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Nutritional Profile, Bioactive and Pharmacological Properties of *Telfairia Occidentalis* (Fluted Pumpkin) in Disease Prevention and Treatment – An Overview

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Abstract

The medicinal value of Telfairia occidentalis is no longer in doubt as herbal remedies have been used wholly and/or together with some other standard medications over the years in the treatment/cure of many illnesses/diseases. Telfairia occidentalis plant is one of amongst the many well-known edible plants species that has potential herbal and/or medicinal components due to its peculiar natural edible content. It possesses many phyto-chemical constituents closet to the class of palmitic, flavonoids, alkaloids, linoleic and oleic acids. Important herbal/medicinal properties such as anti-diabetic, antioxidant, anti-microbial, anti-cancer, anti-inflammatory, male fertility activity, haematological properties, and others are properly recorded. This article tends to review the Nutritional and Functional (Pharmacological and Biological) Profile of Telfairia occidentalis in Disease Prevention and Treatment.

Keywords: Nutritional profile, Bioactive, *Telfairia Occidentalis*, Disease, treatment

Profil nutritionnel, propriétés bioactives et pharmacologiques de *Telfairia occidentalis* (citrouille ondulée) dans la prévention et le traitement des maladies – Une revue

Résumé

La valeur médicinale de Telfairia occidentalis ne fait plus de doute, car les remèdes à base de plantes ont été utilisés seuls et/ou en combinaison avec d'autres médicaments standard au fil des ans dans le traitement/de la guérison de nombreuses maladies. La plante Telfairia occidentalis est l'une des nombreuses espèces végétales comestibles bien connues qui possède des composants herbacés et/ou médicinaux en raison de sa composition naturelle comestible particulière. Elle contient de nombreux constituants phytochimiques proches des classes des acides palmitique, flavonoïdes, alcaloïdes, acides linoléiques et oléiques. Des propriétés médicinales telles que anti-diabétiques, antioxydantes, antimicrobiennes, anticancéreuses, anti-inflammatoires, activité de fertilité masculine, propriétés hématologiques et autres sont bien documentées. Cet article a pour but de passer en revue le profil nutritionnel et fonctionnel (pharmacologique et biologique) de Telfairia occidentalis dans la prévention et le traitement des maladies.

Mots-clés : Profil nutritionnel, Bioactif, *Telfairia occidentalis*, maladie, traitement

ملخص

لم تعد القيمة الطبية لـ Telfairia occidentalis موضع شك حيث تم استخدام العلاجات العشبية بالكامل و/أو جنبًا إلى جنب مع بعض الأدوية القياسية الأخرى على مر السنين في علاج/علاج العديد من الأمراض/الأمراض. نبات Telfairia occidentalis هو واحد من العديد من أنواع النباتات الصالحة للأكل المعروفة التي تحتوي على مكونات عشبية و/أو طبية محتملة بسبب محتواها الطبيعي الغريب الصالح للأكل. يمتلك العديد من المكونات الكيميائية النباتية خزانة لفئة النخيل والفلافونويد والقلويدات وأحماض اللينوليك والأوليك. يتم تسجيل الخصائص العشبية/الطبية المهمة مثل مضادات السكري ومضادات الأكسدة ومضادة الميكروبات ومضادة للسرطان ومضادة للالتهابات ونشاط خصوبة الذكور وخصائص أمراض الدم وغيرها بشكل صحيح. تميل هذه المقالة إلى مراجعة الصورة الغذائية والوظيفية (الدوائية والبيولوجية) لـ Telfairia occidentalis في الوقاية من الأمراض وعلاجها.

