

Full Length Research Paper

Evaluation of chemical and elemental constituents of *Centella asiatica* leaf meal

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Received 28 January, 2020; Accepted 2 April, 2020

Medicinal plants include various types of plants used in herbalism or herbal medicine. It is the use of plants for medicinal purposes, and the study of such uses. The use of medicinal plants is gaining popularity all over the world; hence the need to exploit various plant that could be of economic importance to both man and animal. *Centella asiatica* is one of such plants that are underutilized. Therefore, investigating the chemical and elemental constituents of *C. asiatica* leaf meal is very vital. The phytochemical analyses, proximate composition, vitamin and mineral concentrations were determined using standard procedures. Considerable quantity of phytochemical compounds such as phenolic, saponin, flavonoids, phytate and tannin were determined and the values obtained for these components were 2.75, 8.20, 12.85, 0.76 and 0.0%, respectively. While for the proximate: 95.76, 2.77, 12.40, 2.80, 2.40 and 75.44% were obtained for dry matter, crude fiber, crude protein, ash, ether extract and carbohydrate. The leaf meal contains appreciable quantity of calcium, magnesium, iron, phosphorus and sodium. Vitamins A, C and B₆ are readily available in the leaf meal while E and B₁ are not available. The nutrient composition of *C. asiatica* revealed that it contains some bioactive components which can serve as feed supplements in animal production and improve human health.

Key words: Chemical analysis, *Centella asiatica*, vitamins, minerals, additives, proximate.

INTRODUCTION

Plants have been used for medicinal purposes long before prehistoric period. These medicinal plants are also used as food, flavonoid, medicine or perfume and also in certain spiritual activities. Plants are used both by traditional herbalists and pharmacists for synthetic preparations in the pharmaceutical industries and for management and treatments of different diseases that affect man and animals (Tibi, 2012). The knowledge of

medicinal plants has continued to be useful in the production of drugs, food, spice and feed additives. The research into plants bioactive substances has contributed immensely to the betterment of animal and human. Herbs and vegetables, especially leaves, are important sources of vitamins, minerals, fiber, and some essential amino acids.

Currently, as a result of resistance in the use of

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antibiotics in treating both human and animal diseases the use have been restricted in numerous countries in the world. Therefore, there is need for alternative means to address the issue (Laxminarayan et al., 2015). The use of herbs is gaining importance in animal production and human health due to harmful residual effects and cost effectiveness from antibiotics. Herbs, spices, essential oils, extract or oleoresins contain myriad highly active secondary plant metabolites unfolding a broad range of therapeutic effects. They can stimulate feed intake and endogenous secretions or have antimicrobial or anthelmintic activity. A major field of application of herbs is the protection of animals and their products against oxidation and improves human health. Plant such as: Ginger (*Zingiber officinale*), garlic (*Allium sativum*), cinnamon (*Cinnamo mumzeylanicum*), thyme (*Thymus vulgaris*), Parsley (*Petroselinum crispum*) have been reported to increase digestion, increase appetite, antiseptic and gastric stimulant (Mirzaei-Aghsaghali, 2012)

Centella asiatica L. (Gotu Kola) Urban (*Gotu Kola coriacea* Nannfd., *Hydrocotyle asiatica* L., *Hydrocotyle lunata* Lam., and *Trisanthus cochinchinensis* Lour.) is a tropical medicinal plant from Apiaceae family native to Southeast Asian countries such as India, Sri Lanka, China, Indonesia, and Malaysia as well as South Africa and Madagascar (Jamil et al., 2007). It is native to the warmer regions of both hemispheres. This plant grows wild in damp, shady places up to 7000 ft. and can be commonly seen along banks of rivers, streams, ponds, and irrigated fields. It also grows along stone walls or other rocky areas at elevation of approximately 2000 ft. This plant is among the underutilized plant with few information on the chemical and proximate constituent therefore, to understand the roles played in human, animal nutrition and health, information on proximate, mineral, vitamin and phytochemical composition is crucial to the understanding of the mode of action of these medicinal plant in general. This will be useful for the nutritional and health education of the public as a means to improve their well-being.

