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A REVIEW ON AN UNDERUTILIZED WILD EDIBLE PLANT: GINGERBREAD PLUM (*Neocarya macrophylla*)

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ABSTRACTS

Many of the diverse plant species in Africa that are known to contain numerous compounds that are healthy are still untapped or unexplored by western society. Wild plants with edible portions are those that naturally grow on farms or other untamed terrain, and are essentially rich in supplementing nutritional requirements such as vitamins and minerals. Gingerbread plum (*Neocarya macrophylla*) is a fruit bearing plant and is among the popular wild fruit in Nigeria. Many sections of the tree including the leaves, peels, fruits, stem bark and seeds are utilized either as a antimicrobial agent, supplement, traditional medicine and many more. The portion of the tree is enclosed with varied proportion of important components most commonly used as therapeutic to curb diseases caused by some microorganisms, The leaves extract showed different levels of antimicrobial effect against the microorganisms such as *Staphylococcus aureus*, *Escherichia coli*, *Pseudomanus aeruginosa* in many studies. Moreover, for the nutritional and antinutritional composition of the gingerbread plum fruits peels, research shows a better result of proximate composition that is believed to not interfere with health and wellbeing. Similarly, fruit pulp are popularly used as food which provides a vital macro and micro nutrients such as Minerals like iron, zinc, etc.; dietary fiber; anti-oxidants; amino acids; bioactive compounds; and phytochemicals which are significant for disease prevention, good nutrition, and deliver health benefits and great taste. Furthermore, seeds from the gingerbread plum contain high proportion of oil commonly entitled with physicochemical and antioxidants characteristics, also stem bark of the tree was used to heal pain with antimicrobial activity. Different medicinal applications was evaluated apart from their utmost utilization as a food supplement, hence the increase in global population with realization for the diversification in the utilization of available resources to reduce menace in mortality rate shows the necessity for the use of gingerbread plum as a crucial part.

Keywords: Gingerbread plum, Wild edible plants, Underutilized plants, Oil bearing seeds

INTRODUCTION

Several plant species in Africa are known to contain nutrients that are beneficial to health, yet many of them are still untapped potential sources of medicine (Bamalli *et al*., 2014). Throughout human history and in different locations around the world, various wild food plants have been important. In 2020, Duguma. According to a previous analysis by Lulekal *et al*. (2011), about one billion individuals worldwide consume wild foods on a regular basis, the majority of which are plant-based. Wild edible plants are incredibly nutrient-dense and can essentially serve as a micronutrient supplement (Awas 2007; Feyssa *et al*., 2011). The significance of these plants has been incorporated into the culinary traditions of many rural populations. Many of these edible plants are used as food supplements or as a means of survival during famine or drought seasons (Duguma, 2020). Many wild edible plants are discovered to be often used by rural inhabitants in most of the developing nations, such as Nigeria (Getachew *et al*., 2013). In Nigeria, many cultures use wild edible plants as an additional, temporary, or life-sustaining source of food. As a result, they are vital in the fight against food insecurity (Lulekal *et al*., 2011).

An overview of Gingerbread plum

Gingerbread plum plant (*Neocarya macrophylla*) is wild and fruit bearing plant usually called "*Gawasa*" in Hausa (Muhammad and Umar, 2015). The trees are exclusively West African species (formerly known as *Parinari macrophylla* Sabine and currently known as *Neocarya macrophylla* Sabine), and Prance is a member of the "Chrysobalanaceae" family (Amza *et al*., 2011). The plant produces glabrous, ellipsoid drupes that are yellowish-brown in color and have gray warts on their surface, usually 2.3–3.5 cm of internal circumference and 4–5 cm long, with an endocarp surrounded by pulp (Diabya *et al*., 2016). The endocarp contains one or two kernels, and the flesh is yellowish in color and attractive to the eye when it is fresh. It is also soft and has a distinct flavor that is occasionally compared to avocado (Diabya *et al*., 2016). Gingerbread plum trees can be found in mostly arid and semi-arid regions of Western Africa and Central America, primarily Panama. The plant's fruits are plucked from the ground (Amza *et al*., 2011).