الكلمات الرئيسية: موجز تغذوي، نشاط بيولوجي، تلفايريا أوكسيدنتاليس، مرض، علاج

Introduction

Telfairia occidentalis can be seen as a herb which has so much medicinal potentials (Oladele *et al.,* 2017). It is a recurrent crop cultivated in many parts of West Africa and a few parts East-Central Africa for its nutritious and palatable foliage. *Telfairia occidentalis*, in Nigeria is called *ubong, ugu, umeke umee,, aporoko, and iroko* by many tribes and is grown mostly as a vegetable and also for its seeds and medicinal purposes (Abidemi *et al.,* 2013). *Telfairia occidentalis (Cucurbitaceae)* foliage are utilized in folk medicine and soups, as vegetables in many regions in Nigeria: predominantly, the southern part of Nigeria (Abidemi *et al.,* 2013). *Telfairia occidentalis* leaves as analysed in comparism to some tropical vegetables contains more nutritive value. The percentage protein estimated (21 %) is more than those of the commonly used vegetables. Its leaves are high in minerals (P, Ca, Fe, iron, potassium, sodium, and phosphorus) and vitamins (thiamine, riboflavin, nicotinamide, ascorbic acid) amongst others. It is also rich in antioxidants and phenols (Njoku *et al*., 2018). *Telfairia occidentalis* is reported to possess antioxidant, anti-diabetic, hepato-protective and antimicrobial properties (Eseyin *et al.,* 2018; Salman et al., 2008). The seeds are also consumed as food. Oil extracted from the seeds is utilized for frying, cooking etc. However, some research has reported that the herb has some potential health benefits in the treatment and prevention of certain diseases (Oladele *et al.,* 2017; Olorunfemi *et al.,* 2014 and Kayode and Kayode, 2011). Antioxidant and free radical scavenging properties of this vegetable have been reported by (Abidemi *et al.,* 2013; Nwanna and Oboh, 2007; Adaramoye *et al.,* 2007 and Kayode *et al.,* 2010). Ethno-botanical survey carried out amongst trado-medical practitioners in Lagos, Nigeria, affirms the use of *Telfairia occidentalis* in the treatment of convulsion. Disorders of the Central Nervous System (CNS) tends to account for more chronic suffering, more long-term care, and hospitalizations more than other disorders combined (Abidemi *et al.,* 2013). The leaves has also been implicated in the treatment of liver problem and diabetes (Eseyin *et al.,* 2005; Adaramoye *et al.,* 2007), infertility as reported by (Nwangwa *et al.,* 2007). Some Experimental research evidence has shown that the plant has positive effect on haematopoiesis (Alada, 2000). Oboh *et al.,* (2006) has also reported its effect on hypolipidemic and its therapeutic importance of it leaf extract in hyper-cholestolemia (Oladele *et al.,* 2017).

Nutritional importance of vegetables

Vegetables generally are edible plant sections that are vital for health. Vegetables possess phytochemical compounds, minerals, dietary fibre, and vitamins content that have very vital function in treatment and preventing

diseases (Ülger *et al*., 2018). Studies in the past have proven the nutritional significance of vegetables. Adequate consumption of fruits and vegetables could prevent the occurrence of certain illnesses/diseases including cancers, obesity, diabetes, inflammation, Alzheimer, aging and hypertension owing to some phytochemicals that act as an antioxidant etc (Hossain *et al*., 2015; Nahak *et al.,* 2014). In the last 30 years, utilization of herbal medicine supplements and products has sky-rocketed, having a good number of persons depending on it for better healthcare. Generally, leafy vegetables and local foods forms part of Africa's heritage. It also tends play a very significant part of the African traditions, customs, and food culture. In spite of the health benefits and medicinal importance of these vegetables, only so much has been researched on their usage in Africa. This could be implicated in the insufficient information that the locals have regarding their advantages, cultural beliefs of some tradition and individual predisposition (Akinola *et al.*, 2020; Kansiime *et al*., 2018; Mbhenyane, 2017). Majority of these local leafy vegetables have been under-utilized due to it exotic foreign varieties that could be nutritionally inferior to them. This could possibly be due to insufficient/lack of information about their usage/uses and their importance in rural economies, values, and inadequate world markets.

The underutilized and indigenous information as it regards utilization of these leafy vegetables are uncommonly spread among the people and tradition (Akinola *et al*., 2020; Onuminya *et al*., 2018). These leafy vegetables have high nutritional value and good taste, but are not added to many individual household diets due to its financial strength. Traditionally, these vegetables are basically related to low social status and, poor rural lifestyles, cultural changes and urban expansion have made it increasingly neglect due to decline in indigenous vegetable production, diversity, and consumption (Onuminya *et al*., 2018). In spite of their in cure and treatment of some illnesses/diseases, with proven effectiveness, most of these vegetables are still untested, and its applications is poorly regulated or not even monitored (Ekor, 2014). The scarce information concerning their mode of actions, and its inter-actions with other available drugs and potential effects adversely, its misuse is unavoidable. Research in this area therefore, is very crucial to bring about consumer awareness, health benefits of these vegetables and add new information to database and also, identify areas where research attention is urgently required. There is an increase demand globally as regards to natural plant-derived products as compared to those artificial drugs.

