

Phytochemical Screening and Proximate Analysis of *Newbouldia laevis* and *Allium sativum*

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Target audience: Researchers and farmers

Abstract

The study was conducted to assess the phytochemical and proximate composition of Newbouldia laevis leaves and Allium sativum bulb extracts. The leaves and bulbs extracts were analyzed for their chemical composition and antinutritional factors (ANFs) which include moisture, crude protein, crude fat, crude fiber, total ash, carbohydrate fractions (CHO), metabolisable energy (ME), neutral detergent fiber (NDF) and phytochemicals. The phytochemical screening revealed the presence of flavonoids, terpenoids, tannin, alkaloids, phytic acid, trypsin inhibitor, phenols, antioxidants, carotenoids, oxalate and cyanide in the plant and bulb extracts. The percentages of flavonoid, terpenoid, tannin, alkaloid, phytic acid, trypsin inhibitor, phenol, antioxidants, carotenoid, oxalate and cyanide in the Newbouldia laevis were 0.15, 2.29, 392, 2.51, 2.96, 29.20, 2.86, 1.63, 624, 0.44 and 0.01mg/100g respectively, while that of the Allium sativum were 0.04, 0.07, 7.0, 4.59, 27.80, 0.25, 0.041, 0.23, 11.40, 9.02 and 0.685mg/100g, respectively. The percentage composition of moisture, crude protein, crude fat, crude fiber, ash, NFE, ME and NDF for Newbouldialaevis were 55%, 5.68%, 5.61%, 10.54%, 2.15%, 21.02%, 1626.80kcal/kg and 20.22%, while Allium sativum had 82%, 4.63%, 0%, 6.72%, 5.66%, 0.99%, 320.25kcal/kg and 0%, respectively. Therefore, it can be concluded that Newbouldialaevis leaves and Allium sativum bulbs contain bioactive substances beneficial to animals with antinutrient concentrations below the critical levels hence not deleterious to ruminant animals.

Keywords: Phytochemical, *Newbouldia laevis* and *Allium sativum*

Description of Problems

Plants are potent biochemists and have been components of phytomedicine since times immemorial; man is able to obtain from them a wondrous assortment of industrial chemicals. Plant based natural constituents can be derived from any part of the plant like bark, leaves, flowers, roots, fruits, seeds,

bulbs etc i.e. any part of the plant may contain active components. In most of the reported works, underground parts (roots, tuber, rhizome, bulb etc.) of a plant were used extensively compared with other above ground parts in search for bioactive compounds possessing antimicrobial properties (1, 2). However,

the presence of anti-nutritional factors such as phytic acid, lectins, saponins, alkaloids, gluconosilates, phytoestrogens and other anti-vitamins in plant-based feeds limits its usage in animal feedstuffs as well as aquaculture feeds (3). *Newbouldialaevis* and *Allium sativum* are important medicinal plants that have been used extensively. *Newbouldialaevis* (Boundary Tree) is a medium sized angiosperm in the *Bignoniaceae* family. It is native to tropical Africa, and grows to a height of about 10 m (4). The species *N. laevis* is widely used in African folk medicine for the treatment of several diseases such as an astringent in diarrhoea and dysentery. It is also employed in the treatment against worms, malaria, sexually transmitted disease, and in the reduction of dental cares (5). *Allium sativum*, commonly known as garlic is a specie in the onion genus, *allium*. Garlic is native to central asia,(6) and has long been a staple in the mediterranean region, as well as a frequent seasoning in Asia, Africa, and Europe. It was known to ancient Egyptians, and has been used for both culinary and medicinal purposes (7). Phytochemicals found in garlic are flavonoids and sulphur containing compounds: diallylsulphate, alliin, ajoene, allicin. The systematic screening of plant parts with the purpose of discovering new bioactive compounds is a routine activity in many laboratories. Scientific analysis of plant components follows a logical pathway. Plants are collected either randomly or by following leads supplied by local healers in geographical areas where the plants are found (8). Owing to versatile applications of plant-derived substances, the need to carry out

phytochemical screening and proximate analysis on *Newbouldialaevis* leaf extract and *Allium sativum* extract becomes imperative.