The textures of gingerbread plums fruits do not bruise easily as it is very firm, they are attractive due to the eye pleasing color. The sweetness calls to the taste buds and the fruit is getting recognition by the Africans (National Research Council, 2008). When

roasted, the slightly oily gingerbread fruit nuts are frequently eaten like almonds. Only a small portion of them produce cooking oil, while others are blended with prepared foods and some are eaten as snacks (National Research Council, 2008). The oil from the seed can be extracted from the seed kernels and used to manufacture edible paint, soap, and other products as well as cosmetics (Amza *et al*., 2011).

Utilization of Gingerbread plum Edible Parts

Gingerbread plum Leaves

In Africa, especially in the centeral Africa, gingerbread plum leaves are a staple food for many people (Bamalli *et al*., 2014). The recent spike in mortality and morbidity has resulted in an increase in life-threatening diseases produced by pathogenic microbes, with developing nations having low health status indices being the most susceptible to or victims (Yusuf *et al*., 2015). The need for new treatment methods grows as a result of the increasing prevalence of bacteria with multi-drug resistance, including strains of *E. coli, B. cereus,* and *S. aureus,* which increase the risk of fatal bacterial infections. One of the plants with antimicrobial potential, particularly the leaves of *Neocarya macrophylla* (Isaka *et al*., 2017).

The extract from gingerbread plum plant leaves showed various degrees of antibacterial activity against the tested microorganisms in numerous tests. The antibacterial efficacy of gingerbread plum fruits against *Candida albican, Salmonella typhi, Pseudomonas aeruginosa,* and *Escherichia coli* was demonstrated in a study published by Audu *et al*. (2005). Similar to this, Yusuf *et al*. (2015) have identified *Staphylococcus aureus* and *Escherichia coli* as being susceptible to *N. macrophylla* stem bark extract. As was to be expected, the researchers said that some of these bioactive molecules were responsible for the antibacterial effect. Additionally, Ishaka *et al*. (2017) had previously reported the presence of bioactive substances on the *N. macrophylla* extract of the leaves using GC-MS and were known to acquire antimicrobial potency. Based on susceptibility tests, *Klebsiella pneumoniae* was found to be the most sensitive bacteria in the extract antibacterial screening. *S. aureus* was found to have a moderate level of susceptibility, whereas *E. coli* had the lowest level. The susceptibility was generally found to depend on concentration. The tests suggested that *N. macrophylla* leaf extract has antimicrobial potency and may therefore be a useful alternative in antimicrobial treatment.

Gingerbread plum Peel

Muhammad and Umar (2015) earlier studied the analyses of antinutritional and nutritional composition of peels of the gingerbread plum fruits, found out the proximate composition to have ash content of 5.20 % dry weight, moisture content of 80.05 % in wet weight, total lipid contents of 2.3 % dry weight, crude protein of 2.5 % dry weight. Majority of fruits are known generally to have very low lipid content, consequently it could be useful in monitoring body weight (Hassan *et al.,* 2008). The analyzed sample also contained crude fiber of 5.83 % dry weight. Dietary fiber aids in lowering the vulnerablity of many diseases such as cardiovascular disease by negatively affecting serum and Low Density Lipoprotein concentrations. The peel calorific value was 399.60 kcal/ 100 g dry weight and available carbohydrate content of 89.10 % dry weight.