Many research studies had reported many health benefits of *Solanum macrocarpon, Telfairia occidentalis*, and *Amaranthus viridis* leaf extracts in fighting various illnesses/diseases (*in vitro* and *in vivo*) studies. The usefulness and effectiveness of these leafy vegetables is largely pointer to their phenolic compounds that have some bioactivities (Aworunse *et al*., 2018). Eseyin et al., (2007) reported that giving *Telfairia occidentalis* supplemented-diets significantly reduced cholesterol-induced heart enlargement in Wistar rats and led to reduced lipid peroxidation and blood cholesterol level. Methanolic extracts of *Solanum macrocarpon, Telfairia occidentalis*, and *Amaranthus viridis* have been reported to lower plasma glucose levels and inhibit the activities of α-glucosidase and α-amylase in Wistar rats (Adaramoye *et al*., 2007, Aderibigbe *et al.,* 1999; (Eseyin *et al*., 2010; Oboh *et al*., 2012; Salman *et al*., 2008). Other therapeutic properties of *Solanum macrocarpon ,Telfairia occidentalis*, and *Amaranthus viridis* leaf extracts include anticancer and antimicrobial effects (Aworunse *et al*., 2018).

Chemical Composition of Telfairia Occidentalis

Pod and pulp

Much has not been reported on this aspect of *Telfairia occidentalis*. However, the pulp and pod has the following: crude fibre (0.46 and 0.85), ether extract (0.30 and 0.50), nitrogen free extract (4.84 and 5.60), crude protein (1.3 and 1.4), ash (0.30 and 0.40), and moisture (92.8 and 91.3) respectively (Eseyin *et al.,* 2014).

Seed

Proximate analysis of the seed was reported to be as viz: crude protein (16.0 %), carbohydrate-Starch-(16.5- (62.5), ash (3.44 %), Moisture content (6.30 %). Also present are sucrose, fructose, glucose and sixteen amino acids with lysine (2.6 g/100g) was lowest while glutamic acid (16.4 g/100g) being the highest. Compositions of neutral lipids, glyco-lipids and phospholipids were analyzed as follows: phosphatidyl serine (5.3 %), monogalactosyldiglyceride (11.7 %), lysophosphatidyl choline (14.0%), phosphatidyl choline (26.2 %), phospholipids (58.0%), phosphatidyl inositol (4.4 %), glycolipids (26.0 %), phosphatidylglycerine (1.6 %), phosphatidyl ethanolamine (6.5 %), cerebroside (0.8 %), Free sterols (1.1 %), digalactosyldiglyceride (8.2 %), unidentified (0.5%), monoglycerides (3.0 %), unidentified (0.4 %), neutral lipids (16.0 %), triglycerides (5.6 %), diglycerides (3.8 %), sterylesters (2.5 %), steryl glycoside (3.6 %) and unidentified (0.8 %) (Eseyin *et al.,* 2014). The major occurring fatty acid is oleic acid, constituting 36 %. Substantial levels of vitamins C and A are also available. It contains a very high amount of unsaturated fatty acids indicting that the seed has a high nutritive value. The younger seeds are preferred as food due the fewer amount anti-nutrients and are sweeter than the mature ones (Eseyin *et al.,* 2014: Idris, 2011). The amino acids content has glutamic acid as the highest in value (13.65 mg) then by aspartic acid (10.78 mg) and leucine (10.26 mg). Methionine value was found to be the lowest (1.12 mg). Other parameters measured include acid value (3.65), ester value (8.55), iodine value (7.12), viscosity (0.0035), weight per milliliter (1.755), saponification value (12.2), refractive index (1.426) and specific gravity (0.7227) (Ezugwu and Nwodo, 2000).

