

Original Research Article Phytochemical and Mineral Constituents of *Grewia mollis* Stem Bark

ABSTRACT

Aims: Aqueous extract of *Grewia mollis* Stem Bark was analyzed for its phytochemical and mineral compositions.

Place and Duration of Study: Department of Biochemistry, University of Jos, Jos, between June 2013 and July 2013.

Methodology: The phytochemical screening and mineral composition of the stem bark was carried out using standard methods.

Results: The phytochemical screening revealed the presence of Tannins, Saponins, Cardiac glycosides, Flavonoids, Steroids, Phenols and Resins. Alkaloids and Carbohydrates were however not detected. Analysis of the mineral constituents showed that the plant contains among others Manganese (1.899 g/100g), Zinc (0.375 g/100g), Magnesium (287.060 g/100g), Iron (47.941 g/100g), Copper (0.270 g/100g) and Lead (0.206 g/100g).

Conclusion: The constituent phytochemicals and minerals may account for varied ethno-botanical uses of the plant in folk medicine.

Keywords: *Grewia mollis*; phytochemical constituents; Mineral constituents; Medicinal plants

1. INTRODUCTION

Plants that possess therapeutic properties or exert beneficial pharmacological effects in the animal body are generally termed as “medicinal plant”. And It is now been established that the plants which naturally synthesize and accumulate some secondary metabolites and vitamins, possess medicinal properties [1]. Medicinal plants constitute an important natural wealth of a country. They play a significant role in providing primary health care services to rural people. They also serve as therapeutic agents as well as important raw materials for the manufacture of traditional and modern medicine. Substantial amount of foreign exchange can be earned by exporting medicinal plants to other countries. In this way indigenous medicinal plants play significant role in the economy of a country [1].

Medicinal plants contain both organic and inorganic constituents, and many medicinal plants are found to be rich in one or more individual elements, thereby providing a possible link to the therapeutic action of the medicines [2, 3]. Trace elements play a vital role in the formation of bioactive chemical constituents in medicinal plants and are therefore responsible for both their medicinal and toxic properties [4]. Thus, a quantitative estimation of minor and trace element can be important in determining the effectiveness and toxicity of the medicinal plants in treating various diseases and to understanding pharmacological actions [5].

Grewia mollis (Tiliaceae) is a shrub or tree widely distributed in northern Nigeria and some African countries. It is known to be a strong fire-resistant and various parts of the plant are used in food and medicine. In Nigeria, the stem bark powder or mucilage is used as a thickener in local cakes made from beans or corn flour commonly called “Kosa” and “Punkasau” in Hausa (Nigeria), respectively [6,7]. The dried stem bark is ground and the powder mixed with beans or corn flour thereby enhancing the texture of the food product.

Some findings demonstrated that the mucilage obtained from the stem bark can serve as a good binder in paracetamol formulations [8, 9]. Also the recent reports suggest that high concentration of stem bark in dietary exposure may cause some adverse effects, especially liver injury [7]. Phytochemical studies of *G. mollis* indicated the presence of tannins, saponins, flavonoids, glycosides, phenols, steroids and the absence of alkaloids in the leaves and stem bark [10] while their presence was revealed in the roots [11]. *G. mollis* grows in the wild and can be propagated by seed or seedlings. The seeds are collected from the dried fruits that may have fallen on the ground [12]. The infusion of the bark obtained by cold or hot maceration in water is applied to give a smooth surface to mud walls and floors [13] while the wood ash is used as salt substitute including the ash of the leaves, stems, and roots. Also, the flowers, buds, and young shoots are added to soups and sauces as garnishing while, in Sudan, the young leaves are cooked and eaten as vegetables. The fruit is eaten raw or boiled. The flowers, buds, and young shoots are added to soups and sauces as garnishing while in Sudan, the young leaves are cooked and eaten as vegetables. The fruit is eaten raw or boiled [12]. Studies have also demonstrated a wide spectrum of therapeutic effects such as hepatoprotective [14], antibacterial [15] and Anti-Inflammatory [15] activities. The present study was undertaken to evaluate the phytochemical and mineral compositions of *Grewia mollis* stem bark.

