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EVALUATION OF THE PROXIMATE COMPOSITION OF FIVE COMMON BUT UNDERUTILIZED MEDICINAL PLANTS IN NIGERIA

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ABSTRACT

In order to ascertain the nutritional composition of five medicinal plants viz; *Lantana camara* (LC), *Nicotiana tabacum* (NT), *Harungana madagascariensis* (HM), *Parquetina nigrescens* (PN) and *Alchornea cordifolia* (AC), their proximate analyses were carried out following standard methods of AOAC and data analysed using SPSS Version 23. The results showed significant differences ($P<0.05$) with NT having highest ash, fat, fibre and metabolizable energy (ME) values. The crude protein results followed the order of HM > PN > NT > LC > AC; moisture content, PN > HM > LC > LT > AC; ash, NT > PN > LC > AC > HM; fat, NT > PN > LC > HM > AC; fibre, NT > PN > LC > HM > AC; carbohydrate, AC > LC > HM > PN > NT, and metabolizable energy, NT > PN > LC > HM > AC. The appreciable ME content (3001.91 ± 45.16^{c} to 3321.35 ± 9.4^{a} Kcal/Kg) and other nutrients assessed in the five plants serve as pointers to the fact that they could be reckoned with as cheap and veritable source of energy (and concurrently other nutrients) analysed for poultry diets formulation.

***Key words*:** Medicinal plants, leaf meal, proximate composition, poultry

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INTRODUCTION

Researchers have grown a significantly interest in the usage of leaf meal, most importantly in poultry production in recent years. The interest has been due to the nutritional and medicinal properties among others, derivable from medicinal plants. They are rich source of bioactive constituents that are indispensable to the normal well-being of poultry (Rama *et al.,* 2019). Bioactive compounds like phytochemicals and phytobiotics possess growth promoting, therapeutic efficacy (Murugesan, 2005) immunomodulatory effect (Lillehoj *et al*., 2011) free radical scavenging potential (Sumaira *et al*., 2015), as well as antimicrobial property (Jamroz, *et al.,* 2005). In agreement with the innumerable benefits obtainable from leaf meals, it was hitherto recommended in poultry diets (Oloruntola, *et al.,* 2016). Incorporation of leaf meal in poultry diets was demonstrated with appreciable results using *Gliricidia sepium* leaf (Kagya-Agyemang *et al*., 2007), *Carica papaya* leaf (Onyimonyi and Ernest, 2009), *Cymbopogon citratus* leaf (Mmereole, 2010), *Psidium guajava* leaf (Pandey and Shweta, 2011), *Moringa oleifera* leaf (Liaqat *et al*., 2016; Manjaniq *et al*., 2017), *Polyalthia longifolia* leaf (Alagbe, 2017), *Eucalyptus globulus* leaf (Farhadi *et al*., 2017; Mashayekhi *et al*., 2018), and *Sauropus androgynus* leaf (Prakoso, 2018). Despite the numerous literature reviews on the above medicinal plants, less has been reported on *Lantana camara Linn*, *Nicotiana tabacum Linn*, *Harungana madagascariensis*, *Parquetina nigrescens* and *Alchornea cordifolia*. *L. camara Linn* otherwise known as wild sage, Lantana, sleeper weed etc belongs to the family Verbenaceae (genus Lantana) has been described to be noxious and invasive (Dobhal *et al*., 2011). This plant has been reported to be a very essential medicinal plants to be reckoned with in the world (Ross, 1999). It is a flowering plant usually found in the tropical and sub-tropical South America, West Indies, Asia - Pacific region, Australia, New Zealand and Africa, with a characteristic aromatic smell. It is usually called "Ewon Agogo" or "Ewon adele" in Yoruba land, "Anya nnunu" in Igbo and "Kimbamahalba" in Hausa (Ajiboye *et al.,* 2014; Egharevba *et al*., 2015). The plant contains toxic substances called lantadene A – D, lantanolic and lantic acid having antimicrobial property. Reports from several researchers displayed the plant as antifungal, antitumour, antimalarial, wound healing and analgesic medicinal plant (Deena and Thoppil, 2000; Verma and Verma, 2006). *L. camara* has hepatoprotective effects and other activities ranging from antioxidant, larvicidal, antidiabetic, antimotility, anti-inflammatory, antiurolithiatic, antifertility, and cytotoxic (Sanjeeb, 2012). *N. tabacum* Linn (Solanaceae) was said to have originated from South America and now cultivated in so many parts of the world like India, China, Cambodia Malaysia, etc as a cash crop (Charlton 2004, Binorkar and Jani 2012). The plant has lots of pharmacological potentials and usage in many countries like Brazil, China, Colombia, Cuba, Egypt, Eucador and many others. In Nigeria, hot water infusion of the leaf of the plant is used as sedative while the processed sun-dried

