35 | 0.94 |
| 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. | 4 (4.5) | 6 (6.7) | 4 (4.5) | 54 (60.7) | 21 (23.6) | 4.32 | 0.96 |

Keys: 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4= Agree, 5=Strongly Agree

Source: Field survey, 2019, N= 89

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Table 4.2 shows that 59 respondents representing 66.3% agreed that turkey berries are eaten, although some individuals pick the leaves, boil and drink, 9 respondents representing 10.1% strongly disagreed, 8 respondents representing 9% disagreed, 7 respondents representing 7.9% strongly agreed while 6 respondents representing 6.7% were neutral (mean score of 4.81, SD - 0.65).

Moreover, 67 respondents representing 75.3% agreed that 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, 10 respondents representing 11.2% strongly agreed, while 4 respondents representing 4.5% strongly disagreed, disagreed and were neutral respectively (mean score of 4.76, SD - 0.69). These plants are good sources of protein, essential amino acids, essential fatty acids such as linoleic and linolenic acids and micronutrients such as iron and zinc. Several of these indigenous vegetables continue to be used for prophylactic and therapeutic purposes by rural communities. 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., *2007*).

Also, 57 respondents representing 64% agreed that the use of turkey berry as vegetable in dishes may provide some nutrients derived from vegetables in general, 15 respondents representing 16.9% strongly agreed, 6 respondents representing 6.7% strongly disagreed and disagreed respectively, while 5 respondents representing 5.6% were neutral (mean score of 4.73, SD - 0.73). Furthermore, 55 respondents representing 61.8% agreed that 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,

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development and maintenance, and general good health, 15 respondents representing 16.9% strongly agreed, 9 respondents representing 10.1% strongly disagreed, 6 respondents representing 6.7% disagreed while 4 respondents representing 4.5% were neutral (mean score of 4.65, SD - 0.76). 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 sources. This change has led to substantial losses in knowledge about edible wild resources. Rapid economic and technological development may further contribute to a decline in the customary use of indigenous dietary resources. When this occurs, lost is both the knowledge and skills of recognition and identification of climatically adapted food resources that have previously sustained societies (Ogle & Grivetti, 2015).

Moreover, 69 respondents representing 77.5% agreed that turkey berries tend to reduce the glycemic load when eaten with high-energy foods like bread and polished rice making it ideal for weight loss, 10 respondents representing 11.2% strongly agreed, 4 respondents representing 4.5% strongly disagreed and disagreed respectively, while 2 respondents representing 2.2% were neutral (mean score of 4.52, SD - 0.79). 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.

Also, 65 respondents representing 73% agreed that knowledge of the health promoting and protecting attributes of some vegetables is clearly linked to their nutritional and non-nutrient bioactive properties, 8 respondents representing 9% strongly agreed, 7 respondents representing 7.9% strongly disagreed, 5 respondents

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representing 5.6% disagreed, while 4 respondents representing 4.5% were neutral (mean score of 4.43, SD - 0.82).

The study results indicate that 56 respondents representing 62.9% agreed that 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, 14 respondents representing 15.7% agreed, 12 respondents representing 13.5% disagreed, 4 respondents representing 4.5% strongly disagreed, while 3 respondents representing 3.4% were neutral (mean score of 4.41, SD - 0.86).

Moreover, 59 respondents representing 66.3% agreed that green vegetables are also a source of minerals such as zinc, iron and potassium, 11 respondents representing 12.4% strongly agreed, 9 respondents representing 10.1% strongly disagreed, 6 respondents representing 6.7% disagreed, while 4 respondents representing 4.5% were neutral (mean score of 4.37, SD - 0.89). Consumption of turkey berries is recommended for people who want to put on weight more especially the extract from the leaves. The anti-inflammatory property of the turkey berries together with the soasoline availability make the consumption of turkey berries a pain reliever since it combats pains such as arthritis, back pain, swelling etc. The consumption of turkey berries is recommended for flushing our uric acid that help to prevent or minimize pain, redness and symptoms of gout. Adequate consumption of turkey berries is good for our women since it helps in regulations of menstruation without pain. The consumption of turkey berries is very much recommended for promotion of healthy cardiovascular system since it antioxidants contents combat stroke, cancer and other related heart diseases. People with high blood pressure should make it a habitat of using the turkey berries.