Materials and Methods

Sourcing of plant materials and extraction

The *Newbouldialaevis* (Border tree) plant was harvested from nearby villages in Abeokuta, Ogun state, Nigeria, and was authenticated at the Botany Department, University of Lagos, Akoka.. The leaves of matured *Newbouldialaevis* were collected, air dried at room temperature for 14 days, chopped, crushed and extracted with 70% ethanol. While the *Allium sativum*(garlic) cloves were purchased from Itoku market in Abeokuta. The garlic cloves were peeled crushed and the juice extracted using a blender and sieve.

Proximate analysis

The estimation of the various food parameters namely moisture content, total ash, crude fat, crude fibre, crude protein and total carbohydrate on dry matter basis were carried out using 50g of dried powdered sample. For crude protein determination, Nitrogen was determined by Kjeldahl method(9) and converted to protein by multiplying by a factor of 6.25. Moisture content, crude fat, crude fibre and total ash were determined by (10) and the total carbohydrate was determined based on the difference using the formula below(11).

$$\text{Total carbohydrate} = 100 - [\% \text{ crude protein} + \% \text{ crude fat} + \% \text{ crude fibre} + \% \text{ crude total ash}]$$

Phytochemical screening

Phytochemical tests of *Newbouldia laevis* and *Allium sativum*. i.e flavonoids, terpenoids, tannins, alkaloids, phytate, trypsin inhibitor, phenols, antioxidants, carotenoids and oxalate content were carried out using standard procedures as described by (12) and enunciated by (13) and (14).

Statistical Analysis

The results were analyzed using simple descriptive statistics as contain in (15).

Result and Discussion

Table 1 shows phytochemical constituent of *Newbouldia laevis* leaf and *Allium sativum* bulb extracts. The *Newbouldia laevis* leaves used in this study contained flavonoid, terpenoid, tannin, alkaloid, phytic acid, trypsin inhibitor, phenol, antioxidants, carotenoid, oxalate and cyanide containing 0.15, 2.29, 392, 2.51, 2.96, 29.20, 2.86, 1.63, 624, 0.44 and 0.01mg/100g respectively, while that of the *Allium sativum* were 0.04, 0.07, 7.0, 4.59, 27.80, 0.25, 0.041, 0.23, 11.40, 9.02 and 0.685mg/100g, respectively. The values obtained for tannin (0.392%)

and alkaloid (0.25%) were higher than those reported (0.197% and 0.015%, respectively) by (16). The concentration of flavonoid to the total antioxidant activity of components in food can be very high because daily intake can vary between 50-500mg according to Research Review. However, considering the flavonoid content level of the two plant extracts *Newbouldia laevis* is of higher nutritional potential in diet of ruminants as it helps fight off free radicals.

The tannin contents in the samples considered were lower than 2.05% reported in *Gliricida sepium*(17) as well as 3 to 14% reported in *Leucaena leucocephala*(18). A threshold concentration of 5% for tannin has been reported beyond which there may be rejection of browse by goat and wild browsers (19). In sheep and cattle, dietary levels of 2 and 5% respectively have also been reported to have adverse effects on digestibility (20). The phytic acid level reported in the present study (2.96 mg/100g and 27.80 mg/100g) were similar to those reported by (21) and (22). These levels are unlikely to have adverse effects in ruminants.

Table 1: Phytochemical/ Antinutritional factors of *Newbouldia laevis* leaves and *Allium sativum* bulb extracts.

