CHEMICAL COMPOSITION OF BLACK SEEDS (*NIGELLA SATIVA*), AFRICAN NUTMEG (*MONODORA MYRISTICA*) AND NEGRO PEPPER (*XYLOPIA AETHIOPICA*)

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ABSTRACT
Phytoadditives which are mainly of plant origin, consumed due to their medicinal properties or as spicies due to their taste and flavour. Three phytoadditives which are black seeds (Nigella sativa), African nutmeg (Monodora myristica) and Negro pepper (Xylopia aethiopica) were analyzed for their chemical and proximate compositions, minerals and their phytochemicals. Black seed and Negro pepper had higher crude protein (21.03 vs 17.43%), crude fibre (6.90 vs 5.88%), ether extract (37.91 vs 11.67%) and ash (7.42 vs 7.24%) than African nutmeg (13.54, 2.20, 6.77 and 4.59%) respectively. However, Negro pepper contained the highest metabolizable energy content (3500Kcal/kg), closely followed by African nutmeg (3145.05Kcal/kg) while black seed showed the lowest metabolizable energy content (2890.05Kcal/kg). Black seed contained the highest calcium, magnesium, phosphorus and Iron contents. Negro pepper showed the highest contents for manganese, zinc, selenium and copper. African nutmeg displayed intermediate values for the macro and micro minerals content. Negro pepper has the highest values (0.48, 0.04, 0.32 and 0.07%) for alkaloids, flavonoids, saponin and oxalates, respectively while Black seed has the highest tannin content (0.05%). The findings indicate that these phytoadditives might be good sources of valuable nutrients for human and animal use.
Keywords: Phytoadditives, Black seed, African nutmeg, Negro pepper, Chemical composition

INTRODUCTION

Medicinal plants can be referred to as Herbs and Spices which can be used as natural feed phytoadditives or phytobiotics. Phytoadditives has been defined by Windisch *et al.* (2008) as plant-based compounds that are incorporated into diets of farm animals to improve their productivity, performance and quality of products. Olomu (2011) defined feed additives as materials which are added to feed with the aim of protecting the animals from diseases, improving growth rate, feed efficiency and increasing overall performance. Several studies have indicated that herbs, spices and their extracts are important in sustainable animal production because they are cost effective; they are easily available; they do not have known residual effects; and they avoid the risk of developing antibiotic resistance in the human beings who consume the product (Ryan, 2018). Medicinal plants offer several health benefits including immune stimulation, anti-bacterial, coccidiostatic, antiviral or anti-inflammatory activity and anti-oxidant properties (Dhama *et al.,* 2015; Zenner *et al.,* 2003). Some of the herbs of medicinal benefits are garlic, ginger, black seeds, African nutmeg and Negro pepper.
Although, additives obtained from plants are biologically active but may or may not be nutritive (Shittu *et al*., 2022). Therefore, this study was carried out to assess the nutritional and antinutritional composition of black seed, African nutmeg and Negro pepper.

MATERIALS AND METHODS

The black seed, African nutmeg and Negro pepper were purchased from reputable markets within Ogbomoso metropolis where good quality was normally sold.

Processing of Test ingredients for analysis

The shells of African nutmeg were removed and the seeds, black seed and negro pepper were ground with Eurolex Mixer / Grinder model MG1153 (a domestic blender) into powdery form of 0.05mm and stored in an air tight container until needed for chemical analysis. Sub-samples of the test ingredients were analyzed for chemical composition.

Proximate analysis of the Test ingredients

Black seeds, African nutmeg and Negro pepper powder were analyzed for proximate components; Dry Matter (DM), Crude Fibre (CF), Crude Protein (CP), Ash and Ether Extract (EE) using methods of the Association of Official Analytical Chemists (AOAC, 2012). They were carried out in triplicates and values were reported in percentages. The metabolizable energy was calculated using the formular of (Pauzenga, 1985): (3.5 x CP) + (8.5 x CF) + (3.5 x NFE) x 10. Where: CP - Crude protein, CF - Crude fibre, NFE - Nitrogen Free Extract

Determination of mineral composition of Black seeds (*Nigella sativa*), African Nutmeg (*Monodora myristica*) and Negro pepper (*Xylopia aethiopica*)

Macro elements (sodium, potassium, calcium, magnesium and phosphorus) were determined by flame photometer while the micro elements (iron, manganese, zinc, selenium and copper) were determined in triplicates using atomic absorption spectrophotometer as described in the methods of AOAC, (2005) after appropriate digestion by acids.

Determination of phytochemical composition of Black seed (*Nigella sativa*), African Nutmeg (*Monodora myristica*) and Negro pepper (*Xylopia aethiopica*)

Quantitative and qualitative phytochemical analysis (tannin, saponins, oxalate, alkaloids and flavonoids) of Black seed (*Nigella sativa*), African Nutmeg (*Monodora myristica*) and Negro pepper (*Xylopia aethiopica*) were determined in triplicates using the methods of Harborne, (1999).