Leaves and stem

The proximate and chemical composition of *Telfairia occidentalis* leaf extract is presented as; crude fibre (6.41), crude protein (21.31), nitrogen free extracts (55.56), ash (10.92), ether extract (5.50), gross energy (4420.00 kcal/kg), metabolisable energy (3121.00 kcal/kg), Na (0.02), P(0.40), Mg (0.43), N (3.41), K(0.15), Ca (0.67), Mn (1.18 mg/100g), Phytate (510.51 mg/100g), Zn (7.50 mg/100g), Fe (18.5 mg/100g), oxalate (0.0034 mg/100g), tannin (0.184 mg/100g) (Idris, 2011). The composition of the minerals elements tends to vary with age. The phytochemical composition of its young leaves and stems was higher than that of the older stems and leaves (Eseyin *et al.,* 2014). The high iron (Fe) composition in the young tender leaves is the basis on which the leaf extract is used traditionally as blood tonic in the cure of anemia etc. Crude fiber content (20.17 ± 0.12 %) in leaves of *Telfairia occidentalis* simply indicates good sources of dietary fibres. The high amount of carbohydrate (39.64 %) indicates a corresponding hike in energy value (290.16 kcal/100g). this also confirms that the plant leaves may serve as a good energy source. *Telfairia occidentalis* leaves are a good source of Fe, Mn, Cu, and K, an average of of Zn and Mg essential in nutrition (Eseyin *et al.,* 2014: Idris, 2011). Amino acid content of *Telfairia Occidentalis* was 455.3 mg/g with the essential amino acid (EAA) of 256.1 mg/g or 56.3%, indicates that the plants is high in EAA. An extract of the leaves contains 40

mg/100ml of Vitamins E and C and 5.07 mg/100ml, respectively.

Root

The roots of *Telfairia Occidentalis* compositional vary with age of the plant. The older roots of the plant contain high mineral elements such as magnesium, calcium, sodium and potassium. The highest amounts of anti-nutrients (almost 100 fold for oxalates) are present in the root. Oxalate composition is very high in both old roots (2600 mg/100g) and young (1083 mg/100g)(Idris, 2011).

Functional (Pharmacological and Biological) Activities

Anti- diabetic activity

Diabetes is one amongst the major causes of death in developed countries of the world. Diabetes is now approaching an epidemic magnitude, mostly in the developed countries. The International Diabetes Federation (IDF) has reported that if sufficient steps are not put in place to curtail the disease, it global trend may approach about 330 million people as we approach the year 2025. About 5 and 10 % of world's budget on health care are spent on diabetes. This figure may increase probably to about to 40% in some countries in 2025. The WHO has sued for more acceptances of these traditional (herbal) medical practioners (Eseyin *et al.,* 2014). However, because some religion, folklore, customs, poverty or lack to get orthodox medications, most individual etc in third world countries now depend majorly on traditional herbal for treatment and prevention. Most edible part etc of (fruits and seeds) these plants in the *curcurbitacee* family (such as the seed of *Mormodica cochinchinensis* and fruit of *Mormordica charantia*) have been reported to have anti-diabetic effects. *Telfairia occidentalis* not surprising that it has been known to have anti-diabetic property. From the information that is available, Aderibigbe and Lawal (1999) were the pioneers to publish the anti-hyperglycaemic potentials of *Telfairia occidentalis* in rats. They however, found that the aqueous extraction of *Telfairia occidentalis* leaves tends to reduced blood glucose level when streptozotocin was used to induce glucose and diabetic induced hyper-glycaemic rats significantly. Several scholars had also established the anti-diabetic activity of *Telfairia occidentalis* leaves (Eseyin *et al.,* 2010: Eseyin *et al.,* 2010: Nwozo*et al.,* 2004). An anti-diabetic property of the ethanolic extract of *Telfairia occidentalis* leaves was detectable in the ethyl acetate fraction of *Telfairia occidentalis* leaves (Eseyin *et al.,* 2010). Polysaccharides of *Telfairia occidentalis* leaves had also been reported to have anti-diabetic activity by (Eseyin *et al.,* 2014). The extract from the leaves inhibited *in vitro* activities of α–glucosidase and α–amylase in a dosage dependent style (Oboh *et al.,* 2012). *Telfairia occidentalis* seeds are also reported to contain anti-diabetic properties (Eseyin *et al.,* 2007). Free radicals are implicated in diabetes. Hyper-glycaemic condition that portrays diabetes lead to the non-enzymatic glycation of circulating hemoglobin, tissues such as collagen and DNA to produce advanced glycated end products. Reactive oxygen species (ROS) generated from the glycation activity tends to increase cross linking of extracellular (EC) matrix, nitric oxide (NO) is then quenched and this may do a great damage to DNA (Stanaway and Gill, 2000). The anti-diabetic activity of *Telfairia occidentalis* may be connected to its antioxidant property that enables it to clean-up free radicals.