Parameters	<i>Newbouldialaevis</i>	<i>Allium sativum</i>
Flavonoid mg/100g	0.15	0.04
Terpenoid mg/100g	2.29	0.07
Tannins g/kg	392	7
Alkaloid %	2.51	4.59
Phytic Acid mg/100g	2.96	27.80
Trypsin inhibitor mg/g	29.20	0.25
Phenols mg/100g	2.86	0.04
Antioxidants mg/100g	1.63	0.23
Carotenoid mg/100g	624	11.40
Oxalate mg/100g	0.44	9.02
Cyanide mg/100g	0.01	0.685

Table 2 shows the proximate composition of *Newbouldia laevis* leaf and *Allium sativum* bulbs extracts. The *Newbouldia laevis* leaves in this study contained 55% moisture, 5.68% crude protein, 5.61% crude fat, 10.54% crude fiber, 2.15% total ash, 21.02% NFE, 1626.80kcal/kg ME and 20.22% NDF. The results on the proximate composition of *Newbouldia laevis* contradicts the findings of (16) who reported higher contents for crude protein (28.11%) and nitrogen detergent fiber (46.34%) but lower ash (4.81%) relative to that obtained in this study. From the outcome of the study, *Allium sativum* had 82% moisture, 4.63% crude protein, 6.72% crude fiber, 5.66% total ash, 0.99% NFE, and 320.25kcal/kg ME. The crude protein obtained from the samples considered in this study differed from each other and this is similar to the findings of (23) relative to (24) who reported 20.90% and 15.32% crude protein in browse

plants (*Palisota hirsute* and *Urenalobata*). Crude fiber from the samples were lower when compared to that obtained in cassava leaf meal (15.6%), guava leaves (16.1%), and poultry deep litter manure (16.6%) (25). Crude fat was lower (5.61%) compared to 8.32% and 7.5% obtained for palm kernel cake and rice bran (25). The NDF value of 20.22% obtained in *Newbouldia laevis* was lower than 55.5% average for seven browse plants (*Palisota hirsute*, *Urenalobata*, *Diodia svcandens*, *Microdesmis puberula*, *Nuacleapopegnine*, *Ricinodendron heudelotti* and *Vernonia amygdalina*) and this is low to moderate when compared with that of low quality roughages, which ruminants can effectively degrade (26). The variation in the nutrient contents of browse plants may be due to within species differences, plant parts, season, harvesting regimen, location, soil type, and age as reported by (27).

Table 2: Proximate composition of *Newbouldialaevis* leaves and *Allium sativum* bulbs extracts

Parameters	<i>Newbouldialaevis</i>	<i>Allium sativum</i>
Moisture %	55.00	82.00
Crude protein %	5.68	4.63
Crude fat %	5.61	Absent
Crude fiber %	10.54	6.72
Total Ash	2.51	5.66
NFE %	21.02	0.99
Met. Energy kcal/kg	1,626.80	320.25
NDF %	20.22	Absent
ADF %	Absent	Absent
ADL %	Absent	Absent

NFE- Nitrogen free extract NDF- Neutral detergent fibre ADF- Acid detergent fibre ADL- Acid detergent lignin

Fig.1 Graphical analysis of phytochemical screening between *Newbouldia laevis* leaf extracts and *Allium sativum* bulb extracts.