Results and discussion

The proximate composition of black seeds, African nutmeg and negro pepper is presented in Table 1. Black seed has the highest values recorded for dry matter, crude protein, crude fibre, ether extract and ash followed by Negro pepper and African nutmeg. African nutmeg had the highest nitrogen free extract (64.69%) while the lowest was observed in black seed (25.70%). However, Negro pepper contained the highest metabolizable energy content (3500Kcal/kg), closely followed by African nutmeg (3145.05Kcal/kg) while black seed showed the lowest metabolizable energy content (2890.05Kcal/kg).

Table 1: Proximate composition of Black seeds, African nutmeg and Negro pepper

Parameters	Black seed	African nutmeg	Negro pepper
Dry matter (%)	95.37 ± 0.01	91.88 ± 0.02	93.70 ± 0.02
Crude protein (%)	21.03 ± 0.01	13.54 ± 0.00	17.43 ± 0.03
Crude fibre (%)	6.90 ± 0.01	2.20 ± 0.00	5.88 ± 0.01
Ether extract (%)	37.91 ± 0.03	6.77 ± 0.00	11.67 ± 0.01
Ash (%)	7.42 ± 0.00	4.59 ± 0.01	7.24 ± 0.00
Nitrogen free extract (%)	25.70 ± 0.03	64.69 ± 0.00	51.49 ± 0.00
Metabolizable energy (Kcal/kg)	2890.05 ± 0.02	3145.05 ± 0.01	3500.00 ± 0.01

Table 2: Minerals composition of Black seeds, African nutmeg and Negro pepper

Parameters	Black seed	African nutmeg	Negro pepper
(%)			
Sodium	0.02 ± 0.00	0.09 ± 0.00	0.11 ± 0.00
Potassium	0.31 ± 0.00	0.21 ± 0.00	0.43 ± 0.01
Calcium	0.79 ± 0.01	0.18 ± 0.00	0.28 ± 0.00
Magnesium	0.35 ± 0.01	0.19 ± 0.00	0.28 ± 0.00
Phosphorus	0.62 ± 0.00	0.35 ± 0.01	0.37 ± 0.01
(mg/kg)			
Iron	141.74 ± 0.11	57.27 ± 0.03	85.31 ± 0.07
Manganese	13.47 ± 0.02	17.67 ± 0.02	21.17 ± 0.03
Zinc	21.06 ± 0.02	26.19 ± 0.02	32.44 ± 0.05
Selenium	0.03 ± 0.00	0.02 ± 0.00	0.06 ± 0.00
Copper	5.81 ± 0.01	6.60 ± 0.00	8.00 ± 0.00

Table 2 shows the mineral composition of black seed, African nutmeg and Negro pepper. The results for macro elements composition revealed that Negro pepper has the highest values recorded for sodium and potassium (0.11 and 0.43%) followed by African nutmeg and black seed. Black seed

contained the highest calcium, magnesium, phosphorus and iron contents. Negro pepper showed the highest contents for manganese, zinc, selenium and copper. African nutmeg displayed intermediate values for the macro and micro minerals content.

The phytochemical composition of black seed, African nutmeg and Negro pepper is presented in Table 3. It was observed that Negro pepper has the highest values (0.48, 0.04, 0.32 and 0.07%) for alkaloids, flavonoids, saponin and oxalates respectively. Black seed has the highest tannin (0.05%). African nutmeg (0.02%) and Negro pepper (0.03%) had lower tannin content than black seed.

Table 3: Phytochemical composition of Black seeds, African nutmeg and Negro pepper

Parameters (%)	Black seed	African nutmeg	Negro pepper
Alkaloids	0.32 ± 0.01	0.19 ± 0.00	0.48 ± 0.02
Flavonoids	0.01 ± 0.00	0.02 ± 0.00	0.04 ± 0.00
Saponins	0.21 ± 0.00	0.16 ± 0.00	0.32 ± 0.01
Tannins	0.05 ± 0.00	0.02 ± 0.00	0.03 ± 0.00
Oxalates	0.03 ± 0.00	0.03 ± 0.00	0.07 ± o.00

Among the three ingredients evaluated, black seed has the highest crude protein. The outcome of the proximate composition of black seeds, African nutmeg and Negro pepper showed that they could serve as a source of protein, energy, as well as antioxidant micronutrients supplements for animals. The crude protein contents ranging between 17.43 – 21.03% were consistent with percentage reported by other authors (Dike, 2010; Bouba *et al.,* 2012; Osabor *et al*., 2015; Borquaye *et al.,* 2017 and Kanu and Onuegbu, 2020) but higher than the value (9.22%) reported by Oso and Oladiji (2019). The crude fibre and the lipid contents were relatively higher compared to those reported for other phytoadditives such as ginger and garlic (Okolo *et al.,* 2012) but were within the range reported by Mamun and Absar, (2018). In terms of minerals, the most predominant are calcium, phosphorus, magnesium, potassium and iron; this is in agreement with the works of (Aremu and Ibrahim, 2014) who reported that phosphorus, calcium and magnesium were the most abundant minerals in Nigeria plant foods. Copper, Zinc and Manganese were in trace amounts. The high level of iron in the ingredients (black seed, African nutmeg and negro pepper) is an indication that they possess hematinic property and justifies their inclusion in some local blood tonic preparations to manage iron deficiencies (Akoto *et al*., 2015). Deficiency of iron causes anemia, a condition in which the level of iron in the body is low. This results to a decrease in red blood cells level (Longo and Camaschella, 2015).