Anti-inflammatory and Analgesic Property

Telfairia. occidentalis leave significantly inhibits Carrageenan-induced oedema in the sub-planar hind paw of vegetable extracts. *Telfairia. occidentalis* seed extract shows a significant anti-inflammation property against egg albumin, xylene-induced oedema and exhibits a dose-dependent inhibition of hurt or

disorder in acetic acid-induced writhing. The inhibition of neurogenic and non-neurogenic hurt and also narcotic pains by the extract could in part explain the mechanisms of its action (Eseyin *et al.,* 2014).

Hepato-protective property

Ethanolic and aqueous extracts of *Telfairia occidentalis* leaves possess hepato-protective abilities. Aqueous extract of *Telfaiaria occidentalis* was found to be effective as compared to the ethanolic extract. This could be as a result of high anti-oxidant properties of the aqueous extract. *Telfaiaria. occidentalis* leaves (Oboh, 2005). As compared to the other vegetables that were used in the study as reported by Eseyin *et al.,* (2014), *Telfairia. occidentalis* has proven to be a great leafy vegetable in preventing garlic-induced heap-totoxicity (Oboh, 2006). The freeze dried aqueous extracts of *Telfaiaria. occidentalis* had excellent qualities as a good remedy for cyanide poisoning administered soon shortly after ingestion of sub-lethal dose (*Bolaji and Olabode, 2011*). Polyphenols Free soluble compounds tend to have high antioxidant and high protective effects on liver as compared to the bond poly-phenols when acetaminophen is induced to cause liver damage. This shows a link between the anti-oxidant and hepato-protective activities of *Telfaiaria. occidentalis* leaves (Eseyin *et al.,* 2014). Experimental rats previously treated with the ethanolic leaf extract possess protective performance against paracetamol toxicity in Experimental rats liver enzymes by increasing its content above the normal (Eseyin *et al.,* 2014).

Antioxidant Activity

The hallmark of various complications and chronic diseases such as diabetes, obesity, CVD and cancer is oxidative stress. This is a situation of potentially harmful imbalance between the amount of antioxidants and pro-oxidants in consideration of the later (Yadav *et al*., 2010). *Telfairia occidentalis* leaves extract have various potential antioxidant properties that play a vital act in diabetics, pre-diabetics, and prople with vascular injury. Xia & Wang (2006), have reported the hypo-glycaemic action of *Telfairia occidentalis* (fruit) extract together with the role it plays as an antioxidant to expose mechanism for its cell-protecting action on streptozotocin-induce diabetic rats. *Telfairia occidentalis* seeds possess high amount of tocopherol (vitamin E), and the seed oil was reported to give an important source of tocopherol in Japanese diets (Yadav *et al*., 2010). Dang (2004) reported that pumpkin *Telfairia occidentalis* extract administration significantly tends to increase the hepatic and serous activities of glutathione peroxidase and superoxide dismutase in experimental rats. It also tends to reduce the level of malon-aldehyde. It has also been revealed that *Telfairia occidentalis* polysaccharide may increase the glutathione peroxidase and superoxide dismutase activity and also reduces the malon-aldehyde level in tumour-containing rat serum (Xu, 2000).

