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Phytochemical, Proximate, and Vitamin C Content in Morinda citrifolia (Noni)

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Abstract

Morinda citrifolia, L commonly called noni, has a long history as a medicinal plant and is reported to have a broad range of therapeutic effects, including antibacterial, antiviral, antifungal, antitumor, antihelmin, analgesic, hypotensive, anti-inflammatory, and immune enhancing effects. Photochemical analyses of ethanol and hexane extracts of noni fruit revealed the presence of flavonoids, terpenoids, alkaloids and steroids. Proximate composition of the noni fruit revealed a moisture content of 54.21, crude protein 2.18, crude fat 3.25, crude fiber 4.49, ash 0.73 and carbohydrate 35.14%. The Vitamin C content was estimated using iodometric titration and found to be 134.10 mg/100g. This suggests that the noni fruit if consumed can help promote good health.

Keywords: noni fruit, proximate analysis, phytochemical screening

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1. Introduction

Over the past centuries, medicinal plants have proved to be one of the richest bio-resources useful for medicinal, nutraceutical food supplements, folk medicine, and pharmaceutical intermediates chemical entities [1-3]. They have widely been used as alternative medicines before the introduction of synthetic drugs [2, 4].

Morinda citrifolia, commonly known as 'noni' has a wide distribution in most Africa and southern Asia countries [5]. However, in Ghana, the noni plant can be found in coastal areas such as Accra, Elmina, and Takoradi. The noni plant bears fruit within nine months to one year after planting under favourable condition [6]. Noni belongs to the genus Morinda (Rubiaceae), which has been reported to be made up of about 80 species [7].

Noni is called by various names by different societies all through the world which includes 'Indian mulberry' (English, India), 'Ba Ji Tian' (Chinese), 'Nono' (Cook Islands, Tahiti) and Nonu (Samoa, Tonga) [6, 8].

The plant has a long history related medical uses [8-10]. All parts of the tree, for example, fruits, leaves, root, bark, stem, are natural products utilized for various therapeutic purposes [10-13]. For example, the leaves are most commonly used for external treatments like broken bones and sprains, wounds and ulcers, and boils and burns [14].

The fruit is a yellowish-white ovoid lumpy mass composed of numerous, fused ripened ovaries each separate from white flowers [15].

The fruit bears a caustic odour when ripening, and is hence also called as the 'cheese fruit'. The dull yellowish white juicy pulp is bitter and has numerous hard triangular reddish-brown pits around it [8]. The fruit of noni has been used as food, drink, medicine, colourful dye and for cosmetics purposes [11].

Noni juice is especially known for its medicinal properties: antibacterial, analgesic, anticongestive, antioxidant, antinflammatory, astringent, laxative, sedative, and hypo-tensor which has been cited by many researchers [16-18]. It has a high demand in medicine for different kinds of illnesses such as diabetes, high blood pressure, AIDS, arthritis, cancer, gastric ulcer, sprains, mental depression, senility, poor digestion, atherosclerosis, and blood vessel problems [9,19–22]. The medicinal uses are as a result of the secondary metabolites present in the various parts of the plants [23,24].

Phytochemicals are a group of non-nutrient bioactive compounds produced as primary and secondary compounds naturally present in plant parts such as flowers, leaves, fruits, roots, barks that have defence mechanism and protection against various diseases. Aside these metabolites, the noni plant also contains caproic and caprylic acids, as the main fatty acids which contributes significant in its medicinal properties [12,14,25,26].

In addition to these, noni contains vitamins A, B₃, C [12,27]. Noni has been reported to have considerable amount of vitamin C comparable to the levels in citrus fruit such as orange, grape, etc. [15]. Minerals such as iron, potassium, calcium and sodium are present in varying quantities as reviewed earlier [8].

Although there are several literatures on the medicinal properties of the noni fruit, little data is available on the noni cultivated in Ghana [7,22,28–30].

Therefore, this study seeks to investigate the photoconstituients, proximate analyses and vitamin C content in noni fruits sampled from Accra - Ghana.

2. Experimental section

2.1. Chemicals

Hydrochloric acid, sodium hydroxide, petroleum ether, selenium dioxide, boric acid, ferric chloride, chloroform, Wagner's reagent, copper acetate, ethanol, hexane, KI, KIO₃, ascorbic acid, starch solution and ammonium hydroxide were used as received from Sigma Aldrich without any further purification unless otherwise stated.

2.2. Sampling and sample preparation

The fruits of noni were collected at Ashaiman in the Greater Accra region of Ghana and identified by a horticulturist at the Department of Natural Resources, University of Energy and Natural Resources. Fairly ripped noni fruits were washed thoroughly, air dried and blended. The blended sample was transferred into a clean, labelled container and kept in a refrigerator for further analysis.

2.3. Extraction of phytochemicals from blended noni fruit

The extraction of phytochemicals from the blended noni fruit was performed using a Soxhlet extraction method. About 80 ml each of ethanol and hexane was separately used to extract from 10 g of the blend noni fruit sample for 10 hours. The solvent was then removed with a rotary evaporator after which the extracts were dried by slow evaporation at room temperature. The phytochemicals in the blended noni fruit were identified by following procedures already reported in literature [25,31,32].

2.4. Proximate analysis of blended noni fruit

Proximate analysis which comprised of crude fibre, fat, moisture, protein, ash and carbohydrates were also determined following procedures reported in literature [33].