The consumption of Turkey berries is good for prevention and treatment of kidney diseases. Therefore, people would consume turkey berries to promote and maintain

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healthy kidney. Turkey berries is good for combating respiratory discomfort. It enabled the system get rid of mucus and phlegm, subdue coughing and lungs inflammation. The iron abound in turkey berries makes it good for the treatment of anemia. The intake of turkey berries is good for the treatment indigestion, and stomachaches. The ability of turkey berries to neutralize acid in stomach makes it recommendable for the healing of gastric ulcer. The regular consumption of turkey berries helps prevent worm infestation in the intestine. The regular consumption of turkey berries lowers sugar level in the blood which makes it good for fighting diabetes.

Also, 70 respondents representing 78.7% agreed that turkey berries contain phytochemical, antibacterial and antioxidant properties of Turkey berry, 8 respondents representing 9% strongly agreed, 5 respondents representing 5.6% disagreed, 4 respondents representing 4.5% strongly disagreed, while 2 respondents representing 2.2% were neutral (mean score of 4.35, SD - 0.94). The use of turkey berries is good for preventing and healing colds and flu. The consumption of turkey berries is important for promoting a healthy skin. The use of turkey berries is recommendable for treatment of Asthma. Due to the anti-bacterial, anti-fungal properties as well as stops the abnormal growth of cells, turkey berries is good for combat of cancer.

Moreover, 54 respondents representing 60.7% agreed that 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, 21 respondents representing 23.6% strongly agreed, 6 respondents representing 6.7% disagreed, while 4 respondents representing 4.5% strongly disagreed and were neutral respectively (mean score of 4.32, SD - 0.96). 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

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(Zinyama et al., *20*10; Zamede et al., 2011). Guerreroet al. (2008) 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.

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**Table 4.3 Nutritional knowledge**

| *Nutritional and health benefits of Turkey berries* | *Frequency* | *Percentage* | *P -Value* |
|---|---|---|---|
| Prevent colon cancer | 26 | 29.2 | 0.671 |
| Improves haemoglobin level | 31 | 34.8 | 0.596 |
| Reduces blood pressure | 15 | 16.9 | 0.604 |
| Reduces the level of blood glucose | 17 | 19.1 | 0.607 |
| Total | 89 | 100 | |
| Which diseases or sicknesses can Turkey berries cure? | | | |
| Fever | 19 | 21.3 | 0.792 |
| Asthma | 17 | 19.1 | 0.004* |
| Anaemia | 15 | 16.9 | 0.543 |
| Cough and cold | 12 | 13.5 | 0.612 |
| Cancer | 10 | 11.2 | 0.517 |
| Epilepsy | 16 | 18 | <0.001* |
| Total | 89 | 100 | |
| Possible side effect of consuming too much of turkey berries | | | |
| Diarrhoea | 36 | 40.4 | 0.529 |
| Toxicity/poisoning | 23 | 25.8 | 0.621 |
| Bitterness in mouth | 12 | 13.5 | 0.742 |
| Constipation | 18 | 20.3 | 0.526 |
| Total | 89 | 100 | |

P-value (Pearson ‘s Chi-square for categorical variables) Statistical significance at P< 0.05 P-values with * are significantly different

Source: Field survey, 2019, N= 89

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Table 4.3 reveals that 31 respondents representing 34.8% said that turkey berries improves haemoglobin level (***p*** < 0.596), 26 respondents representing 29.2% indicate that turkey berries prevent colon cancer ($p < 0.671$), 17 respondents representing 19.1% said that turkey berries reduces blood pressure ($p < 0.604$), while 15 respondents representing 16.9% also said that turkey berries reduces blood pressure ($p < 0.607$). Significant differences were found within the specific health benefits of consuming turkey berries. (see Table 4.3). 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).

