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Research Article

Nutritional Potential of *Pachira glabra* leaves

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ABSTRACT

This aim of this study was to evaluate the nutritional potential of ethanolic extract of *Pachira glabra* leaves. The proximate composition, phytochemicals and minerals were analyzed using standard methods. The qualitative and quantitative findings showed the presence of rich bioactive compounds such as saponins 32.82 mg/100 g, alkaloids 15.53 mg/10 g, tannins 22.98 mg/100 g, phytate 10.26 mg/100 g, steroids 22.91 mg/100 g, Phenols 26.01 mg/100 g and flavonoids 56.37 mg/100 g. The proximate composition analysis indicated that carbohydrates were present in the highest concentration 48.73%, while fats were found to be the lowest 1.90%. Among the minerals analyzed, chloride content was the highest 30.36 mg/g, followed by calcium 23.34 mg/g and magnesium 7.42 mg/g. The amount of iron was the least, recorded at 1.06 mg/g. *Pachira glabra* leaves were found to enhance metabolic processes *via* enzyme activation, highlighting their ethno-medicinal potential.

Keywords: *Pachira glabra*, Proximate composition, Phytochemicals, Saponins, Flavonoids, Tannins, Alkaloids and Steroids

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INTRODUCTION

Medicinal plants hold significant value for the health of both humans and animals due to their pharmacological potential. These plants are rich in phytochemicals such as tannins, saponins, alkaloids and flavonoids which are effective against microbial infections (Singh A and Singh R, 2016) and possess various biological roles, including anti-ulcer, anti-inflammatory and antioxidant activities (Saxena M, *et al*., 2013). Anti Microbial Resistance (AMR) being a global issue, projected to increase mortality rates in Africa and Asia by 2050 due to inappropriate use of antibiotics and antifungals. This situation indicating the downsizing of effective alternatives, as the effectiveness of current antibiotics continues to decline. In developing countries, approximately (Anyanwu MU and Okoye RC, 2017) 80% of the population depend on traditional healthcare approaches that involve the use of plant extracts (Robinson MM and Zhang X, 2011). In Ghana, for instance, these extracts often serve as the first choice of treatment. Alarmingly, the spread of multi-drug resistance *Staphylococcus aureus* has been recorded at a rate of 34.8% (Karikari AB, *et al*., 2017). This traditional mode of treatment in healthcare has compelled researchers to work on the mechanisms by which medicinal plants affect microbes. There has been increasing research on the role of traditional medicinal plants in disease prevention and control. Nutritional factors such as protein, carbohydrates and minerals are essential to fight diseases, enhancing the application of herbal plants in medicine. Phytochemicals, which are secondary metabolites produced by plants, are biologically active, naturally occurring chemicals are found in various parts of a plant that provide significant health benefits for humans (Ibegbulem CO, *et al*., 2003). Their functions are diverse and include providing strength to plants, attracting insects for pollination and feeding, and acting as part of the plants defense mechanism against environmental hazards such as pollution, stress, drought and pathogenic attacks (Ejele AE and Akujobi CO, 2011). Additionally, these compounds contribute to the color, flavor and aroma of plants. Research has linked phytochemicals to human health by contributing to protection against diseases (Dandjesso C, *et al*., 2012). They are present in variety of plants utilized as important components of both human and animal diet, including seeds, fruits, herbs and vegetables (Okwu DE, 2001). Phytochemicals may also be used as chemotherapeutic and chemo preventive agents. Among the most important phytochemicals are alkaloids, tannins, flavonoids and phenolic compounds (Ujowundu CO, *et al*., 2010).

Pachira glabra is an evergreen tree that can grow rapidly to a height of 15 m and a width of 15 m. It belongs to the family Bombacaeae and is believed to have originated in Brazil, although it has extended to nearly all tropical and subtropical regions, as well as temperate region as part of the forest. There are 24 species of the genus *Pachira*.

Pachira glabra grows mainly along water bodies. It is planted as shade tree in urban forestry in public places and in hotels. The seeds of *Pachira glabara* are delicious. The seeds could be eaten raw or boiled. The young flower and leaves equally edible. The bark is usually taken for blood fortification. Although *Pachira glabara* is found in both the tropical and sub-tropical regions, there is no adequate information regarding its nutritional value (Ogunlade I, *et al*., 2011).