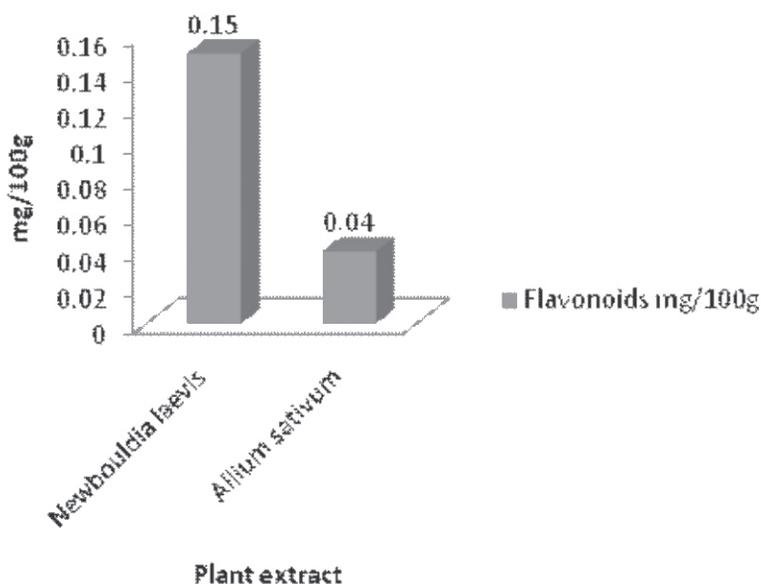


Fig 1: Percentage composition of Flavonoids(mg/100g) present in *Newbouldialaevis* and *Allium sativum*

Figure 1 shows the Flavonoid content of *Newbouldia laevis* leaves extracts and *Allium sativum* bulb extracts. It can be deduced from the graph that *Newbouldia laevis* has a higher content (0.15 mg/100g) of flavonoid, relative to that of *Allium sativum* (0.04mg/100g). Flavonoid has been known for decades to promote anti-inflammatory activity in animals, according to the findings of (28). According to (29) flavonoids and proanthocyanidins are often found in fruits and vegetables, and they are powerful cancer prevention agents.

Especially, flavonoids are potent antioxidants and the body uses them to lower inflammation, reduce blood pressure and fight off radicals, which cause disease and aging, sometimes from the inside out. The concentration of flavonoid to the total antioxidant activity of components in food can be very high because daily intake can vary between 50-500 mg according to Research Review. However, considering the flavonoid content level on the two plant extracts *Newbouldia laevis* is of higher nutritional potential in diet of ruminants as it helps fight off free radicals.

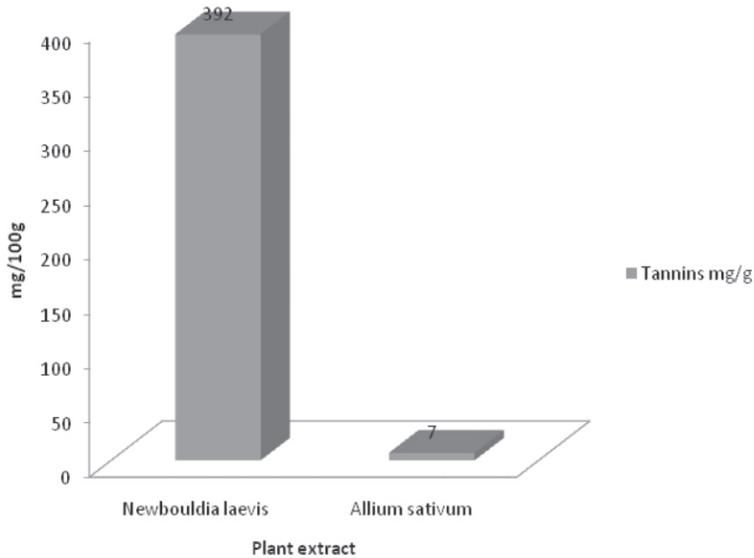


Fig 2: Percentage composition of Tannins (mg/g) present in *Newbouldia laevis* and *Allium sativum*

Figure 2 shows the Tannins content of *Newbouldia laevis* and *Allium sativum*. It can be inferred from the graph that a lower amount of tannin was obtained in *Allium sativum* (7mg/100g) 0.7% compared to that in *Newbouldia laevis* (3.92mg/100g) 0.392%. Tannins are group of secondary plant metabolites formed by water soluble phenolic

compounds with a great diversity, which can be divided into two major groups, the hydrolysable and the condensed tannins (30). Since the tolerable (inclusion level) amount of tannin in the diet of goat is 5% (19), it can then be inferred that the tannin content in both *Newbouldia laevis* and *Allium sativum* extract can be tolerated by ruminants when fed or drenched.