Moreover, 19 respondents representing 21.3% said that turkey berries cures fever ($p < 0.792$), 17 respondents representing 19.1% revealed that turkey berries cures asthma ($p = 0.004$*), 16 respondents representing 18% indicated that turkey berries can be used to treat epilepsy ($p = 0.543$), 15 respondents representing 16.9% held that turkey berries can be used to cure anaemia ($p = 0.612$), 12 respondents representing 13.5% said that turkey berries cures cough and cold ($p = 0.517$), while 10 respondents representing 11.2% revealed that turkey berries cures cancer ($p <0.001$*).

There were significant differences between diseases or sicknesses turkey berries can cure including fever ($p < 0.792$), epilepsy ($p = 0.543$), anaemia ($p = 0.612$), cough and cold ($p = 0.517$), while the other diseases cured asthma ($p = 0.004$*), and cancer ($p <0.001$*) were not significantly different (Table 4.3). Turkey berries are great tasting food and have many health benefits that are amazingly healing for kidney disease, ulcers, high blood pressure, anemia, cancer, colds, flues, gout, arthritis, asthma, and so much more. Arthan, Kittakoop, Esen & Svasti (2009), reported a moderate α-

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glucosidase inhibitory action of the berry, making it a possible anti-diabetic agent. They further explained that the turkey 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.

Furthermore, 36 respondents representing 40.4% said that the possible side effect of consuming too much of turkey berries is diarrhoea ($p < 0.529$), 23 respondents representing 25.8% indicated that toxicity/poisoning are side effects of consuming too much turkey berries ($p < 0.621$), 18 respondents representing 20.3% revealed that consuming too much of turkey berries can cause constipation ($p < 0.526$) while 12 respondents representing 13.5% said that consuming turkey berries in high quantities can cause bitterness in mouth ($p < 0.742$). There were significant differences between possible side effect of consuming too much of turkey berries diarrhoea ($p < 0.529$), toxicity/poisoning ($p < 0.621$), constipation ($p < 0.526$) and bitterness in mouth ($p < 0.742$) (Table 4.3).

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 haemoglobin levels in the blood.

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### 4.1.3 Implications of the Study in Relation to other Studies

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, 2007). 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 betacarotene, calcium, iron and vitamin C.

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### 4.2 The reasons why turkey berries are not cultivated for commercial purposes.

Table 4.4 assessed the reasons why turkey berries are not cultivated for commercial purposes.

**Table 4.4 Reasons why turkey berries are not cultivated for commercial purposes**

| *Reasons why turkey berries are not cultivated for commercial purposes* | *1 n(%)* | *2 n(%)* | *3 n(%)* | *4 n(%)* | *5 n(%)* | *M X* | *SD* |
|---|---|---|---|---|---|---|---|
| Lack of capital for turkey berry farming | 6 (6.7) | 3 (3.4) | 4 (4.5) | 59 (66.3) | 17 (19.1) | 3.21 | 0.65 |
| Low knowledge on nutritional benefits of consuming turkey berries | 5 (5.4) | 4 (4.3) | 4 (4.3) | 60 (64.5) | 16 (17.2) | 3.14 | 0.69 |
| Lack of land for cultivation | 4 (4.3) | 69 (74.2) | 5 (5.4) | 5 (5.4) | 6 (6.5) | 3.11 | 0.78 |
| Inadequate markets for turkey berry sales. | 2 (2.2) | 3 (3.4) | 4 (4.5) | 71 (79.8) | 9 (10.1) | 2.98 | 0.82 |
| Inadequate knowledge on turkey berry mass cultivation | 5 (5.6) | 4 (4.5) | 4 (4.5) | 68 (76.4) | 8 (9) | 2.74 | 0.85 |

Source: Field survey, 2019, N= 89

Keys: 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4= Agree, 5=Strongly Agree

Table 4.4 shows that 59 respondents representing 66.3% agreed that lack of capital for turkey berry farming is the reason why turkey berries are not cultivated for commercial purposes, 17 respondents representing 19.1% strongly agreed, 6 respondents representing 6.7% strongly disagreed, 4 respondents representing 4.5% were neutral, while 3 respondents representing 3.4% disagreed (mean score of 3.21, SD - 0.65). 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

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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.