and well ground leaves is used as stimulant and in the treatment of convulsions (Adesina 1982; Bhat *et al*., 1985). *H. madagascariensis* (Lam. Ex Poir), a native to Madagascar is a member of the family Hypericaceae formerly known as Gutifferae. The medicinal importance of the plant made it to be imported to Africa. The leaves, stem-bark, including its roots have been documented to possess antibacterial, antifungal, and antiviral activities (Iwu, 1994). *P. nigrescens* (Perplocaceae) is a very useful medicinal plant traditionally in the treatment of gastro-intestinal complications, sickle cell anaemia and other health challenges (Imaga *et al*., 2010; Ayoola *et al*., 2011). The plant is very common around villages and farms in Nigeria. *A. cordifolia* (Euphorbiaceae) is a perennial shrub that is very common in West Africa, especially in Nigeria (Oliver, 1986). The extract of the plant possesses antibacterial property already experimented in *vitro* and *in vivo* (Merlin *et al*., 2017) and as such could be a promising candidate for leaf meal preparation in broiler diets (Oloruntola, *et al*., 2016). *L. camara Linn*, *N. tabacum*, *H. madagascariensis*, *P. nigrescens* and *A. cordifolia* are common and available medicinal plants whose potentials have not been well exploited as leaf meal for poultry diets in Nigeria. Information on them regards this purpose are very scanty, hence the importance and pertinence of this study.

Materials and methods

Collection and preparation of the medicinal plants

Fresh leaves of each of the plants in their natural habitat were plucked in Akure, Ondo State (Latitude: 7.26785, Longitude: 5.14746 N 7°16'3.96'', E 5°8'51.028'') in the month of August, 2019. Akure is on 9 M above sea level with mean annual rainfall and temperature of 2378 mm and of 26.7°C respectively. After proper identification, the leaves were individually packed in baskets and rinsed in turn under running tap water in order to get rid of any possible dust particles from them. They were thereafter arranged in flat trays and air-dried under shade. The samples became brittle after twelve (12) days of air-drying. Pulverization to fine particles was carried out using Bajaj Twister Mixer Electric Grinder (3 Jar QC. NO: HP/14/001/0064). All the samples were stored in air-tight plastic containers at 4°C until the commencement of Laboratory analyses.

Proximate analysis

The proximate analyses were determined following standard methods (AOAC, 2006). Moisture content; by the drying/indirect method and total ash by weighing 2 g each of the leaf samples into the crucible. The samples were ashed in a muffle furnace at a temperature of 550°C, cooled in a desiccator and weighed. The total ash was then calculated. Crude fat was obtained using Soxhlet direct (petroleum ether) solvent extraction method (Reinik *et al*., 2007). This process involved weighing 3g each of the leaf samples into a thimble and plugged into the soxhlet extractor with cotton wool. The solvent was poured into a round bottom flask which later fitted to the soxhlet and placed on a heating mantle. The oil was extracted as the solvent was refluxed several times. The extraction lasted for about 7 hours after which the flask was

cooled and disconnected. The final weight was recorded and the fat content was calculated. Crude fibre was determined according to the method of Pearson, (1976). Crude protein was determined using Macro kjeldahl method from the nitrogen content by the protein conversion factor 6.25 to give the crude protein content (Pearson, 1976). The percentage carbohydrate was obtained by difference that is 100 – (% Protein + % Ash + %Crude fibre + % Moisture + % Fat) while the ME (Kcal/Kg) was obtained by calculation (Janssen, 1989).