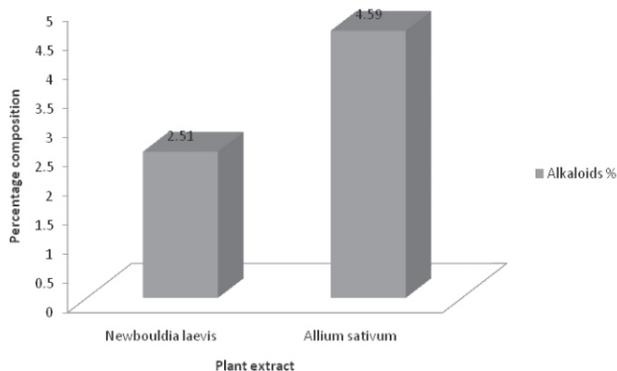


Fig 3: Percentage composition of Alkaloids (%) present in *Newbouldia laevis* and *Allium sativum*

Figure 3 represents the graphical content of Alkaloid in *Newbouldia laevis* and *Allium sativum*, respectively. A higher quantity of Alkaloid was obtained in *Allium sativum* 4.59mg/100g (0.459%), while a lower amount 2.51mg/100g (0.251%) was found in *Newbouldia laevis*. Average alkaloid content in the two plant extracts considered were higher than the average of 0.1% obtained from other natural browse plants (31). In addition, considerable specie

differences in susceptibility to alkaloids exist among livestock: cattle and horses are highly susceptible while sheep and goats are resistant to alkaloid toxicoses, especially the pyro-lizidine alkaloids. From the values obtained, it could be inferred that the alkaloid levels in the two plant extracts can be included in ruminants' diets, and their tolerability and utilization is subject to specie variation (32).

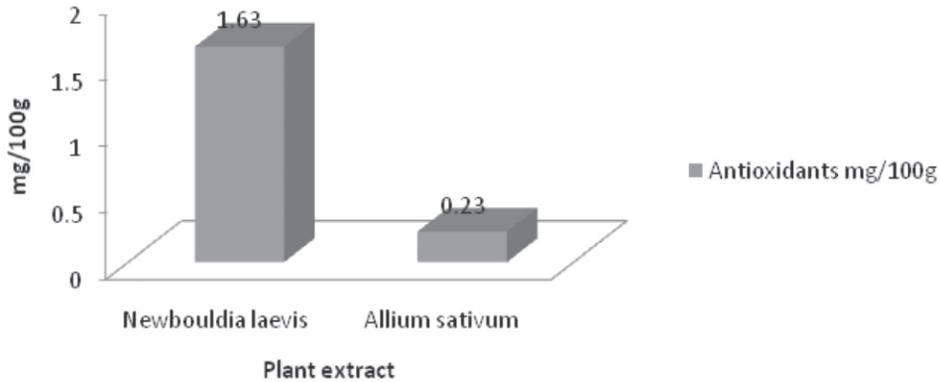


Fig 4: Percentage composition of Antioxidants (mg/100g) present in *Newbouldia laevis* and *Allium sativum*

Figure 4 represents the content of antioxidant in *Newbouldia laevis* and *Allium sativum*. A higher quantity of antioxidant 1.63mg/100g was found in *Newbouldia laevis*, while a lower amount of 0.23mg/100g was obtained in *Allium sativum*. Antioxidant compounds in food are found to have a health-protecting factor. Primary sources of naturally occurring

antioxidants are whole grains, fruits and vegetables (FITDAY, 2000-2011). It can be deduced that, the concentration of antioxidant in the two plant extracts considered is acceptable nutritionally because of the major role of antioxidant in diet of ruminants, as it helps to prevent rancidity, thereby ensuring a consistent structure in the muscle.