The phytochemical contents of the three samples were relatively low when compared to wheat bran, soybean, barley, garlic, broccoli and cabbage (Santamaria *et al.,* 1999). Some antinutrients like tannins could exert beneficial biological activities such as antimicrobial, anti-viral and antifungal (Chung *et al.,* 1998). In addition, saponins suppress the absorption of alcohol, cholesterol and iron in the digestive system (Falade *et al.,* 2005). Biologically, the important phytochemicals such as oxalates, tannins, alkaloids, flavonoids and saponin are present in minimal amount which are not likely to cause serious harm. Black seed, African nutmeg and negro pepper can be considered as a rich source of protein, lipid, energy and minerals (Ogunka-Nnoka and Mepba 2008). Some phytochemicals present in these ingredients such as oxalates, tannins, flavonoids, saponine and alkaloids might inhibit the bioavailability of minerals and vitamins (Nwinuka *et al.,* 2005) if present in high amount. Aside reducing the bioavailability of minerals in the body, oxalates also contribute significantly to kidney stones (Park, 2013). However, the amounts of antinutrients present in the ingredients are very minimal which might not cause serious harmful effect. Differences in the chemical compositions may be due to differences in soil characteristics and climatic conditions at the locations where the ingredients were cultivated. They may also be due to growth conditions, genetic variations and differences in analytical procedures (Ozcan, 2004).

CONCLUSION

Herbs are used in poultry and other livestock diets to produce a wide range of biological activities like antibacterial, antifungal, antiviral, anti-parasite and anticoccidiosis. The outcome of the chemical composition of this present study showed that black seeds, African nutmeg and Negro pepper could serve as phytoadditives that could enrich the antioxidant capacity of animals and can be utilized in livestock diets.

REFERENCES

Akoto, O., Borquaye, L.S., Howard, A.S., and Konwuruk, N. (2015). Nutritional and mineral composition of the fruits of *Solanum torvum* from Ghana. *International Journal of Chemical and Biomolecular Science,* 1:222–226.

AOAC International, (2012). Official methods of analysis of AOAC International 19th Revised edition, Gaithersburg (MD), AOAC International.

Aremu, M.O. and Ibrahim, H. (2014). Mineral content of some plant foods grown in Nigeria: A review. *Food Science and Quality Management*, 29:73-89.

Borquaye, L.S., Darko, G., Laryea, M.K., Gasu, E.N., Amponsah, N.A. and Appiah, E.N. (2017). Nutritional and anti-nutrient profiles of some Ghanaian spices. *Cogent Food and Agriculture,* 3:1348185.

Dhama, J., Latheef, S.K., Abdul Samad, H., Karthik, K., Tiwari, R., Khan, R.U., Alagawany, M., Farag, M.R., Alam, G.M., Laudadio, V. and Tufarelli, V. (2015). Multiple beneficial application and modes of action of herbs in poultry health and production. A Review. *International Journal of Pharmacology,* 11(3):152-176.

Falade, M.S., Owoyomi, O., Harwood, C.E. and Adewusi, S.R.A. (2005). Chemical composition and starch hydrolysis of *Acacia colei* and *Acacia tumida* seeds. *Cereal Chemistry Journal,* 82(5):479–484.

Kanu, C.N. and Onuegbu, P.I. (2020). Evaluating the Nutrient and antinurient composition of *Monodora myristica* (NUT MEG) for use as feed additive. *Journal of pure and Applied Science*, 18(9):129-138.

Mamun, M.A. and Absar, N. (2018). Major nutritional composition of black cumin seeds cultivated in Bangladesh and the physicochemical characteristics of its oil. *International Food Research Journal,* 25(6):2634-2639.

Osabor, V.N., Bassey, F.I. and Ivara, S.E. (2015). Chemical profiling of African guinea pepper fruit (*Xylopia aethiopica*). *Journal of Medicinal Plant Herb Therapy Research*, 3:10-15.

Shittu, M.D., Alagbe, J., Ojebiyi, O.O, Ojediran, T. (2022). Growth performance and haematological and serum biochemical parameters of broiler chickens given varied concentrations of *Polyalthia longifolia* leaf extract in place of conventional antibiotics. *Animal Science and Genetics Journal*, 18(2):57-71.