2. MATERIAL AND METHODS

2.1 Chemicals and Reagents

All reagents and chemicals used were of analytical grades and prepared in glass apparatus using distilled water

2.2 Plant Material

The stem bark of *Grewia mollis* were obtained from Akwanga-Nasarawa, Nasarawa State, Nigeria and were authenticated at the Herbarium of the Department of Botany, University of Jos, Nigeria, where a voucher specimen was deposited at the Herbarium of the Institute.

2.3 Phytochemical Screening

The presence of Alkaloids, Flavonoids, Steroids, Phenols, Resins, Tannins, Saponins, Cardiac glycosides and Carbohydrates content of the plant were determined by the methods described by Sofowora [16], Trease and Evans [17] and Harborne [18].

2.4 Total Minerals

The determination of the levels of inorganic minerals of *Grewia mollis* stem bark was carried out by acid digestion using nitric acid and perchloric acid mixture (HNO: HClO₄, 5:1 w/v). The total amounts of Manganese, Zinc, Magnesium, Iron, Lead, and Copper in the digested samples were determined by atomic absorption spectrophotometry [19].

2.6 Statistical Analysis

The data were expressed as Mean $\pm$ Standard Error of Mean.

3. RESULTS

Table 1 shows the phytochemicals present in *Grewia mollis* stem bark. Tannins, Saponins, Cardiac glycosides, Flavonoids, Steroids, Phenols, and Resins were detected. Alkaloids and Carbohydrates were however not detected. The mineral analysis of *Grewia mollis* (Table 2) showed its rich content of elements like Manganese (1.899 g/100g), Zinc (0.375 g/100g), Magnesium (287.060 g/100g), Iron (47.941 g/100g) and Copper (0.270 g/100g). The plant also contains minute amount of Lead (0.206 g/100g).

Table 1: Qualitative phytochemical screening of *Grewia mollis* Stem Bark

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Phytochemicals	Status
Alkaloids	-
Flavonoids	+
Tannins	+
Saponins	+
Steroids	+
Cardiac glycosides	+
Phenols	+
Resins	+
Carbohydrates	-

89 Key= + present; - absent

90

91 **Table 2: Mineral composition of *Grewia mollis* Stem Bark**

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Minerals	Composition (g/100g)
Manganese	1.899±0.003
Zinc	0.375±0.001
Magnesium	287.060±0.001
Iron	47.941±0.002
Lead	0.206±0.001
Copper	0.270±0.001

93 Values are expressed as Mean ± SEM (n = 3).

94

95 DISCUSSION

96

97 A medicinal plant is any plant in which one or more of its organs contains substances that can
 98 be used for therapeutic purpose of which are precursors for the synthesis of useful drugs. The
 99 crude extracts or purified form of plant has been used as medicines and cosmetics [1]. The
 100 medicinal value of these plants lies in bioactive phytochemical constituents that produce
 101 definite physiological action on the human body [20]. In this study, the phytochemical
 102 investigation of *Grewia mollis* Stem Bark indicates the presence of Tannins, Saponins,
 103 Cardiac glycosides, Flavonoids, Steroids, Phenols and Resins. This is in agreement with the
 104 work done by Onwuliri *et al.* [10]. These phytochemicals are well known for their
 105 pharmacological activities.

106

107 Saponin has been shown to affect sex hormones like oxytocin which is implicated in the onset
 108 of labour in women and subsequent release of milk [21]. Studies have shown that saponins
 109 have antitumor and anti-mutagenic activities and can lower the risk of human cancers, by
 110 preventing cancer cells from growing. They seem to react with the cholesterol rich
 111 membranes of cancer cells, thereby limiting their growth and viability. Rao and Sung [22]
 112 found that saponins may help to prevent colon cancer. Anti-hyperglycemic potential of
 113 saponins has also been reported [23, 24]. The presence of saponin in *Grewia mollis* Stem
 114 Bark may explain its use as an anti-diabetic agent. The high saponin content may however be
 115 conferring possession of hemolytic property. This can influence the use of the plant in folk
 116 medicine a cholesterol binding agent.