2.5. Vitamin C content of blended noni fruit

The Iodometry titration procedure was followed for the determination of vitamin C content in the sample as reported earlier [34]. Typical, 1g of the blended noni fruit was dissolved in 50 ml of distilled water and titrated against iodine solution using starch as indicator.

3. Results and Discussion

Phytochemicals are non-nutritive plant chemicals that have protective or disease preventive properties for plants. They also have the ability to protect humans from a host of diseases.

The results obtained for the phytochemical screening of the blended noni fruit is shown in table 1 which indicated the presence of secondary metabolites such as terpenes, alkaloids and steroids in both ethanol and hexane extracts. The presence terpenes and alkaloids have been reported to possess health promoting effects [14].

Table 1: Phytochemical screening of blended noni fruit

Secondary metabolites	Results from	
	Ethanol extract	Hexane extract
Saponins	_	_
Tannins	+	_
Flavonoids	+	_
Steroids	-	+
Terpenes	+	+
Alkaloids	+	+
ND: indicatos procono	a of matabalitas:	indiantas absonos

 $\ensuremath{\text{NB:}}\xspace$ + indicates presence of metabolites; - indicates absence of metabolites

Both extracts showed the presence of more than one secondary metabolite which is responsible for the medicinal and therapeutic application of the noni fruit. For example, the presence of flavonoids in the ethanolic extract of the noni have multiple biological effects including antioxidant, free radical scavenging abilities, antiinflammatory, anticarcinogenic. Also, flavonoids in food are generally responsible for colour, taste, prevention of fat oxidation, and protection of vitamins and enzymes. Steroids have been observed to promote nitrogen retention in osteoporosis and in animals with wasting illness [31]. Steroids have been targeted as anti-inflammatory and analgestic agents in pharmacological applications. The presence of alkaloids in plants provide information to determine lead structures for novel synthetic drugs. These compounds have antimicrobial activity by inhibiting DNA topoisomerase of the microorganisms. Alkaloids have also been reported to possess anticancer, antiasthma and antibacterial properties [31]. Tannins are also known for their antibacterial potential due to their character that allows them to react with proteins to form stable water-soluble compounds, which kills bacteria by directly damaging their cell walls [32].

Although both extracts had common secondary metabolites, the choice of solvent had an influence on the secondary metabolite present in

the extract. For example, flavonoids were present in the ethanol extract and not in the hexane whereas steroids were also present in the hexane and not the ethanol. Similar result on the effect of solvent on phytochemical screening have be reported by earlier researchers [12,25,35].

Some studies have identified the presence of tannins and saponins in the fruit of noni plant [36,37]. However, these were absent in this current study. This can primarily be due to the difference in geological locations of the plants which has a great effect on the nutritional value.

The results of the proximate analysis are presented in figure 1. The relatively high moisture content of 52.6% contributes to the bulk tissue weight of fleshy pulp of the noni makes it ideal for fruit juicing. Although very high moisture content of up to 90% have been earlier reported, nevertheless, in terms of natural product stability, high moisture content tends to promote microbial contamination and chemical degradation, as it provides a medium for many reactions to occur [12,33,38]. This also account for the reason why the fresh fruit cannot be stored for a longer period of time without it deteriorating.

Ashes represent the minerals contained in foods, and the main elements found in noni have been reported as calcium, potassium, sulfur and phosphorus [33]. The ash content in noni fruit is generally low, with a value of 0.73%, which is consistent with earlier studies reported in literature [33].

Fats are important part of diet because they are vital to the development of the nervous system [39,40]. As a concentrated source of calories, fat also helps to resolve the potential problems of the infant's high calorie needs and small stomach capacity [41]. It is well known that dietary fats rich in linoleic acid prevent cardiovascular disorders such as coronary heart diseases, arteriosclerosis and high blood pressure. Also, linoleic acid derivatives serve as structural components of the plasma membrane and as precursors of some metabolic regulatory components. The fat content was estimated to be 3.25%. The crude fibre content was recorded to be 4.49% and its presence in food has a number of beneficial effects relating to indigestibility in the small intestine. Crude fibre is also essential for enhanced faecal bulk, prevents constipation and stimulates peristalsis [42]. The crude protein content and carbohydrates were found to be 2.18 and 35.14% respectively.



Figure 1: Proximate analyses of the blended noni fruit

The iodometric method for the determination of vitamin C in fruits has been reported to be cost effective, accurate, precise and rapid as compared other methods such as spectroscopic, to chromatographic electrochemical and [34]. Therefore, the iodometric method was adopted for this study. The Vitamin C content was estimated using iodometric titration and found to be 134.10mg/100g. An earlier review had report vitamin C content in noni fruit to range between 24–158mg/100g [6]. A research on the vitamin C content in fruits in Jimma Town. Ethiopia revealed that papaya (1673.0 \pm 136.1 mg/100 mL), orange $(141.3 \pm 22.1 \text{ mg}/100 \text{ mL})$, lemon $(199.8 \pm 126.6 \text{ mL})$ mg/100 mL), mango(1104.5±204.6 mg/100 mL) and tomato (542.0± 101.5 mg/100 mL) [34]. This points to the fact that the vitamin C content in the noni fruit is comparable to that of oranges. If consumed, this can help boost the immune system which is required in the fight against the covid 19 pandemic.

4. Conclusion

The results obtained in this work suggest that the identified phytochemical compounds are bioactive constituents therefore these plants are proving to be an increasingly valuable reservoir of bioactive compounds of substantial medicinal merit.

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