According to minerals profile shown per 100 g on a dry weight basis, the peel includes the highest concentrations of potassium (68.00 mg), sodium (22.33 mg), and phosphorus (68.00 mg) (0.81 mg). Moreover, it contains very little calcium (0.07 mg). While potassium and sodium are essential biological electrolytes, calcium is essential for the growth of teeth and bones. The concentrations of copper and iron were 0.2 mg and 0.3 mg, respectively. Zinc (0.10 mg) and magnesium (0.60 mg) are also present in trace concentrations in the peels (Muhammad and Umar, 2015). They demonstrated that the peel could provide the body with various micro and macro nutrients that it needs. According to Muhammad and Umar (2015), the peel of *Neocarya macrophylla* fruits may be a source of several important mineral elements, including sodium, potassium, magnesium, and iron, which are present in significant amounts. The molar ratio of antinutrients to nutrients shows that fruit peels reduce the availability of the majority of minerals and should thus be consumed with caution. Moreover, the peels might be added to feed formulations as a supplement.

Gingerbread plum Fruit

The most vital component of a plant that is frequently used as food is the fruit pulp (Bamalli *et al*., 2014). Several ways of eating the fruits are available. Occasionally, they are consumed raw or even boiled. Also manufactured as fragrant syrups, which are used as the base for various beverages that are far stronger than many fruit juices (Amza *et al*., 2011). According to popular belief, fruit juices include a variety of excellent sources of vital nutrients, including vitamins A, B, C, and folate (Bhardwaj *et al*., 2014), minerals such as boron, manganese, molybdenum, selenium, copper, potassium, iron, and zinc (Farid and Enani 2010). Nutritionally beneficial components such as dietary fiber, bioactive compounds, phytochemicals, antioxidants, and amino acids (Farid and Enani 2010).

Table 1: Antinutritional Factors and Vitamins of Gingerbread plum Kernel Flour from Guinea and Niger

Component Vitamin (mg/ 100 g)	KFGPN	KFGPG
Thiamine (B_1)	13.16	5.56
Riboflavin (B_2)	0.56	0.37
Pyridoxin (B_6)	1.15	0.83
Biotin (H)	235.50	130.80
Antinutritional factors		
Trypsin inhibitor (mg/ g)	24.49	22.77
Phytic acid (g/ 100 g)	3.19	4.51
Tannin (g/ 100 g)	1.92	1.82

Data from Diabya *et al.*, (2016)
KFGPN: Kernel Flour Gingerbread plum from Niger.
KFGPG: Kernel Flour Gingerbread plum from Guinea.

Table 2: Mineral Composition of Defatted Seed Flour of Gingerbread plum

Elements (g/g)	Defatted Gingerbread plum Seed Flour
Sodium (Na)	1360.03
Potassium (K)	12500.59
Zinc (Zn)	110.84
Iron (Fe)	166.06
Copper (Cu)	45.08
Manganese (Mn)	22.66
Calcium (Ca)	6669.99
Magnesium (Mg)	20999.65
Phosphorous (P)	4629.98

Data from Amza *et al.*, (2010)

Table 3: Proximate Composition of Defatted Gingerbread plum Seed Flour (g/100g, dry basis)

Components	Defatted Seed Flour of Gingerbread plum
Moisture	10.00
Crude protein	61.71
Crude lipid	2.14
Ash	6.43
Carbohydrate	12.10
Crude fibre	7.37

Data from Diabya *et al.*, (2016)

Consumption of fruit is also a superb strategy to maintain and balance the body's levels of hydration (Bhardwaj *et al*., 2014). Minerals, fatty acids, energy, dietary fiber, and protein required for human health are present in the seed bearing fruits. The seeds of the fruit have a high protein content (20.37 %), appreciable quantity of minerals (mostly potassium, calcium, magnesium, and phosphorus), a well-balanced amino acid composition, and 47.27 % fat (Amza *et al*., 2011). The amino acids content is important and play vital role in human healthy growth and development and are also readily available in many wild edible plants (Rajani *et al.*, 2015). The metabolism of free amino acids has been linked to periodontal disease, because amino acids are the building blocks of proteins and polypeptides (Min *et al*., 2017). Except for threonine and tryptophan, which were below the minimum amount required, most of the essential amino acids were present at levels higher than the reference pattern established by the Food and Agricultural Organization and the World Health Organization (Amza *et al*., 2010).