MATERIAL AND METHODS

Collection and preparation of plant sample

Fresh leaves of *Pachira glabra* were collected from a farm at Umu Owa, Ngor-Okpala local government area, Imo state, Nigeria. The leaves were authenticated at the herbarium in the department of botany, university of Port Harcourt, Rivers state, Nigeria, the leaves were carefully washed, shredded and air dried for about two weeks in the laboratory. The dried leaves were then milled into powder using a kitchen blender and soaked in an airtight plastic container for further use.

Chemical analyses of the samples

Proximate analysis: The proximate composition of the sample with respect to moisture, lipid, ash and crude fiber contents was determined following the standard methods of the Association of Official Analytical Chemists (AOAC) (*Table 1*) (Helrich K, 1990). The organic nitrogen content was quantified using the micro Kjeldahl method and an estimate of the crude protein content was done by multiplying the organic nitrogen content by a factor of 6.25 (Sosulski FW and Imafidon GI, 1990). Total carbohydrate content was calculated by difference.

Phytochemical and mineral analysis: Qualitative and quantitative phytochemical screening was carried out by adopting the methods as described by (Edeoga HO, *et al*., 2005; Oluduro AO, 2012) (*Table 2*).

Table 1: Proximate composition of *Pachira glabara* leaves

Parameters	Amount (%)
Carbohydrate	48.73
Crude protein	16.65
Fat	1.90
Dietary fiber	5.21
Ash	10.10
Moisture	12.23

Table 2: Qualitative phytochemical composition of *Pachira glabara* leaves

Phytochemicals	Presence (+) or absence (-)
Saponins	+
Steroids	+
Flavonoids	+
Tannins	+
Alkaloids	+
Phenols	+
Phytate	+

The bioactive substances determined included flavonoids, saponins, tannins, phenols, phytates and steroids. Each constituent was calculated in milligrams per 100 g of the sample, with triplicates for each analysis. The quantitative mineral determination was performed using the methods of Oluduro AO, 2012 (*Table 3*).

Table 3: Quantitative phytochemical composition of *Pachira glabara* leaves

Phytochemicals	mg/100 g
Saponins	32.82
Phytate	10.26
Flavonoids	56.37
Tannins	22.98
Alkaloids	15.53
Phenols	26.01
Steroids	22.91

RESULTS AND DISCUSSION

The results from this study revealed that the dominant component of the proximate analysis of *Pachira glabra* leaves was carbohydrate, comprising 48.73%. This value is lower than that of *Cucumis metuliferus* (jelly melon) seeds, which contain 50.24% carbohydrate and *Cucumis sativus* (cucumber) seeds which contain 50.1% carbohydrate (Niyi OH, *et al*., 2019). The presence of carbohydrates shows that the leaves are a good source of energy. In addition to carbohydrates, *Pachira glabara* leaves contains an appreciable amount of protein 16.65%, which can be vital for repairing worn out body tissues and contributing significantly to growth (Murray K, *et al*., 2009). The leaves also have a relatively high ash content 10.10%, which is higher than the reported values of 3.7% for sesame and 4.2% for *Canarium album*. The crude fiber content was found to be 5.21%.

Among the analyzed minerals, chloride content was the highest at 30.36 mg/g, followed by calcium 23.34 mg/g, magnesium 7.42 mg/g, and potassium 6.83 mg/g. Iron and zinc were found in very low amounts (*Table 4*). Adequate mineral intake is essential for normal physiological functions and is required for various enzymatic processes in the body. Potassium, in particular, plays an important role in maintaining body fluid volume and osmotic equilibrium, regulating muscles and nerve irritability, controlling glucose absorption and enhances its of normal protein retention during growth (National Research Council, 1998).