Anti-malaria activity

This is a disease which affects above 40% population of the world. It is prone mostly in the sub-Saharan Africa and responsible for about over 2 million deaths pa. The wide-spread of the resistance strain(s) of malaria parasite to drugs (such as chloroquine) that until the advent of Artemisinin has was the main anti-malarial drug that has been administered is the leading cause of increase in death from malaria. Regrettably, the hold off to the push for Artemisinin-based combination medication has been reported in some areas. Several of these anti-malarial medications in use as of now, such as artemisinin and quinine are either incurred from plants or are derived of plant constituents. Plants generally, have been a rich and an alternative place for novel drugs. *Telfairia occidentalis* roots tends to show a significant blood schizonticidal properties in both 4 days early pathological test and in

already shown infection with average mean survival period compared to those of normal medication, e.g chloroquine (5 mg/kg) (Eseyin *et al.,* 2014). The leaves extract of *Telfairia occidentalis* shows anti-plasmodial properties in 4-days early infection test and also in already shown infection with a recognised increase in average survival period. This however, remains less than that gained with the normal medication (e.g chloroquine (5 mg/kg/day). Seed extract also showed potential blood schizontocidal properties in early and already established conditions (Eseyin *et al.,* 2014). *Telfairia occidentalis* presents a very high *in-vitro* synergistic attributes when combined with chloroquine, and also against CQ-tolerant *P. berghei* isolates. The research studies showed that *Telfairia occidentalis* has a vital anti-plasmodial effect, which could be exploited in the prevention, control and treatment of malaria parasites. *Telfairia occidentalis* supplemented foods possess some medicinal or herbal effects as a source of anti-inflammatory substances, which could help with many illnesses/diseases which includes arthritis amongst other. The seed oil significantly hinder adjuvant induced arthritis in experimental rats, which is similar to a well-known anti-inflammatory substance known as indomethacin Fahim *et al.*, (1995) and Yadav *et al.,* (2010). The supplementation of herbs constituents and normal medications (drugs) could bring about what is known as drug interaction effects (antagonistic, no-change and synergistic, effects) when treating ailments/diseases. Fahim *et al.*., (1995) and Yadav *et al.,* (2010) subjected drug interaction effects of *Telfairia occidentalis* (seed) oil and indomethacin, and resulted in no effect in the adjuvant created arthritis model in experimental rats. The oil possesses good hypo-tensive property, as reported by Zuhair *et al.,* (2000). In their research, they also found out that *Telfairia occidentalis* oil possesses very effective drug inter-action with hypotensive drugs, with regards to improve hypotensive activity in hypertensive animal. *Telfairia occidentalis* seed snacks Supplementation shows high level prevention of crystal formation that tends to reduce risk of disease such as bladder stone (Yadav *et al.,* 2010). Supplementation of up to 60 mg/kg (body mass)/day of *Telfairia occidentalis* seed tends to reduce bladder stones incidences; farther the supplementation time of *Telfairia occidentalis* seeds, the greater the results observed (Yadav *et al.,* 2010). It was further reported the *Telfairia occidentalis* seed reduces increase bladder, reduce urethral pressure and bladder pressure compliance. Some *Telfairia occidentalis* species possesses some bio-anti-mutagenicity from the ethyl acetate fractions and chloroform. It could ease depression, due to the fact that the seed contains L-tryptophan; this raises levels of 'happy' (serotonin) (Yadav *et al.,* 2010).

Anti-cancer Property

Cancer is a term used to describe a large group of diseases that can affect any part of the body. One prominent attributes of cancer is metastasis. WHO have reported that cancer is a foremost cause of death in the world, constituting up to 7.6 million deaths (about 13 %) in 2008. Deaths from cancer in world have been projected to continue to rise over 13.1 million in 2030. Research has shown that *Telfairia occidentalis* possesses anti-cancer properties. Extract (crude) from the seed of *Telfairia occidentalis* show anti-cancer properties by inhibiting oxidative burst activity in the blood, isolated poly-morphonuclear cells (PMNs) and mono-nuclear cells (MNCs). The potency order was hexane fraction > dichloromethane fraction > ethyl acetate fraction > butanol fraction > aqueous fraction > crude extract (Okokon *et al.,* 2012). *Telfairia occidentalis* seeds tend to decrease serum phosphatase concentrations, prostatic acid, and increased testosterone: estradiol ratio, also reduce the mass and