Table 4: Amino acid of Kernel Flour of Gingerbread plum from Niger and Guinea (g/100g protein)

Amino acid	KFGPN	KFGPG
Essential Amino acid		
Histidine	2.33	2.44
Threonine	2.45	2.38
Valine	5.03	5.24
Methionine	1.24	1.46
Phenylalanine	5.23	5.15
Isoleucine	3.96	4.04
Leucine	7.61	7.42
Lysine	4.41	5.75
Tryptophan	1.43	1.48
Non-Essential Amino acid		
Tyrosine	3.38	2.58
Cysteine-s	1.62	1.17
Aspartic acid	8.86	8.60
Glutamic acid	23.87	25.47
Serine	5.1	4.94
Glycine	5.25	4.94
Arginine	12.03	11.66
Alanine	3.98	3.87
proline	3.45	3.98

Data from Diabya *et al.,* (2016)
KFGPN: Kernel Flour of Gingerbread plum from Niger and
KFGPG: Kernel Flour of Gingerbread plum from Guinea

Malnutrition is a health problem of great concern in Africa, for instance, the number children with stunted type of malnutrition raised by almost a million within two decades (between the year 2000 to 2016) (Sibiya *et al.,* 2021). As recorded by Duguma (2020), the utilization of wild indigenous plants especially their fruits could fight malnutrition and increase food security. Most foods from the wild play a vital role in supplying nutrition to communities during food scarcity periods as they can be eaten in different forms such as snack in emergency situations.

Amza *et al.,* (2010), in his study on defatted gingerbread plum seed flour, it was found to be a great source of mineral elements which include magnesium, phosphorus potassium, and calcium but low source of copper and manganese. The high calcium content makes it appropriate natural source of calcium supplement for lactating and pregnant women, as well as elderly and children groups. It also contributes iron to an appreciable amount from a nutritional perception. Gingerbread plum can relieve a substantial amount of the zinc required for this nutrient which is essential to the normal immune system functioning (Amza *et al.,* 2010).

Oils from Gingerbread plum Seeds

Oilseeds are seeds with a protein to oil ratio of about 25 %, which increases to between 50 and 60 percent once the oil is removed (Amza *et al*., 2011). These seeds fall under the following categories: soya bean, peanut, cotton seed, palm kernel, locust bean, rapeseed, sesame seed, linseed, melon seeds, castor bean, African oil bean, sunflower seed, safflower, and related seeds (Amza *et al*., 2011). Some of these seeds are currently underutilized in relation to their potential because they are not widely recognized. Gingerbread plum seed is one of these underutilized oilseeds. Rural communities have used the oils from the seeds for many years in the manufacture of lubricants, soaps, and other personal care items as well as for food, cosmetic, and medical applications. The oils were applied tropically to cure a variety of ailments, including varicose veins, dandruff, muscular spasms, and wounds (Bamalli *et al*., 2014). Gingerbread plum seeds, like the majority of oilseeds, are very important as a dietary source since they contain between 21 and 25 percent protein and 40 and 60 percent oil (Amza *et al*., 2011; Amza *et al*., 2010). Around 61 % of the defatted gingerbread plum seed meal was protein. The seeds of the gingerbread plum are also a great source of several amino acids,

including valine, lysine, and phenylalanine (Amza *et al*., 2010), demonstrating their importance for balancing the lack of these necessary amino acids when employed in cereal-based diets.