117

118 Tannins and flavonoids are thought to be responsible for anti-diarrheal activity [25].
 119 Investigations of mode of action indicate that tannins and flavonoids increase colonic water
 120 and electrolyte reabsorption while other phytochemicals act by inhibiting intestinal mobility
 121 [25]. This explains the anti-diarrheal use of *Grewia mollis* stem bark in traditional medicine. In

addition, tannin has astringent properties, hastens the healing of wounds and inflamed mucous membrane. Plants with tannins are used for healing of wounds, varicose ulcers, hemorrhoids, frost-bite and burns [26, 27]. The biological functions of flavonoids include protection against allergies, inflammation, platelets aggregation, microbes, ulcer and tumour [21]. They are free radical scavengers, super antioxidants and potent water soluble thus preventing oxidative damage and have strong anti-cancer activity [28]. Thus, the acclaimed anti-inflammatory and wound healing uses of *Grewia mollis* stem bark extract may be attributed to flavonoids and tannins.

Cardiac glycosides were found to be present in *Grewia mollis* stem bark, a compound that has been shown to aid in treatment for congestive heart failure and cardiac arrhythmia. This is another reason why this plant is widely used in traditional medicine. Cardiac glycosides work by inhibiting the Na⁺/K⁺ pump. This causes an increase in the level of sodium ions in the myocytes, which then leads to a rise in the level of calcium ions. This inhibition increases the amount of Ca²⁺ ions available for contraction of the heart muscle, improves cardiac output and reduces distention of the heart [29].

Phenolic compounds have antimicrobial properties. Phenol and phenolic compounds have been extensively used in disinfections and remain the standards which other bactericides are compared [30]. Thus, the presence of phenolic compounds in *Grewia mollis* stem bark might be responsible for its antimicrobial activities. Other phytochemicals such as Steroids and Resins might be responsible for the some pharmacological activities of the plant.

Minerals which are either macrominerals or microminerals are essential for the normal growth and maintenance of the body. The mineral analysis of *Grewia mollis* stem bark shows the presence of Manganese (1.899 g/100g), Zinc (0.375 g/100g), Magnesium (287.060 g/100g), Iron (47.941 g/100g) and Copper (0.270 g/100g). The plant also contains minute amount of Lead.

Magnesium is involved in over 300 enzymatic reactions in the body [31, 32], including glycolysis, the Krebs cycle, creatine phosphate formation, nucleic acid synthesis, amino acid activation, cardiac and smooth muscle contractibility, cyclic AMP formation, and protein synthesis. Magnesium is also important in the proper utilization of vitamins B and E and functions with other minerals such as calcium, sodium and potassium in maintaining fluid and electrolyte balance [33].

Copper is an essential trace element for humans and animals. The ability of copper to easily accept and donate electrons explains its important role in oxidation-reduction reactions and scavenging free radicals [34].

Iron is very important in the formation of haemoglobin in red blood cells and deficiency of iron leads to anaemia. *Grewia mollis* stem bark could be used as a source of iron in the treatment of iron-deficiency anaemia.

Manganese plays an important role in a number of physiologic processes, as a constituent of multiple enzymes and an activator of other enzymes [35]. A number of manganese-activated enzymes play important roles in the metabolism of carbohydrates, amino acids, and cholesterol. It is also thought to aid in the maintenance of epithelia tissue [36].

Zinc is essential in the activation of certain enzymes. These include dehydrogenase, alkaline phosphatase and carboxypeptidase. Zinc containing organic compounds is employed as astringent and anti-fungal agents. It aids wound healing and metabolism of nucleic acid and insulin. Zinc in excess causes anaemia and if deficient in the body can lead to dermatitis [37].

Effect of lead deficiency in the body results in anemia while excess lead (Pb) in the body can cause brain damage [38].

5. CONCLUSION

This study shows that *Grewia mollis* stem bark is a rich source of phytochemicals and mineral elements which justify the various therapeutic uses attributed to it in folklore medicine. However the presence of trace amount of lead (Pb) calls for caution because of its toxicity.

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