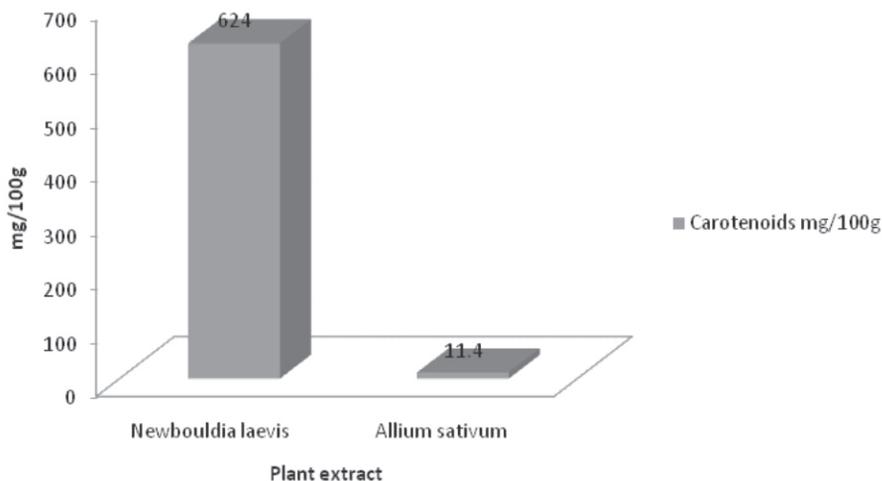


Fig 5: Percentage composition of Carotenoids (mg/100g) present in *Newbouldia laevis* and *Allium sativum*

Figure 5 shows Carotenoids content in *Newbouldia laevis* and *Allium sativum*. A higher level of carotenoid was obtained in *Newbouldia laevis* (11.4mg/100g) relative to the level obtained in *Allium sativum* (624mg/100g). They are also known to exhibit medicinal activity as well as physiological activity. Carotenoid is

essential for normal growth, reproduction, maintenance of health, vigor and proper functioning of eyes, also protects against cold and influenza (33). Hence, carotenoid in *Newbouldia laevis* and *Allium sativum* extract is acceptable and has a major role in nutrition in the form of provitamin A and vitamin C (33).

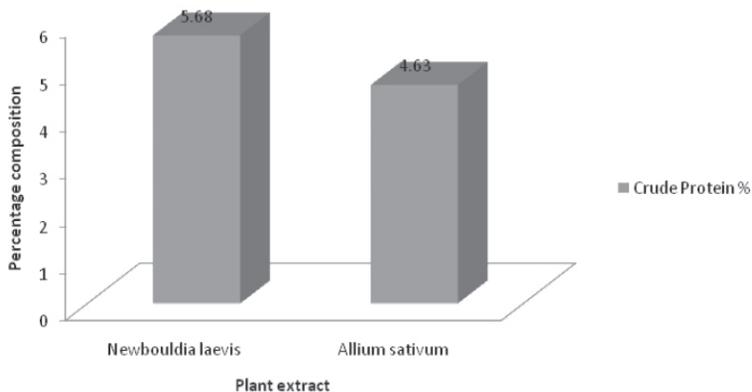


Fig 6: Percentage composition of Crude Protein (%) present in *Newbouldia laevis* and *Allium sativum*

Figure 6 shows the Crude protein content of *Newbouldia laevis* and *Allium sativum*. From the graph *Newbouldia laevis* had a higher level (5.68%) compared to that of *Allium sativum*(4.64%). These values are lower with those reported by (34) and (35) who reported 28.11% CP in *Newbouldialaevis*. Different reasons

have been cited to cause variation in its values for browse plant(36). Browse plants extracts with CP level below 7% are considered deficient and therefore may not sustain live weight in animal (37). The relatively low CP value obtained for *Newbouldia laevis* and garlic can be hinged on the fact that both samples have been extracted before being analyzed.