Statistical analysis

All data were analysed using SPSS Computer Software Package Version 23 (SPSS, 2015).

Results and discussion

The results obtained from this experiment for the five selected medicinal plants are as shown in Table 1 with their pictorial representations (Figures 1 to 5).

Table 1: Proximate nutrient composition of five selected medicinal plants in Nigeria

Parameters (%)	Medicinal plant samples					
	LC	NT	HM	PN	AC	Sig level
Moisture	13.48 ± 0.20^{b}	12.99 ± 0.23^{b}	14.29 ± 0.17^{a}	14.31 ± 0.21^{a}	11.39 ± 0.39^{c}	***
Total ash	11.69 ± 0.41^{b}	19.88 ± 0.37^{a}	5.58 ± 0.33^{c}	12.22 ± 0.57^{b}	5.84 ± 0.40^{c}	***
Crude fat	9.29 ± 0.18^{c}	12.51 ± 0.17^{a}	9.27 ± 0.19^{c}	11.12 ± 0.14^{b}	6.32 ± 0.51^{d}	***
Crude protein	8.79 ± 0.34^{cd}	9.50 ± 0.17^{c}	15.68 ± 0.39^{a}	14.02 ± 0.14^{b}	8.52 ± 0.29^{d}	***
Crude fibre	1.14 ± 0.10^{c}	9.50 ± 0.09^{a}	0.76 ± 0.06^{c}	2.06 ± 0.05^{b}	0.23 ± 0.05^{d}	***
Carbohydrate	55.60 ± 0.42^{b}	44.72 ± 0.52^{e}	54.42 ± 0.02^{c}	46.26 ± 0.30^{d}	67.71 ± 0.62^{a}	***
Dry matter	86.52 ± 0.20^{b}	87.02 ± 0.23^{b}	85.71 ± 0.17^{c}	85.69 ± 0.21^{c}	88.61 ± 0.39^{a}	***
ME (Kcal/Kg)	3065.20 ±1.34^{b}	3321.35 ± 9.4^{a}	3062.17 ± 20.33^{b}	3095.35 ± 0.69^{b}	3001.91 ± 45.16^{c}	***

Mean values with different superscript along the same row are significantly different (p< 0. 05). Sig = Significant, *** = Highly significant, LC = L*antana camara*, NT= N*icotiana tabacum*, HM= H*arungana madagascariensis*, PN= *Parquetina nigrescens*, AC= A*lchornea cordifolia* and ME= Metabolizable energy.