Also, 60 respondents representing 64.5% agreed that low knowledge on nutritional benefits of consuming turkey berries affects the consumption rate, 16 respondents representing 17.2% strongly agreed, 5 respondents representing 5.4% disagreed and were neutral respectively (mean score of 3.14, SD - 0.69).

The study reveals that 69 respondents representing 74.2% disagreed that lack of land for cultivation turkey berries is the reason why turkey berries are not cultivated for commercial purposes, 6 respondents representing 6.5% strongly agreed, 5 respondents representing 5.4% agreed, and were neutral respectively (mean score of 3.11, SD - 0.78). In Ghana, it grows wild and many who sell them pick them from wildly grown Turkey berry shrubs for sale. The harvesting of the berries are said to be an irritating experience for harvesters, considering the prickly nature of the shrub.

Furthermore, 71 respondents representing 79.8% agreed that inadequate markets for turkey berry sales is the reason why turkey berries are not cultivated for commercial purposes, 9 respondents representing 10.1% strongly agreed, 4 respondents representing 4.5% were neutral, 3 respondents representing 3.4% disagreed, while 2 respondents representing 2.2% strongly disagreed (mean score of 2.98, SD - 0.82). In recent times, the demand for the berry has increased and led to its commercialisation. Many Ghanaians use it in palm nut soups. The boiled fruits are pounded together with the palm fruits before it is strained for soup. Others use it like garden eggs in stews. It is known as a very good booster of blood levels and many doctors recommend it in anaemic patients.

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Moreover, 68 respondents representing 76.4% agreed that inadequate knowledge on turkey berry mass cultivation is the reason why turkey berries are not cultivated for commercial purposes, 8 respondents representing 9% strongly agreed, 5 respondents representing 5.6% strongly disagreed, while 4 respondents representing 4.5% disagreed and were neutral (mean score of 2.74, SD - 0.85). Despite the recognition of African vegetables to be beneficial to human health, dietary utilization of non-domesticated plants has received very little attention in economic development efforts. Attention is given to 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.

### 4.2.1 Implications of the Study in Relation to other Studies

Turkey berry consumed mainly by the people in southern part of Ghana. There are a number of pharmacological and health benefits associated with turkey berries. Despite the recognition and consumption of turkey berries in Ghana there is limited literature on the nutritional value of it. It is believed to boost haemoglobin levels.

Turkey berries contain lots of iron and so very good for treating anemia. They stimulate the production of red blood cells. Turkey berries can be used in soups and consumed daily to increase red blood cell production. 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.

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# CHAPTER FIVE

# SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

## 5.1 Summary

The main objective of the study was to assess the health benefits turkey berries consumption in Ghana- case study of community 5 a suburb of Tema metropolis. This study used the descriptive research design. Quantitative research approach was used for the study. Questionnaires were used in collecting the data from the field. This research was carried out using selected vegetable sellers, spices and turkey berry consumers in the Tema Metropolis. The entire population of sellers in the selected area was ninety-seven (97). The census sampling technique was used to select all the ninety seven (97) participants for the study. The statistical package for social scientist (SPSS version 20) was used to analyze the pre-coded questions.

## 5.2 Major Findings of the Study

The study results show that 66.3% agreed that turkey berries are eaten, although some individuals pick the leaves, boil and drink. Moreover, 75.3% agreed that 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. Also, 64% agreed that the use of turkey berry as vegetable in dishes may provide some nutrients derived from vegetables in general.

Furthermore, 61.8% agreed that 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. Moreover,

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77.5% agreed that turkey berries tend to reduce the glycemic load when eaten with high-energy foods like bread and polished rice making it ideal for weight loss.