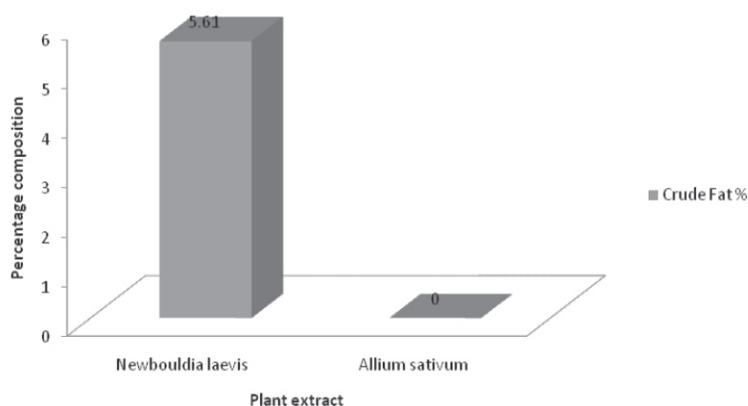


Fig 7: Percentage composition of Crude Fat (%) present in *Newbouldia laevis* and *Allium sativum*

Figure 7 shows the Crude fat content of *Newbouldia laevis* and *Allium sativum* extracts. From the graph *Newbouldia laevis* had a higher level compared to that of *Allium sativum*. Dietary fat function in the increase of palatability of food by absorbing and retaining flavours (38). The ether extract of *Newbouldia laevis* was 5.61% and this value was

higher than that reported by (34) of 3% and (39) of 4.92% for browse in semi-arid north eastern Nigeria and for browse plants in the western Nigeria respectively. However, in this study particularly the fat content in *Newbouldia laevis* is in consonance with the value (6.02 %) obtained by other authors (40).

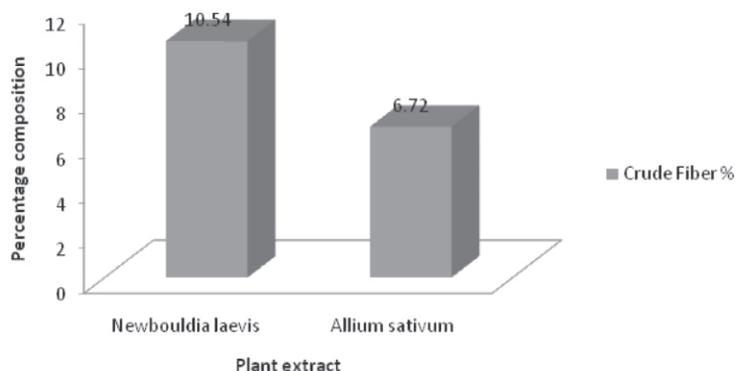


Fig 8: Percentage composition of Crude Fiber (%) present in *Newbouldia laevis* and *Allium sativum*

Figure 8 shows the Crude fiber content of *Newbouldia laevis* and *Allium sativum* extracts. From the graph *Newbouldia laevis* had a higher level compared to that of *Allium sativum*. It was (41) reported that non-starchy vegetables are the richest sources of dietary fiber. Crude fiber is the part of the food that is not digested by most mammals but the normal functioning of the intestinal tract depends upon the presence of adequate fiber. It increases

stool bulk and decreases the time that waste materials spend in the gastrointestinal tract. A low fiber diet has been associated with heart disease, cancer of the colon and rectums, varicose veins, phlebitis, obesity, appendicitis, diabetes and even constipation (42; 43). The result of the fiber content implies that *Newbouldia laevis* will enhance better function of the GIT relative to *Allium sativum*.

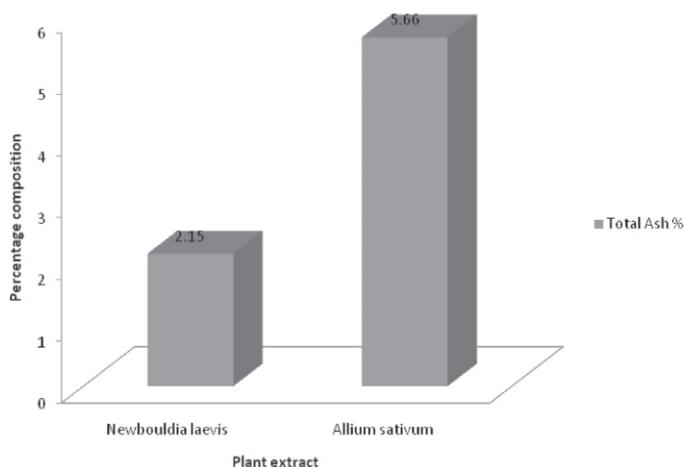


Fig 9: Percentage composition of Total Ash (%) present in *Newbouldia laevis* and *Allium sativum*

