

THE EFFECT OF PROCESSING ON THE PROXIMATE, MINERAL AND VITAMIN COMPOSITION OF NEEM LEAVES (*Azadirachta indica*) GROWN IN GWAGWALADA, FCT-ABUJA

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ABSTRACT

This study was conducted to evaluate the effect of processing on the proximate, mineral and vitamin composition of Neem leaves grown in Gwagwalada, Abuja. Fresh Neem leaves (FNL), air dried Neem leaves (ADNL) and ensiled neem leaves (ENL) were analyzed using standard analytical methods. The results of the analysis shows that Crude protein (12.10%, 20.24%, 31.44%), Crude fibre (8.71%, 12.67%, 9.74%), Ether Extract (2.71%, 3.88%, 4.00 %), Ash (2.61%, 8.46%, 9.61%), Moisture (37.28%, 5.9%, 11.22%) and Nitrogen Free Extract (36.59%, 48.85%, 33.99%) for FNL, ADNL and ENL respectively. FNL, ADNL and ENL had the following macro mineral contents respectively: Calcium (41.34mg/100g, 57.98mg/100g, 66.10mg/100g), Magnesium (10.72 mg/100g, 20.67mg/100g, 22.13mg/100g), Potassium (9.20 mg/100g, 9.78mg/100g, 13.01 mg/100g), Sodium (1.00 mg/100g, 1.23 mg/100g, 1.23mg/100g), Phosphorus (0.45mg/100g, 0.33mg/100g, 1.88mg/100g). Vitamin analysis of all samples showed that they contain appreciable quantity of vitamins with the ENL having higher concentrations of ascorbic acid (72.02 mg/100g), thiamine (11.00 mg/100g), riboflavin (0.71 mg/100g), β -carotene; 0.33 and 0.21(mg/100g), α -tocopherol; 0.001 and 0.10 (mg/100g) and folic acid; 3.11 mg/100g) relative to ascorbic acid; 68.31 and 61.92 (mg/100g), thiamine; 10.33 and 10.34 (mg/100g), riboflavin; 0.72 and 0.66(mg/100g), β -carotene; 0.18 mg/100g), α -tocopherol (0.006 mg/100g) and folic acid; 2.41 and 0.12 (mg/100g) found in FNL and ADNL. It was concluded that ENL is rich in proteins, fats, energy, minerals and vitamins compared to the other samples (FNL and ADNL) and could be used as a potential protein supplements in livestock feed.

Keywords: Neem leaves, Processing, Proximate composition, Gwagwalada.

INTRODUCTION

The high cost of conventional feedstuff and use of antibiotics has already sent many livestock farmers out of business, thus leading to reduction in overall animal protein production and availability for human dietary's need. The cost of feed accounts for 60-80% of total cost of livestock production in developing countries alone (Esonu, 2006). In view of this, there is increased interest by livestock producers in the search for alternative source of feed supplement that is

not only cheap and could boost the growth of livestock but organic and readily available.

In an effort to develop new feedstuff for animal feeding, a number of researcher's have investigated the use of non-conventional feedstuffs like leaf and seed meals of ethno medicinal plants (Okoliet *al.*, 2001). Some plants and their extracts improve feed intake and their enzymatic activity may have antimicrobial, coccidiostatic or anthelmintic effects. Among the potential plants is neem (*Azadirachta indica*) which has been reported

to contain several minerals, vitamins, amino acid, protein and other nutrients.

Neem (*Azadirachta indica*) which is also known as Dogoyaro in Hausa, and Ogwuakuma in Igbo, it is a medicinal plant it is also a fast growing evergreen tree which has a potential to provide medicinal and nutritive value to livestock (Schmutterer, 1990). Neem plays an important role in strengthening the immune system of the body. Neem cake despite its bitter components, livestock consumes diets containing varied percentage of Neem cake. De-oiled Neem seed cake is rich in essential amino acids, crude proteins, fiber contents, sulphur and nitrogen (Uko and Kamalu, 2007) (Oforjindu, 2006; Esonuet *al.*, 2006; Ogbuewu, 2008). Neem oil, which is rich in long chain fatty acids could be used in livestock feed.

In view of these abundant potentials in neem (*Azadirachta indica*), this study was carried out to investigate the effects of different processing methods on the proximate, mineral and vitamin composition of fresh, air dried and ensiled neem leaf grown in Gwagwalada, Abuja.

MATERIALS AND METHODS

Experimental site

This experiment was carried at the University of Abuja Gwagwalada. It is located along airport road, Gwagwalada FCT-Abuja. Gwagwalada falls within latitude 08°51' and 09°37'N, longitude of 007°20' and 007°51'E, and the land mass cover 6,550 km (6,500 hectares) and with annual rainfall approximately between 1100 mm to 1650 mm (NPC, 2006).