Also, 73% agreed that knowledge of the health promoting and protecting attributes of some vegetables is clearly linked to their nutritional and non-nutrient bioactive properties. The study results indicate that 62.9% agreed that 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.

Moreover, 66.3% agreed that green vegetables are also a source of minerals such as zinc, iron and potassium. Also, 78.7% agreed that turkey berries contain phytochemical, antibacterial and antioxidant properties of turkey berry. Moreover, 60.7% agreed that 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.

The study reveals that 34.8% said that turkey berries improve haemoglobin level, 29.2% indicate that turkey berries prevent colon cancer, 19.1% said that turkey berries reduces blood pressure, while 16.9% also said that turkey berries reduces blood pressure. Moreover, 21.3% said that turkey berries cure fever, 19.1% revealed that turkey berries cures asthma, 18% indicated that turkey berries can be used to treat epilepsy, 16.9% held that turkey berries can be used to cure anaemia, 13.5% said that turkey berries cures cough and cold, while 11.2% revealed that turkey berries cures cancer.

Furthermore, 40.4% said that the possible side effect of consuming too much of turkey berries is diarrhoea, 25.8% indicated that toxicity/poisoning are side effects of consuming too much turkey berries, 20.3% revealed that consuming too much of turkey berries can cause constipation while 13.5% said that consuming turkey berries in high quantities can cause bitterness in mouth.

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The study shows that 66.3% agreed that lack of capital for turkey berry farming is the reason why turkey berries are not cultivated for commercial purposes. Also, 64.5% agreed that low knowledge on nutritional benefits of consuming turkey berries affects the consumption rate. The study reveals that 74.2% disagreed that lack of land for cultivation turkey berries is the reason why turkey berries are not cultivated for commercial purposes.

Furthermore, 79.8% agreed that inadequate markets for turkey berry sales is the reason why turkey berries are not cultivated for commercial purposes. Moreover, 76.4% agreed that inadequate knowledge on turkey berry mass cultivation is the reason why turkey berries are not cultivated for commercial purposes.

## 5.3 Conclusions

The study concluded that the use of turkey berry as vegetable in dishes may provide some nutrients derived from vegetables in general. To add more, turkey berries reduced the glycemic load when eaten with high-energy foods like bread and polished rice making it ideal for weight loss. The study concluded that, turkey berries improves haemoglobin level, prevent colon cancer, and reduces blood pressure. Moreover, turkey berries cure fever, cures asthma, epilepsy, anaemia, cough and cold, and cancer. Furthermore, the possible side effect of consuming too much of turkey berries is diarrhoea, toxicity/poisoning, constipation and bitterness in mouth.

The reasons why turkey berries are not cultivated for commercial purposes were lack of capital for turkey berry farming, low knowledge on nutritional benefits of consuming turkey berries, lack of land for cultivation turkey berries, inadequate markets for turkey berry sales, and inadequate knowledge on turkey berry mass cultivation.

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## 5.4 Recommendations

- Turkey berry were found to be rich sources of micronutrients and fibre. Therefore, the consumption of Turkey berry should be promoted by researchers, non-governmental organizations and other relevant government/non-governmental departments at all levels of the Ghanaian society.
- Consumption may be promoted by finding ways to cultivate them and also organizations working with indigenous vegetables should conduct food festivals using Turkey berry in a variety of foods and the development of new recipes with the aim of preserving the indigenous knowledge of these vegetables. In addition to all these promotional activities, the government should be engaged by researchers towards the implementation of policies that will promote research on indigenous vegetables.
- More research needs to be done to determine the nutritional content of other species of Turkey berries growing in Ghana. Systematic efforts need to be initiated to develop a nutrient database to report energy, vitamin and mineral composition data as well as anti-nutrients edible wild plants like Turkey berry in Ghana. Such data could be of enormous nutritional and economic return.

## 5.5 Suggestions for Further Research

There is also the need to carry out further studies on different maturity levels of the vegetable to ascertain which type contains more nutrients.