secretory activity of the enlarged prostate (Ejike and Ezeanyika, 2011). It reduced the mean relative protein content (mg/tissue), prostate weight of the rats' prostates and serum prostatic acid phosphatase, combating the induction of BPH in mice (Ejike and Ezeanyika, 2011), by simply increasing the level of serum testosterone while at the same time lowering the level of serum estradiol. *Telfairia occidentalis* leaves shows it contain saponins, tannins, phytosterols, flavonoids, phenolic compounds, chlorophyll and glycosides that have been proven to exhibit chemo-suppressive properties. Recent reports have linked the antioxidative and super-oxide scavenging properties of individual active components of herbal medicine with their anticancer properties. Herbal medicines are also implicated in nutrient supplement for anti-cancer properties. Several research (*in vitro)* and *in vivo* studies of herbal medicine on different cell lines have been reported. Since the high anti-oxidant property of *Telfairia occidentalis* has been established, it is therefore likely that the cancer chemo-preventive activity of the seed could be attributed to the antioxidant components and activity of the plant (Eseyin *et al.,* 2014).

Antimicrobial activity

Illnesses/diseases that are caused by viruses, fungi, bacteria and other parasites are major reason of disability, death, and economic and social disruption for many people. Many people do not have access to the much needed treatment and preventive care even in the available effective and safe mediations. Due to increasing resistance to drug by infectious micro-organisms has necessitated the research and development of new medications that militate against harmful micro-organisms. Base on this, natural sources are been considered as options to identify novel and new anti-microbial parts. Several range of anti-microbial parts are been identified from *Telfairia occidentalis*. *Telfairia occidentalis* oil tends hinder *Serratia marcescens, Klebsiella pneumoniae, Pseudomonas aeruginosa, Enterococcus faecalis, Candida albicans, Staphylococcus aureus, Escherichia coli, Salmonella enterica subsp. enterica serotype typhimurium, Acinetobacter baumanii and Aeromonas veronii biogroup sobria* at the conc level of 2·0% (v/v) (Yadav *et al*., 2010). A peptide (MW 8 kDa) in *Telfairia occidentalis* seeds is shown to hinder *Mycosphaerella arachidicola , Fusarium oxysporum, and Botrytis cinerea* at a dosage level of 375 mg and to exert an inhibitory effect on cell-free translation with an IC50 (50% inhibitory concentration) of 1·2mM (Yadav *et al*., 2010). Refined a-moschin and b-moschin, are two proteins with a MW of 12 kDa from the fresh brown *Telfairia occidentalis* seeds, displays translation-inhibiting properties with IC50 of 17 mM and 300 nM, respectively (Xiong, 2000). An important inhibitory effect of this purified protein (MW 28 kDa) toward fungal growth of *Fusarium oxysporum* was inserted in an agar disc plate at a concentration higher than 2 mM. This protein tends to possess a synergistic effect with *nikkomycin*, a chitin synthase inhibitor, for the growth inhibition of *Candida albicans* (Ng *et al.,* 2002). Three *Telfairia occidentalis* seed basic proteins, MAP4 (MW 4·6 kDa), MAP11 (MW 11·7 kDa) and MAP2 (MW 2·2 kDa), have been proven to inhibit the propagation of yeast, with MAP11 being the most effective inhibitor. However, MAP2 and MAP4 were not able to inhibit the propagation of the Gram-negative bacterium such as *E. coli* (Yadav *et al*., 2010). Furthermore, it is reported that phloem exudates from *Telfairia occidentalis* fruits possess anti-fungal properties by inhibition of disease causing fungal *proteases* (Yadav *et al*., 2010). Of recent, Park *et al*. (2010) isolated a protein referred to as Pr-1 in *Telfairia occidentalis* that has potential anti-fungal properties, without causing harm to human erythrocytes. It is a thermo-stable protein at up to 70*8*C,

without indicating grows activity towards *Staphylococcus aureus* or *E. coli* (Park *et al*. (2010). By these facts, it is importance to encourage those in developing countries to consume *Telfairia occidentalis*, since it has been proven against some organisms that cause infectious diseases (Yadav *et al*., 2010).