Figure 9 shows the Total Ash content of *Newboudia laevis* and *Allium sativum* extracts. From the graph *Newboudia laevis* had a lower percentage compared to that of *Allium sativum*. The proportion of ash content is a reflection of the

mineral contents preserved in the food materials (44; 45). The result of the Ash contents of the plants extract considered is acceptable for ruminants in supplying the required minerals for normal functioning of the body.

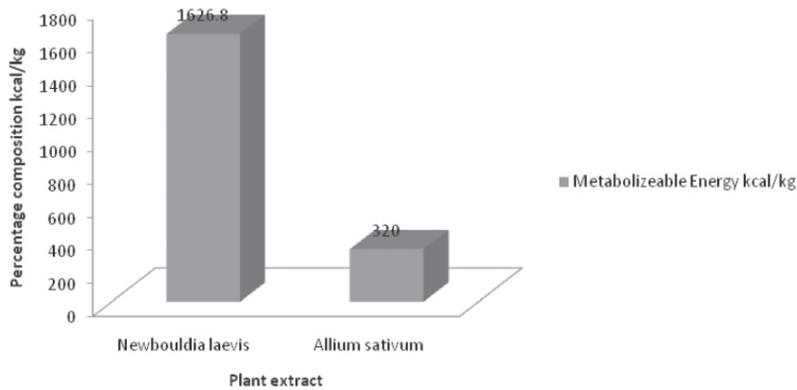


Fig 10: Percentage composition of Metabolizable Energy (Kcal/kg) present in *Newboudia laevis* and *Allium sativum*

Figure 10 shows the Metabolizable Energy content of *Newboudia laevis* and *Allium sativum*. It can be inferred from the graph that *Newboudia laevis* had higher metabolizable energy of 1626.86 kcal/kg compared to that of *Allium sativum* 320.25kcal/kg. Metabolizable energy was not a constant fraction of digestible energy, values range from 70-80% depending on level of feeding and digestibility. (46) stated that an animal's energy needs are based on its body weight and body surface area because that more accurately accounts for heat loss. Animals also regulate their food intake by eating to satisfy metabolizable energy requirements. It is obvious that ruminants will benefit considerably by

consuming a diet composed of *Newboudia laevis* relative to that containing *Allium sativum*. Since it is evident that animals performing strenuous work or engaged in considerable physical activity require more energy as stated by Burger and Ivan (1993). Hence, considering the metabolizable energy levels on both extracts, *Newboudia laevis* is of higher nutritional potential in diet of ruminants supplying more energy than *Allium sativum*.

Conclusions and Applications

It is evident that both plants have nutritive value which animals can effectively benefit from them when included in their diet or use as

ethnoveterinary medicine . Though results revealed presence of antinutritional factors (ANFs), their concentrations are below the critical levels and therefore are not deleterious to ruminant animals. For full potentials of the plant extracts to be enhanced, plants can be subjected to soaking or boiling which could eliminate or minimize the effects of ANFs.

Recommendation

The use of untested traditional medicines will no doubt continue, there is need to distinguish between the efficacious and safe products and the ineffective and/or unsafe products to promote their use for the improvement of the health of people in developing countries. Since the active constituents of many of these products are poorly known, there is also a strong need to focus future studies on phytochemicals examination of these efficacious plants. Furthermore, the possible mode of actions of these products needs to be well established, so as to also exploit them from commercial point of view. Feeding trials using ruminants and monogastric animals are recommended in order to fully ascertain the medicinal values of these plants.

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