According to reports by Diaby *et al*. (2017), the types of gingerbread plum seed acquired from Guinea and Niger, respectively, contained 60 and 56 % oil in the fruit's kernels. Because the oil had a high concentration of oleic acid, it stood out from most oilseeds. Many vegetable oils from various sources have been found to have varying amounts of oleic acid but substantial concentrations of mono-unsaturated and poly-unsaturated fatty acids. According to Diaby *et al*. (2017), pumpkin seed oil has an average amount of 83.74 % poly-unsaturated and mono-unsaturated fatty acids, of which 33.32 % were linoleic acid. Moreover, almond oil has a total fatty acid composition of 66.7 to 69.7 % oleic acid and 88.4 to 92.8 % poly-unsaturated and mono-unsaturated fatty acids (Diaby *et al*. 2017). The modulation of metabolism in the human body is significantly influenced by poly-unsaturated fatty acids. While some unsaturated vegetable oils can lower cholesterol levels, the high linoleic acid concentration is crucial for nutrition (Bamalli *et al*. 2014). Yet it was discovered that the gingerbread plum kernel oils from Guinea and Niger contained, respectively, 90.58 % and 75.51 % monounsaturated and polyunsaturated fatty acids, as well as 41.43 % and 42.46 % oleic acid (Diaby *et al*., 2016).

Table 5 displays the fatty acid profile of gingerbread plum seed oil. Linoleic, oleic, and arachidonic acids, which made up 19.10 %, 47.15 %, and 17.64 % of the total fatty acids in the oil, are among the unsaturated fatty acids that are abundant in it (Amza *et al*., 2010). An earlier study found that gingerbread plum seed oil has extremely high levels of linoleic and oleic acids (Amza *et al*., 2010). Saturated acids made up around 14.72 % of all fatty acids, with stearic and palmitic accounting for the majority of them, with trace amounts of arachidic. The oils were abundant in linoleic acid, which has a beneficial impact on blood lipids by reducing serum cholesterol and blood pressure. The tissue-level metabolism, which results in the hormone-like prostaglandins, is what gives linoleic acid its nutritional potential (Amza *et al*., 2010).

Many micronutrients that are beneficial to consumers on health point of view can be found in foods with a plant origin. Many bioactive lipophilic substances, including sterols, polar lipids, fat-soluble vitamins, and other plant-based nutrients are found in natural oils (Diaby *et al*., 2017). Vegetable oils contain sterols in both their free and esterified forms, and because the compositions of the two fractions differ, combining the results from these two classes of chemicals provides a more thorough method for determining the validity of vegetable oils. According to Diaby *et al*. (2017), esterified sterol content reduced while free fatty acid level increased after the separation of sterol during refining. The organoleptic qualities of many foods, particularly vegetable oils, are significantly influenced by volatile molecules.

Table 5: Fatty acid profile of Seed Oil of the Gingerbread plum (%)

Fatty acids	Seed
Saturated	
Palmitic acid (16.0)	9.12
Stearic acid (18:0)	5.35
Arachidic acid (20:0)	0.25
Mono-Unsaturated	
Palmitoleic acid (16.1)	0.21
Oleic acid (18:1)	47.15
Eicosenoic acid (20:1)	0.37
Poly-Unsaturated	
Linoleic acid (18:2)	19.10
Arachidonic acid (20:4)	17.64

Data from Amza *et al.,* (2010)

The findings of Diabya *et al*., (2016) on the physicochemical and antioxidant properties of gingerbread plum
kernel oil revealed that the *Neocarya macrophylla* kernel oil from Niger and gingerbread plum kernel oil from Guinea are distinct from one another. Gingerbread plum kernel oil from Guinea had a higher oil content than that from Niger, at 60.6 % compared to 56.15 %. This can be the result of high temperatures in the Birnin N'Gaouré (southern section of the Republic of Niger) area. In fact, the final oil content was significantly impacted by the temperature during oil synthesis, according to Rondanini *et al*. (2014). When compared to gingerbread plum kernel oil from Niger, gingerbread plum kernel oil from Guinea displayed greater levels for all oil indices, including the iodine value, saponification value, free fatty acid, acid value,

peroxide value, color, and pH essays (Diabya *et al*., 2016).