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# APPENDIX A

## QUESTIONNAIRES FOR THE RESPONDENTS

I am studying a Master Program at the University of Education, Kumasi Campus. I have designed the following questionnaire to **ASSESSING THE HEALTH BENEFITS OF TURKEY BERRIES CONSUMPTION IN GHANA- CASE STUDY OF COMMUNITY 5 A SUBURB OF TEMA METROPOLIS.** The responses you provide to aid this study is purely for academic purposes and will be treated with the utmost confidentiality. I would highly appreciate if you fill this questionnaire. It will take approximately 10-15 minutes. We expect your kind cooperation in this respect.

**Section A: Demographic Information of the Respondents**

1. What is your gender? a. Male [ ] b. Female [ ]

2. Age category of respondents

Below 18 years [ ] 19-25 years [ ] 26-35 years [ ] 36-45 years [ ] 46-55 years [ ] Above 56 years [ ]

3. Educational level attained.

a. No formal education [ ] b. Basic school [ ] b. Senior High School/Vocational [ ]

c. Tertiary [ ]

4. Marital status

a. Single [ ] b. Married [ ] c. Divorced [ ] d. Widowed [ ]

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**Section B: The perceptions of caterers on the food and nutritional value of turkey berries.**

Please use the following likert scale to assess the perceptions of caterers on the food and nutritional value of turkey berries. by ticking one of the boxes from (1) to (5) where (1) = strongly disagree (2) = disagree (3) = Neutral, (4) = agree (5) = strongly agree

| **Statement(s)** | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 5. Turkey berries are eaten, although some individuals pick the leaves, boil and drink. | | | | | |
| 6.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. | | | | | |
| 7.The use of turkey berry as vegetable in dishes may provide some nutrients derived from vegetables in general. | | | | | |
| 8.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. | | | | | |
| 9.Turkey berries tend to reduce the glycemic load when eaten with high-energy foods like bread and polished rice making it ideal for weight loss. | | | | | |
| 10.Knowledge of the health promoting and protecting attributes of some vegetables is clearly linked to their nutritional and non-nutrient bioactive properties. | | | | | |

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| | | | | | |
|---|---|---|---|---|---|
| 11.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. | | | | | |
| 12.Green vegetables are also a source of minerals such as zinc, iron and potassium. | | | | | |
| 13.Turkey berries contain phytochemical, antibacterial and antioxidant properties of Turkey berry. | | | | | |
| 14.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. | | | | | |

**Nutritional knowledge**

15. What nutritional and health benefits can be derived from Turkey berries?

Prevent colon cancer [ ] Improves haemoglobin level [ ] Reduces blood pressure [ ]

Reduces the level of blood glucose [ ]

Others [specify] .....

16. Which diseases or sicknesses can Turkey berries cure?

Fever [ ] Asthma [ ] Anaemia [ ] Cough and cold [ ] Cancer [ ] Epilepsy [ ]

Other [specify] .....

17. What could be the possible side effect of consuming too much of turkey berries

Diarrhoea [ ] Toxicity/poisoning [ ] Bitterness in mouth [ ] Constipation [ ]

 Others [specify] .....

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**Section C: The specific meals which make use of turkey berries as a spice.**

18. What are the specific meals which make use of turkey berries as a spice?

**M**eat pepper soup **[ ] P**alm kernel soup **[ ]** **F**ish pepper soup [ ] Groundnut soup [ ]

Other please specify…….

**Section D: The reasons why turkey berries are not cultivated for commercial purposes.**

Please use the following likert scale to evaluate the reasons why turkey berries are not cultivated for commercial purposes. by ticking one of the boxes from (1) to (5) where (1) = strongly disagree (2) = disagree (3) = Neutral, (4) = agree (5) = strongly agree

| Statement(s) | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 19. Lack of capital for turkey berry farming | | | | | |
| 20. Low knowledge on nutritional benefits of consuming turkey berries | | | | | |
| 21. Lack of land for cultivation | | | | | |
| 22. Inadequate markets for turkey berry sales. | | | | | |
| 23. Inadequate knowledge on turkey berry mass cultivation | | | | | |

**Thanks for your cooperation**