MATERIALS AND METHODS

Leaf meal preparation

Fresh leaves of *Centella asiatica* were identified by an Agronomist from the Agronomy Unit of the Department of Agriculture, Babcock University, Ilishan Remo, Ogun State, Nigeria. The plant was harvested around the Teaching and Research Farm of the Department of Agriculture and Industrial Technology, Babcock University, Ilishan-Remo, Ogun State, Nigeria. Harvesting was done between the hours of 16:00 and 18:00 when the plant must have completed its lightstage of photosynthetic process for the day. The leaves were washed, chopped and air dried at an average room temperature of 27°C until when it's properly dried and pulverized with a blender to obtain a fine powder. The powdered sample was stored at 4°C in a dry, clean container with lid for

further analysis.

Chemical analysis

Phytochemical analyses

Phytochemical analyses were conducted to determine the presence of phytate, saponin, flavanoid, tannin and alkaloid while the quantification of saponin was done by afrosimetric method (Kozioł, 1991). The gravimetric method of Haborne (1973) was used in determination of alkaloid and flavonoid contents. All the analyses were done using triplicate samples.

Proximate analysis

The moisture content was determined by drying at 105°C in an oven until a constant weight was reached. For total ash determination, the leaf sample was weighed and converted to dry ash in a muffle furnace at 450°C and at 550°C for incineration. The crude fat content was determined by extraction with n-hexane, using a Soxhlet apparatus. All these determinations were carried out according to AOAC (1990). Kjeldahl method was used for crude protein determination. Carbohydrate content was determined by calculating the difference between the sums of all the proximate compositions from 100%.

Vitamin and minerals analysis

Vitamin analyses were carried out according to the method of Martin-Prevel et al. (1984). Mineral analyses were carried out using an atomic absorption spectrophotometer (AAS) calcium, magnesium and Iron. Atomic emission spectrophotometer technique was used to determine sodium content.

RESULTS

Phytochemicals

The analysis of *C. asiatica* in Table 1 revealed that they contained appreciable quantity of phytochemicals. Phytochemical composition of *C. asiatica* leaf contains 2.75% phenolic, saponin 8.2%, flavonoids 12.85%, phytate 0.76% and 0.00% tannin.

Proximate

The proximate composition as contained in Table 2 revealed the dry matter to be 95.76, 2.77 12.40% crude protein, 2.80 and 2.40% crude fiber and 75.44% carbohydrate. Value of dry matter obtained in this study indicated that the leaf meal contains little quantity of moisture content.

Vitamin

Vitamin composition of *C. asiatica* leaf meal (CALM) indicated that it contains some vitamins which could be of

Table 1. Phytochemical composition of *Centella asiatica* leaf meal.

Parameter	Composition	Means±Std
Phenolic	2.75	2.75±0.05
Saponin	8.20	8.20±0.40
Flavonoids	12.85	12.85±0.05
Tannin	0.00	0.00±0.00
Alkaloid	2.90	2.90±0.30
Phytate	0.76	0.76±0.04

Table 2. Proximate composition of *C. asiatica* leaf meal.

Parameter (%)	Composition	Means±Std
Dry matter	95.76	95.76±0.01
Crude fibre	2.77	2.77±0.010
Crude protein	12.40	12.40±0.10
Ash	2.80	2.80±0.10
Crude fat	2.40	2.40±0.10
Carbohydrate	75.44	75.44±0.01

Table 3. Vitamin composition of *C. asiatica* leaf meal.

Vitamins mg/100 g	Composition	Mean±std
A	0.39	0.39 ± 0.01
E	N/A	-
C	0.76	0.76 ± 0.01
B1	N/A	-
B6	0.78	0.78 ± 0.01

NA: not available.

Table 4. Minerals composition of *C. asiatica* leaf meal.