Table 4: Minerals composition of *Pachira glabara* leaves

Parameters	Amount (mg/g)
Sodium	3.06
Chlorides	30.36
Calcium	23.34
Potassium	6.83
Iron	1.06
Magnesium	7.42
Phosphorus	9.28
Zinc	1.21

The presence of magnesium in the sample provides its usefulness in the reactions involved in converting vitamin D to its active form and therefore leading to the formation of Adenosine Triphosphate (ATP) as constituent to release parathyroid hormone and relaxing the muscles. Another important mineral found in the *Pachira glabra* leaves is calcium. Calcium is known to ease insomnia, regulate the passage of nutrients through cell walls and stimulate muscle function. The presence of zinc in the sample adds significant value to *Pachira glabra* leaves, as zinc is required to maintain the proper functioning of the sense of smell, support a healthy immune system, build proteins, trigger enzymes and create DNA. Additionally, chloride values were high in the leaves. Chlorine compounds play an essential role in the electrical neutrality and pressure of extracellular fluids, as well as in regulating the acid-base balance of the body (Whitney EN, *et al*., 2002).

The result of the phytochemical analysis showed the presence of tannins, flavonoids, alkaloids and steroids in the leaves, with flavonoids being the most abundant. Flavonoids, found in high amounts acts as an antioxidants and help to scavenge molecules that are injurious to cells in the body. Flavonoids acts as signaling molecules, detoxifying agents, phytoalexins and helps in stimulating seed germination, temperature acclimatization, and providing drought resistance. Additionally, they reduce Reactive Oxygen Species (ROS) in plant tissue, which are generally generated due to infection or Ultraviolet (UV) irradiation.

Other important role flavonoids are their contribution to the fragrance, color, and taste of fruits, flowers and seeds. This fragrance and color attract pollinators that assist in pollination and seed dispersal (Roy A, *et al*., 2022). They exhibit antioxidant actions by suppressing ROS formation through the inhibition of enzymes or by chelating trace elements involved in free radical generation. They also scavenge ROS and up-regulate or protect antioxidant defenses (Roy A, *et al*., 2022).

Alkaloids were also detected in the leaves. Alkaloids are highly valuable in medicine and are used for the production of several valuable drugs (George DP, 1998). They are reported to possess antimalarial, anticancer, antiasthma, analgesic, hypoglycemic and antibacterial activities (Shi QI, *et al*., 2014). Plants having alkaloids are used in medicine for reducing headaches and fever due to their anti-bacterial and analgesic properties.

Pachira glabra leaves hold significant potential for various applications. They can be used as natural colorants and possess added valued properties, (Bridle P and Timberlake CF, 1997). These properties include potential antioxidant capabilities, used as nutraceuticals, antimicrobial effects and chronic disease prevention (O'neill JI, 2014). Traditionally, these leaves

have been used as a phyto pharmaceutical, appetite stimulant, choleretic agent, and for treatment of many other diseases.

Epidemiological studies have shown relationships between anthocyanin-rich foods and Cardiovascular Diseases (CVDs), as well as a correlation between total anthocyanin intake and risk of developing these CVDs. Additionally, anthocyanins demonstrate *in vitro* anti-thrombotic effects (Rechner AR and Kroner C, 2005).

Moreover, steroid containing compounds found in *Pachira glabra* are important in pharmacology due to their relationship with sex hormones (Okwu DE and Okwu ME, 2004). Tannins present in the leaves have been implicated in speeding up blood clotting processes, reduction blood pressure, modulation immune responses and lowering plasma lipid levels.

CONCLUSION

This study reveals that *Pachira glabra* leaves possess significant amount of nutrients and secondary metabolites such as alkaloids, flavonoids, saponins, tannins. These findings shows that *Pachira glabra* leaves may play a vital role in preventing various diseases such as inflammation, lipid peroxidation, and bacterial infections serving as a natural therapeutic agent for some diseases. The result of the study revealed the presence of high carbohydrate content in the leaves, shows that they can serve as a good source of energy.

The presence of important minerals in the *Pachira glabra* leaves indicates there potential as an alternative source of nutrients needed to fight malnutrition in developing countries. Therefore, it is expected that the significant phytochemical properties, proximate composition and mineral elements identified could provide supplementary benefits for their application in herbal medicine while also providing basic nutrition and energy.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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