Collection and processing of test materials

Neem (*Azadirachta indica*) leaves were harvested from the premises of University of Abuja, Nigeria and was authenticated at the Department of Crop Science, University of Abuja, Gwagwalada with a voucher number of ABJ-02C. The leaves were divided into three parts, the first part was air dried (ADNL) for 10 days until a constant weight was obtained and made into powder using a laboratory blender (Model TS-02, Panasonic). The second part of the fresh sample (250 grams) was ensiled (ENL) in an air tight labelled container while the fresh sample (FNL) (third part) was sent into the laboratory for further analysis.

Proximate composition

Proximate analysis was carried out according to the methods outlined by AOAC (2000) to determine the moisture, crude protein, crude fibre, ether extract and ash. Energy was calculated using the formula described by Crisan and Sands, (1978) as shown below:

$$\text{Energy} = (37 \times \text{Ether extract}) + (17 \times$$

$$\text{carbohydrate}) + (17 \times \text{crude protein})$$

$$\text{NFE} = 100 - (\% \text{CP} - \% \text{CF} - \% \text{EE} - \% \text{Ash})$$

Mineral analysis

Macro and micro minerals were determined using Atomic Absorption Spectrophotometer (Model: 02T-10, Punjab, India).

Vitamin analysis

Vitamin compositions were evaluated according to the methods outlined by (Ngozi *et al.*, 2017).

RESULTS AND DISCUSSION

Proximate composition of fresh (FNL), air-dried (ADNL) and ensiled Neem leaves (ENL)

Proximate composition of fresh (FNL), air-dried (ADNL) and ensiled Neem leaves

(ENL) is presented in Table 1. The proximate components of the FNL, ADNL and ENL contains moisture, crude protein, crude fibre, ether extract, ash, nitrogen free extract and energy at (37.28 %, 5.90 % and 11.22 %), (12.10 %, 20.24 % and 31.44 %), (8.71 %, 12.67 % and 4.00 %), (2.71 %, 3.88 % and 4.00 %), (2.61 %, 8.46 % and 9.61 %), (36.59 %, 48.85 % and 33.99 %) and (1130.9, 1793.71 and 1896.9 Kcal/kg) respectively. The result revealed that ENL had the highest concentration of crude protein, ether extract and ash compared to the other samples. The higher nutritive value could be attributed to the presence of beneficial microorganism during the period of ensiling. However, the crude protein level (20.24 %) reported in this experiment for air dried neem leaf (ADNL) is in agreement with the findings of Esonu *et al.* (2005). Higher crude fibre in ADNL is advantageous because it will improve digestion, lower blood sugar and cholesterol level in animals (Fasola *et al.*, 2011). Ash content is an index used to determine the mineral content in a sample (Onwuka, 2005). The result revealed that ENL contained appreciable amount of minerals followed ADNL and the fresh sample respectively. According to Aiyesanmi and Oguntokun (1999); Alagbe (2019) fat are pivotal to the functioning of cells, increase palatability of foods and contributing energy to the body. The energy values revealed that ENL > ADNL > FNL, however, the values were higher than those reported for *Persea americana* leaves (388 Kcal/kg) and *Annona muricata* leaves (356 Kcal/kg) by Princewill *et al.* (2019). These differences could be attributed to the age of plant, stage of

maturity, varieties as well as processing methods.

Mineral composition of fresh (FNL), air-dried (ADNL) and ensiled neem leaves (ENL)

Mineral composition of FNL, ADNL and ENL is presented in Table 2. Fresh, ADNL and ENL contains calcium (41.34 mg/100g, 57.98 mg/100g and 66.10 mg/100g), potassium (9.20 mg/100g, 9.78 mg/100g and 13.01 mg/100g), magnesium (10.72 mg/100g, 20.67 mg/100g and 22.13 mg/100g), sodium (1.00 mg/100g, 1.03 mg/100g and 1.23 mg/100g), phosphorus (0.45 mg/100g, 0.33 mg/100g and 1.88 mg/100g), manganese (2.01 mg/100g, 2.67 mg/100g and 2.02 mg/100g), zinc (0.004 mg/100g, 0.56 mg/100g and 0.56 mg/100g), iron (2.51 mg/100g, 2.12 mg/100g and 2.45 mg/100g) and copper (0.33 mg/100g, 0.06 mg/100g and 0.22 mg/100g) respectively. The result suggests that ENL is capable of supplying adequate quantity of minerals to animals when compared to ADNL and FNL. According to Onuwuka (2005), minerals play a key role in biochemical reactions, functioning of co-enzyme and physiological functioning of the body. Calcium plays a vital role in providing rigidity and support to animals (Ibrahim *et al.*, 2001). Magnesium, zinc, iron and manganese are important co-factors found in the structure of certain enzymes and are indispensable in numerous biochemical pathways (Soetan *et al.*, 2010). Interrelationship also occurs between various minerals in the body, for instance, zinc, copper and magnesium deficiency could result in low birth rate, infertility and other reproductive abnormalities (Pathak and Kapil, 2004; Alagbe, 2020). Copper deficiency results in an increase in iron in the liver,