Male fertility activity

Fluted pumpkin contains dose-contingent progress in the semen fluid analysis. Also, in the microscopic structure of the testes, showing a near complete morphological reconstitution and development of spermatozoa (Nwangwa *et al.,* 2007). *Telfairia occidentalis* leaf extract tends to increase sperm movements, growth and count in experimental rat (Saalu *et al.,* 2010). Oil from the seeds at dose (400 mg/kg) also helps sperms parameters but no impact on testicular microscopic structure, luteninizing and testosterone hormone level of experimental rat (Akang *et al.,* 2010). The oil increased the level of sperm count, growth, testicular weight, luteinizing hormone, and testosterone equate to the alcohol treated experimental rats. Fluted pumpkin has demonstrated a prophylactic impact on alcohol induced testicular injury and better semen quality. Farther more, it tends to better the luteinizing hormone and serum testosterone levels (Akang *et al.,* 2011). Fluted pumpkin seeds that are included in a diet results in simple reduction in the biochemical neutering and an improved secretory performance of the testes in experimental rats, therefore indicting that it could be helpful in preventing the entry of experimental andro-pause (Ejike and Ezeanyika, 2013). The spermatozoa activity of *Telfairia occidentalis* could be due to the result of the carbohydrate level which may have raised the sperm movement and growth by the increase in carbohydrate breakdown resulting in the released of energy. Pyruvate is the most preferred material that is essential for the activity and survival of sperm cells. Other content of *Telfairia occidentalis* such as vitamin C, zinc and arginine can play vital parts> research has proven that nutritional therapies with vitamin E, arginine, vitamin C, and zinc has been proven to be of benefit in treating male infertility. This beneficial effect of *Telfairia occidentalis* on male fertility could be as a result of the anti-oxidant properties present in the plant since anti-oxidants such as vitamins retinol (A), ascorbic acid (C) and tocopyrol (E) have been proven to have excellent protective cause on testis (Akang *et al.,* 2011).

Hematological activity

Telfairia occidentalis plant is used ethno-pharmacologically to treat anaemia. The haemoglobin increasin properties of *Telfairia occidentalis* leaves has been reported by (Dina *et al.,* 2006). *Telfairia occidentalis* extract of the leaves tends increase the haematocrit level and the reticulocyte count in experimental rabbits. *Telfairia. occidentalis* leaves extract Administration had led to a moderate increase in haemoglobin (Hb) content in anaemic experimental mice that were compared to the Hb repletion in anaemic experimental mice given $FeSO_4$. Human erythrocytes that are exposed to hypo-tonic and heat stress were stabilized by *Telfairia occidentalis* extract in a dose dependent manner (Eseyin *et al.,* 2014). The ability of *Telfairia occidentalis* leaves extract to inhibitory and reverse activities on sickle cell have also been reported by (Cyril *et al.,* 2012). It was obvious from the reports that utilization of *Telfairia occidentalis* leaves enhances various heamatological properties and therefore tends to improve the nutritional and physiological status of its consumers. This is also due to the high levels of proteins and iron in the leaf. Reports of these studies have farther proven that the ethno-botanical application of *Telfairia occidentalis* as a blood tonic and anti-anemic (Eseyin *et al.,* 2014).

Conclusion

The herbal/medicinal properties of leaf and seed (oil) of *Telfairia occidentalis* has been proven to potent on many diseases and illnesses. It is obvious therefore that *Telfairia occidentalis* has proven to possess beneficial anti-diabetic, anti-oxidant, antimicrobial, testiculo-protective, anticancer, anti-inflammatory, male fertility activity and haematological. Several of these activities have proven the theories of trado-medical (herbal medical) practioners, several clinical tests, involving humans, need to be carried out. Researchers have attributed some of the medicinal activities of *Telfairia occidentalis* to the increased amount of anti-oxidant properties which compounds like flavonoids, phenolics, Vitamins E and C. The presence of other phyto-chemicals compounds like saponins etc could also play a valuable part in the activities of *Telfairia occidentalis*. Researchers have continued to pay attention to the part of investigating plant; it could be obvious then that more medicinal properties/ herbal benefits of the plant could be discovered. So far, only little has been done regarding the chemistry of the plant, particularly on the leaf. Researchers could give more attention to investigate more on the isolation and identification of bio-active properties of *Telfairia occidentalis*. Therefore, it is eminent to identify components that are responsible for these identified medicinal properties. This will tend to provide "lead "to the discovery of new supplements/drugs from the plants and also enhance the effective exploitation of the medicinal benefits of *Telfairia occidentalis*.

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