A physicochemical study of the seed oil from the gingerbread plum (*Parinari macrophylla*) revealed that it has a 152.87 mgKOH/g saponification value. The values of 142.760 mgKOH/g for Nepoleana imperials seed oil, and 137 mgKOH/g for cashew kernel oil, respectively, are oils with higher saponification values. The use of oil in the production of soap is indicated or justified by high saponification value (Jega *et al*., 2013). According to Jega *et al*. (2013), who provided meaningful details on the physicochemical analysis of gingerbread plum (*Parinari macrophylla*) seed oil, the iodine value of *Parinari macrophylla*, which was obtained, is lower than the iodine values of the following oils: cashew kernel oil (41.3 I/100g), and avocado pear (42.664 I/100g). The iodine value that was measured was under 100; oils with iodine values below 100 are referred to be non-drying oils and are good or useful in the manufacture of soap. The value is relatively comparable to that reported for *Parinari macrophylla* seed oil 32.07 gI_2/100g (Warra 2013).

Table 6: Chemical Characteristics of Seed Oils of Gingerbread plum

Parameter	Concentration
Acid value (mg KOH/ g)	13.42
Saponification value (mg KOH/ g)	152.87
Iodine value (g I_2/ 100 g)	31.8
Free fatty acid (% oleic acid)	14.52
Peroxide value (meq H_2O_2)	45.5
Percentage yield (%)	49.3

Jega *et al.,* (2013)

Table 7: Physical Properties of Seed Oils of Gingerbread plum

Parameter	Characteristics
Colour	Golden yellow
Odour	Agreeable
Physical state at room temperature	Liquid

Jega *et al.,* (2013)

Gingerbread plum Stem Bark

An unpleasant sensory and emotional sensation can result from real or potential tissue injury. Drugs called analgesics are used to lessen discomfort without making a person pass out (Yusuf *et al*., 2015). Study of Yusuf *et al*. (2018) on the stem bark of *Neocarya macrophylla* examined the anti-microbial activity stigmasterol of the stem bark. The findings showed that a stigmasterol isolated from Neocarya stem bark of the macrophylla had broad-spectrum antibacterial action, indicating its potential as a candidate for the creation of new antimicrobial and antifungal medications. The methanol stem bark extract of the *Neocarya macrophylla* was studied for its acute toxicity and its potential as an analgesic by Yusuf *et al*. (2015). The results of the study demonstrated that the methanol stem bark extract of N. macropylla has analgesic activity in test animals, supporting its traditional use as a pain reliever. Researchers found that the investigation into the phytochemical components and antibacterial activity of the root bark extract of *Neocarya macrophylla* (sabine) plant against Klebsiella pneumoniae, a bacterium that causes ear infections, was successful (Datti *et al*. 2020). The root bark of *N. macrophylla* underwent phytochemical screening, and the results showed that the crude ethanol extract contains alkaloids, flavonoids, saponins, steroids, phenols, and tannins, while the fractions lack some phytochemicals. Phenolic substances, including tannins and flavonoids, have reportedly been shown to demonstrate antibacterial properties (Sharada *et al*., 2008). Additionally, *N. macrophylla* root bark extract has a strong anti-Klebsiella pneumoniae effect. *Neocarya macrophylla* root bark is highly effective against Escherichia coli, according to research by Bayero *et al*. (2019) on the phytochemical screening and antibacterial activity of root bark extracts from the plant.

A research conducted by Halilu *et al*. (2010) on the phytochemical screening and mineral element analysis of the root bark of *Parinari macrophylla* sabine (*chrysobalanaceae*) and its effect on microorganisms, *P. macrophylla* was observed for its antimicrobial activity against Staphylococcus aureus, Escherichia coli, Aspergillus fumigatus, and Aspergillus flavus. The findings provide a rationale for the use of *P. macrophylla* in Northern Nigerian traditional medicine to treat skin conditions.