Minerals g/100 g	Composition	Mean±std
Calcium	24.38	24.38±0.3
Magnesium	3.18	3.14 ±0.05
Iron	0.20	0.20±0.1
Phosphorus	3.14	3.14±0.01
Sodium	8.20	8.20±0.06

importance to man. 0.39 mg/100 g was obtained for vitamin A, no trace of vitamin E and B₁, 0.76 mg/100 g of vitamin C and 0.78 mg/100 g of vitamin B₆ (Table 3).

Minerals

Appreciable quantity of minerals was observed in the *C. asiatica* leaf, it contains 24.38 g/100 g of calcium, 3.18 g/100 g magnesium, 0.20 g/100 g iron, 3.14 and 8.20

g/100 g sodium (Table 4). The quantity of calcium in CALM could be a good source of food supplement to both man and human suffering from calcium deficiency.

DISCUSSION

Phytochemical analyses of *C. asiatica* leaf meal (CALM) in Table 1 revealed the presence of tannin, flavonoids, saponin, alkaloid, phytate and phenolic compounds. The

phytochemical constituents isolated from CALM have been reported to have hypotensive, anti-inflammatory, antioxidant, antifungal, antimicrobial and antibacterial activities (Wadood et al., 2013).

Biological activities of phenolic acids include increase in secretion of bile; reduce blood cholesterol and lipid levels. Okwu and Vitus (2008) also revealed that phenol modifies the prostaglandin pathways, thereby protecting platelet from clumping. Value obtained for phenolic compound in this study was 2.75%. However, Okwu and Vitus (2008) obtain a lower value of 0.75 and 0.09% from back stem and leaves of *Mangifera indica*. Higher value of phenol obtained in this study could be of health benefit to both man and animal when consumed.

The flavonoids obtained in this study was appreciable 12.85%; flavonoids have been reported to exert multiple biological properties including antimicrobial, cytotoxicity, anti-inflammatory and antitumor activities. They act as powerful antioxidants which can protect the human body from free radicals and reactive oxygen species (Nakatani, 2000; Wei and Shibamoto, 2007; Dharmendra and Abhislick, 2013; Gupta et al., 2013). Flavonoids constitute a wide range of substances that play important role in protecting biological systems against the harmful effects of oxidative processes on macromolecules such as carbohydrates, proteins, lipids, and DNA (Atmani et al., 2009). The presence of flavonoids in *Centella asiatica* supports the findings of Das (2011) who observes flavonoids derivatives in *C. asiatica* leaf. Roy (2018) also reports the presence of flavonoids derivatives in *C. asiatica* leaf meal. Flavonoids could prevent oxidative reactions and improve health status of both plant and animal. Tannin has been reported to form complexes with dietary protein, thereby inhibiting protein metabolism and utilization in monogastric animals (Vaithiyanathan et al., 1993). Tannin strongly inhibits digestive enzymes (Kumar, 1992). Absence of tannin in *C. asiatica* indicated that protein metabolism, feed utilization and mineral absorption will not be hampered if consumed. The value obtained in this study was 0.00% which was lower to the value of 3.03% obtained by Alagbe (2019) in *C. asiatica* leaf this might be due to difference in location, age of harvest, morphotypes of plant used for the study or extraction method. Marripan (2018) reports the absence of tannin in *C. asiatica* when hexane and chloroform was used as extraction media.

Suma et al. (2014) report that zinc and iron deficiency symptoms have occurred in man and poultry birds when fed diets high in phytic acid. Phytate obtained in this study was 0.76%. This value was similar to the value of 0.77% by Alagbe (2019) for *C. asiatica* leaf meal. Olumide et al. (2019) also reported a lower values of 0.03, 0.17 and 0.02% respectively for *Ocinum gratissimum*, *Vernonia amygdalina* and *Moringa oleifera*, the higher value obtained in this study indicated that *C. asiatica* could be effectively utilized when moderately

incorporated into animal feed while cautions as per moderation must be taken for human consumption considering the relatively high content of phytic acid in *C. asiatica*.