Figure 1: *Harungana madagascariensis*

Figure 2: *Alchornea cordifolia*

Figure 3: *Parquetina nigrescence*

Figure 4: *Lantana camara*

Figure 5: *Nicotiana tabacum*

There was an observed highly significant differences ($p<0.05$) in all the parameters of the proximate analysis among the selected medicinal plants. The moisture content (MC) of the HM and PN had the highest percentage but similar statistical value of 14.29 ± 0.17^{a} and 14.31 ± 0.21^{a} respectively, followed by LC and NT (13.48 ± 0.20^{b} and 12.99 ± 0.23^{b}) while the dry matter followed the reverse order. AC had the lowest value of 11.39 ± 0.39^{c} of dry matter content. Total ash was highest in NT (19.88 ± 0.37^{a}), followed by PN (12.22 ± 0.57^{b}), LC (11.69 ± 0.41^{b}), AC (5.84 ± 0.40^{c}) and HM (5.58 ± 0.33^{c}) in that order. The ash values of LC and PN were not statistically different, so also the ash values of HM and AC. Crude fat was found to be in decreasing order from NT (12.51 ± 0.17^{a}), PN (11.12 ± 0.14^{b}), LC (9.29 ± 0.18^{c}), HM (9.27 ± 0.19^{c}), to AC (6.32 ± 0.51^{d}). The crude fat of LC and HM were not statistically different. Crude protein was highest in HM (15.68 ± 0.39^{a}), followed by PN (14.02 ± 0.14^{b}), NT (9.50 ± 0.17^{c}), LC (8.79 ± 0.34^{cd}), and lowest in AC (8.52 ± 0.29^{d}). NT had the highest value (9.50 ± 0.09^{a}) for crude fibre, followed by PN (2.06 ± 0.05^{b}), LC (1.14 ± 0.10^{c}), HM (0.76 ± 0.06^{c}) and finally AC (0.23 ± 0.05^{d}). There was no significant difference between the mean crude fibre values of LC and HM. Carbohydrate highest value was recorded in AC (67.71 ± 0.62^{a}) followed by LC (55.60 ± 0.42^{b}), HM (54.42 ± 0.02^{c}), PN (46.26 ± 0.30^{d}) and NT (44.72 ± 0.52^{e}) in that order. Calculated ME (Kcal/Kg) of the plant samples in decreasing order revealed NT to have the highest value (3321.35 ± 9.4^{a}), followed by PN (3095.35 ± 0.69^{b}), LC (3065.20 ± 1.34^{b}), HM (3062.17 ± 20.33^{b}) and AC (3001.91 ± 45.16^{c}). There was no significant difference in the mean values of ME (Kcal/Kg) for LC (3065.20 ± 1.34^{b}), HM (3062.17 ± 20.33^{b}) and PN (3095.35 ± 0.69^{b}). The proximate analysis results from all the medicinal plants studied compared favourably well with earlier researchers. The ash content of *L. camara* (11.69 %) was lower than that (12.06 %) earlier reported (Sambo *et al*., 2015) and higher than that of Clement *et al*. (2018) which were 10.77 % and 2.3 % respectively. The crude protein (8.79 %) and crude fibre of *L. camara* in this study were lower than the results from the analyses of the above authors. However, the result for Carbohydate (55.62 %) was similar to the former report of Ajiboye *et al*. (2014) by a slight higher difference of 0.98 %. The moisture content, ash, crude fat, and carbohydrate values in *N. tabacum were* higher than the earlier report (Oyekunle *et al*., 2019) while crude protein and crude fibre values were lower than those reported by these same authors. The moisture content, ash and crude protein of *H. madagascariensis* were higher and lower in crude fat and crude fibre than those reported. Ash and moisture content were higher in *P. nigrescens* (Afzel.) than those reported by Gbadamosi *et al*. (2012) and lower than the values of crude fat, crude protein and crude fibre recorded by this same authors. *Alchornea cordifolia's* proximate composition showed lower ash (5.84 %), crude fat (6.32 %), and crude fibre (0.23 %) content compared to other authors (Philip *et al*., 2014; Nodu *et al*., 2014). However, the carbohydrate content of *A. cordifolia* in this study (67.71 %) was higher than the earlier report (43.53 %) by the authors above. The value of crude protein

in each of these five selected plants in this study was higher than those reported for twenty seven selected Nigerian vegetables (Omale, 2010) but compared favourably well (other nutrients inclusive) with the findings of Osuntokun and Olajubu (2014). Likewise, crude protein, total ash, crude fat, and carbohydrate content of all the studied medicinal plants were higher than those reported by Awodi (2017), for *Myrianthus arboreus* leaves.

Conclusion

The five medicinal plants analysed in this study are cheap and veritable source of nutrients with *Harungana madagascariensis (*HM*)* and *Parquetina nigrescens* (PN) taking the lead in crude protein, 15.68 ± 0.39^{a} % and 14.02 ± 0.14^{b} % respectively. Their relatively low fibre content (except *Nicotiana tabacum*) is a good nutritional quality for their consideration as leaf meal in poultry diets. The high ME values obtained for the plants (3001.91 ± 45.16^{c} - 3321.35 ± 9.4^{a} Kcal/Kg) coupled with their endowed appreciable nutrients could be explored in the formulation of poultry feed. However, supplementation with appropriate enzymes may be grossly essential where the fibre content is high for proper nutrients' utilization.

Recommendations

The leaves of these plants can be aseptically processed, and thereafter incorporated in form of leaf meal in the diets of poultry birds. Meanwhile, further research into the amino acid profile, mineral, vitamin, anti-nutritional factors, and toxicity effect (if any) of each of the medicinal plants on animals are of paramount value for their acceptance and usefulness in feed preparation.

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