sodium is an important intracellular cation involved in the regulation of acid base balance and muscle contraction (Akpanyung, 2005). Moderate quantities of sodium and potassium were present in all the samples and these are principal cations of extracellular and intracellular fluids and aid in maintaining electrolyte balance in the body (Robert *et al.*, 2003).

Vitamin composition of fresh (FNL), air-dried (ADNL) and ensiled Neem leaves (ENL)

Table 3 shows the vitamin composition of FNL, ADNL and ENL. The sample contains ascorbic acid (78.13 mg/100g, 61.92 mg/100g and 72.02 mg/100g), thiamine (12.33 mg/100g, 11.34 mg/100g and 11.00 mg/100g), riboflavin (0.72 mg/100g, 0.66 mg/100g and 0.71 mg/100g), β -carotene (0.33 mg/100g, 0.21 mg/100g and 0.18 mg/100g), α -tocopherol (0.001 mg/100g, 0.10 mg/100g and 0.006 mg/100g) and folic acid (2.41 mg/100g, 2.12 mg/100g and 3.11 mg/100g) respectively. The result thus suggests that FNL is capable of supplying adequate quantity of vitamin C (ascorbic acid) when compared to the other treatments. Vitamins are chemically complex

organic compounds that have significant role in growth and development of the human body (Muhammad *et al.*, 2017). Vitamin A, E, K and D are fat soluble vitamins whereas, vitamin B1, B2, B3, B6, B7, B9, B12, biotin and vitamin C are water soluble vitamins. β -carotene are precursors of vitamin A and it plays a key role in good sight or vision as well as cell growth and development (Shearer *et al.*, 2012). Folic acid (Vitamin B₉) regulates the homocysteine level in blood and this amino acid is marker for cardiovascular diseases (McDowell, 2012; Alagbe, 2020).

CONCLUSION

The result from these findings suggests that ENL are high in nutrients when compared to FNL and ADNL. Ensiling is one of the best methods of improving the nutritive value of plants and also promotes the presence of beneficial bacteria such as lactobacillus. Nutrients in plants are important for physiological functions in the body; they also play a key role in satisfying animal needs for energy and life processes, improve productivity and boost the immune system of animals.

Table 1 Proximate composition of fresh (FNL), air-dried (ADNL) and ensiled Neem leaves (ENL)

Nutrient	FNL	ADNL	ENL
Moisture (%)	37.28	5.90	11.22
Crude protein (%)	12.10	20.24	31.44
Crude fibre (%)	8.71	12.67	9.74
Ether Extract (%)	2.71	3.88	4.00
Ash (%)	2.61	8.46	9.61
Nitrogen Free Extract (%)	36.59	48.85	33.99
Energy(Kcal/kg)	1130.9	1793.71	1896.9

Table 2 Mineral composition of fresh (FNL), air-dried (ADNL) and ensiled Neem leaves (ENL)

Minerals (mg/100g)	FNL	ADNL	ENL
Macro-elements			
Calcium	41.34	57.98	66.10
Magnesium	10.72	20.67	22.13
Potassium	9.20	9.78	13.01
Sodium	1.00	1.03	1.23
Phosphorus	0.45	0.33	1.88
Micro-elements			
Manganese	2.01	2.67	2.02
Zinc	0.004	0.56	0.56
Iron	2.51	2.12	2.45
Copper	0.33	0.16	0.22
Cobalt	0.92	0.17	0.10

Table 3 Vitamin composition of fresh (FNL), air-dried (ADNL) and ensiled neem leaves (ENL)

Vitamin analysis (mg/100g)	FNL	ADNL	ENL
Ascorbic	68.31	61.92	72.02
Thiamine	10.33	10.34	11.00
Riboflavin	0.72	0.66	0.71
β-carotene	0.33	0.21	0.18
α-tocopherol	0.001	0.10	0.006
Folic acid	2.41	2.12	3.11

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