Alkaloids are essential for protecting and ensuring the survival of plant because they ensure their survival against micro-organisms (antibacterial and antifungal activities). Alkaloids contained plants can be used as spices and drugs. Alkaloids that have stimulant property as caffeine, nicotine and morphine are used as analgesic and quinine as antimalarial drug (Saxena et al., 2013). Pharmacological activities of alkaloids include antihypertensive, anticancer and antiarrhythmic effect. The value of alkaloids obtained in this study (2.90%) support the findings of Roy (2018) in quantitative analysis of *C. asiatica* leaf extract. Alagbe (2019) also obtained a lower value of 2.03% for *C. asiatica* leaf. The presence of alkaloids in this plant could serve as protective role in animal and as constituent of most valuable drugs.

Akindahunsi and Salawu (2005) noted that saponin though non-toxic saponin exhibits cytotoxic effects and growth inhibition against a variety of cells making it to have anti-inflammatory and anticancer properties. AICR (1997) noted that saponin showed tumor inhibiting activity in animals. The value obtained for saponin in this study was 8.20% which could be of health benefit to both human and animal.

The proximate composition of *C. asiatica* leaf meal in Table 2 indicated that dry matter content of *C. asiatica* was 95.76%, which was higher than the value obtain by Alagbe (2019) who reported 90.44% for *C. asiatica* leaf. Nworgu et al. (2007) reported a lower value of 87.96% for fluted pumpkin and Abu et al. (2015) observed lower value of 92.40% for cassava leaf. Ibronke et al. (2013) obtained 48.09% for *Sphenocentrum jollyanum* plant. This might be as a result of level of dryness of the leaf, method of drying and age at harvest.

The percentage crude protein obtained in this study was 12.40% which was similar to 13.06% obtained by Alagbe (2019) in *C. asiatica* leaf. Oku (2018) obtained 16.80% in *Ipomea involucrate* leaf. Discrepancy observed might be due to plant morphotypes and stage of harvest. The value obtained in this study is an indication that *C. asiatica* might be a good source of dietary protein supplement.

Carbohydrate obtained in this study was 75.44%. However, Olumide et al. (2019) report low value of 49.75, 44.90 and 31.70% for *O. gratissimum*, *V. amygdalina* and *M. oleifera*. CALM could be a potential energy source to human and animal.

Crude fibre obtained in this study was 2.77% which is lower than the value, 24.8, 11.40, 12.00%, 12.93 and 5.60 observe for *Microdesmis puberula*, cassava leaf meal, neem leaf meal, mucuna leaf meal, and pawpaw leaf meal (Esonu et al., 2002; Iheukwumere et al., 2008; Onyimonyi et al., 2009; Emenalom et al., 2009) respectively. The relatively low crude fibre of CALM

makes it a potentially good feed stuff for poultry production.

Ash content obtained in CALM in this study was 2.80% which was lower than the value of 4.07 and 8.45% obtained by Alagbe (2019) and Onyimonyi et al. (2009) in *C. asiatica* leaf and pawpaw leaf respectively and higher than the range of 0.38 to 1.9% for selected vegetables grown in Peshawar (Bangash et al., 2011).

Quantity of ash obtained support the claim of Das (2011), Hashim (2011) and Josh et al. (2013) that *C. asiatica* leaves contains minerals such as calcium, magnesium, iron, sodium and phosphorus.

Table 3 showed vitamin composition of *C. asiatica* leaf meal, the value of Vitamin A in this study was 0.39 mg/100 g, this result was similar to the report of Hashim (2011) who obtained 0.44 mg/100 g of Vitamin A in *C. asiatica* leaf, Josh et al. (2013) observe 0.0 mg/g vitamin A in *C. asiatica* leaf. The variation observed in vitamin composition of CALM could be due to age of harvest of plant, drying methods, plant morphotypes or environmental factors. The different varieties of *C. asiatica* could be exploited as a good source of pro-vitamin A and lutein to overcome vitamin A deficiency as well as age-related muscular degeneration (Chandrika et al., 2006).