Table 8: Elemental Concentration of the Gingerbread plum Root bark in µg/ g

Mineral Element	Root bark
Cu	52.69
Cd	0.61
Pb	6.59
Mn	25.15
Mg	335.69
Fe	278.3
Zn	10.74
K	1705.7
Ca	1344.72
Na	59.00

Data from Halilu *et al.,* (2010)

Non- Food Application of Gingerbread plum parts

These trees produce reasonably hard wood that may be polished to a brilliant shine and used for furniture, construction materials, firewood, and charcoal, in addition to producing them (National Research Council, 2008).

Medicinal application

Traditional Medicine

According to WHO (2000) traditional medicine encompasses all of the theories, beliefs, and practices that are inherent to various cultures, whether or not they can be rationalized, and that are used to maintain health as well as to prevent, diagnose, develop, or cure physical and mental disorders. The use of medicinal plants as dietary supplements, staple foods, and functional foods is common in many nations to promote health. Wild plants are excellent candidates for nutraceuticals, or functional meals with substances that may promote health, since they include a variety of secondary metabolic products from plants, including polyphenols, terpenoids, and polysaccharides (Garca *et al*., 2014). Natural materials derived from plants and other sources have been utilized extensively as treatments for human illness for thousands of years (Yusuf *et al*., 2015). Hence, the plant may serve as a source of bioactive compounds in the ongoing battle against bacterial virulence and resistance.

In Northern Nigeria, a plant called N. micropyle is used in traditional medicine to treat pain conditions (Ajayi *et al*., 2019). It is also used to treat cancer, pulmonary issues, ear and eye infections, tooth decay, snakebite, pain, inflammation, and skin infections. Other conditions it is used to treat include diarrhea, asthma, dysentery, and skin infections (Ajayi *et al*., 2019). Vegetable fiber consumption was said to improve glucose tolerance and boost insulin sensitivity, as well as lower serum cholesterol levels, coronary heart disease risk, and blood pressure (Muhammad and Umar, 2015). As a result, fruit is a good source of dietary fiber and may satisfy some of the fiber needs for the human body. Pharmacologically, the decoction of the bark and leaves is applied to internal issues, inflamed eyes, and as a mouthwash. The leaves are commonly used as mouthwash and for toothaches, but they can also be chewed or applied to have the same results. Anthelmintic properties are present in the leaves (Ajayi *et al*., 2019).

Ajayi *et al*., (2019) in their findings about short-term toxicological evaluation of *Neocarya macrophylla* seed oil-based diets in albino rats deduced that the *N. macrophylla* seed oil can also be utilized in food formulation for people with cardiovascular illnesses considering that it has excessive HDL and low LDL. High-density lipoprotein has regularly been shown to be a reciprocal risk element for coronary heart disease. It has been postulated that an excessive degree of HDL cholesterol is attributed with reduced atherosclerotic disorder (Allison and Michael, 2004).

CONCLUSION

The gingerbread plum tree is undoubtedly a valuable source of nutrients and health benefits. According to the review, gingerbread plum has been extensively used since ancient times in traditional medicine and food applications. Several plant parts have interesting anti-oxidant, anti-viral, and anti-inflammatory properties. The biological effects of gingerbread plum have been the subject of numerous investigations, all of which have yielded encouraging findings. The main finding is that gingerbread plums have a higher antioxidant capacity than other common fruits, which is a major trend. The fruit is also high in protein. Since gingerbread plum seed oil contains fatty acids that are known to have positive benefits when applied to the skin, it can be employed in the pharmaceutical and cosmetic sectors. The phytochemicals in the stem, bark, leaves, and fruit of the gingerbread plum trees include bioactive

components with an antimicrobial action, lending credence to the plant's ethnomedical use in the treatment of microbial illnesses such diarrhea, dysentery, tooth decay, and skin infections.

RECOMMENDATIONS

Research on this plant should be done more to investigate its potentials on commercial application. Studies should also be conducted to determine availability of toxic compounds of its edible parts and if present, then further analyze the threshold toxicity level. On the other hand, the government should make it part of policy on industries to increase the certain proportion of the plant as part of raw materials necessary for the production of certain items.

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