Vitamin C obtained in this study (0.76 mg/100 g) was lower compared to the values, 11 mg/100 g and 9.73 mg/g by Josh et al. (2013) and Das (2011) respectively. Edelman and Colt (2016) obtain 2 mg/100 g in lentil, considerable higher value is obtained from kale, spinach and duck weed. The lower value obtained in this study might be due to difference in leaf composition and dehydration process, as ascorbic acid show highest reduction with the dehydration processes (Gupta et al., 2013). Vitamins E and B₁ were not detected, this connote that CALM is not a good source of vitamin E and B₁.

The analysis indicated that CALM contains vitamin B₆ also known as pyridoxine a water soluble vitamin that the body needs for several functions. It is significant to protein, fat and carbohydrate metabolism and the creation of red blood cells and neurotransmitters. Vitamin B₆ is used in prevention and treatment of anemia caused by deficiency, it prevent clogged arteries and reduce heart disease risk (Lizzie, 2018). CALM could serve as good supplement of vitamin B₆.

Mineral composition of CALM in Table 4 indicated that it contains appreciable amount of minerals. The value obtained for calcium was 24.38 g/100 g. This was higher compared to the 2.10 g/100 g obtained by Chandrika et al. (2011) in different varieties of *C. asiatica* examined. Alagbe (2019) report a lower value of 10.20 mg/100 g for *C. asiatica* leaf meal (CALM). Edelman and Colt (2016) also obtain lower value of 0.34, 8.46, 10.36 and 6.00 mg/100g in lentil, kale, spinach and duckweed while Okwu and Vitus (2008) report 1.41, 3.82 mg/100 g for mango stem and mango leaves which are also used as phytogetic plants. The variations obtained in different

varieties of CALM might be due to plant morphotype, method of extraction, storage time and age at harvest. This finding support the claim of Chandrika et al. (2011) that CALM can be used as non-expensive calcium feed supplement.

Magnesium is often used as a laxative. The value obtained for magnesium in this study was 3.18 g/100 g, this value was higher than the values of 0.2g/100g and 0.4g/100g obtain by Chandrika et al. (2011) for different varieties of CALM. However, Alagbe (2019) report a higher value of 9.06 (mg/100 g) for *C. asiatica* whereas, Okwu et al. (2008) report a lower value of 0.46 and 0.91 mg/100 g for mango stem bark and leave.

Iron constituent in this study was 0.20 (mg/100g), this was lower than the value obtain by Chandrika et al (2011) who obtained 0.40, 0.50, and 0.29 mg/100g respectively from different varieties of *C. asiatica*.

The composition of sodium was 8.20 g/100 g; this was higher than the value of 2.2 g/100 g, 1.1 g/100 g and 2.6 g/100 g obtain in *C. asiatica* by Chandrika et al. (2011) and higher than value 0.97 mg/100 g reported by Gupta (2004) in *C. asiatica*. The value obtained in this study was also higher than the value obtain in *Hymenocardia ulmoides* and *V. ferruginea* leaves by Andzouana and Mombouli (2011).

Phosphorus component was 3.14 g/100 g which could help in appetite control and improve feed utilization, maintain blood sugar levels and normal heart contraction (Linder, 1991). The value obtained in this study is higher than the value 0.16 mg/100 g by Ngozi et al. (2017).

According to different studies done with CALM in the previous decade, the nutrients content shows relatively close values but in some instances, big variations are also seen (Das, 2011; Hashim, 2011; Joshi and Chaturvedi, 2013). These values may vary considerably depending on the analytical method, biotic and abiotic factors. The presence of considerable quantity of mineral component in CALM could be of importance in reducing anemia, proper functioning of the nervous system and carbohydrate metabolism.

Conclusion

It can be concluded from the study that *C. asiatica* leaf meal could serve as a good source of vitamins and mineral supplements to human and animal. The leaves also contain phytochemical components such as flavonoids, alkaloids which are of good health benefit to both human and animal when consume for therapeutic purpose and could be of economic importance to the pharmaceutical industry.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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