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Nutritional and Anti-nutrient Composition of Melon Husks: Potential as Feed Ingredient in Poultry Diet

Ogbe A.O. and George G.A.L.
Department of Animal Science, Faculty of Agriculture, Nasarawa State University, Keffi, NIGERIA

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Abstract

Melon husks were collected from Nasarawa Local Government Area of Nasarawa State and milled into powder for proximate, mineral and phytochemical analysis. The results of proximate analysis showed that melon husks contained crude protein (19.14% ±0.46), carbohydrate (61.01% ±0.35), crude fibre (8.12% ±0.85), ash (7.73% ± 0.12), crude fat (1.71% ±0.04) and fatty acid (1.37% ± 0.03). The minerals detected include, Ca (2.1% ±0.13), K (1.3% ±0.04), Mg (0.42% ±0.1) and Na (259.85±1.78), Fe (98.42±1.55), Mn (58.83±0.54), Zn (47.77±1.06), P (30.11±0.2) and Cu (5.94±0.3) in parts per million (ppm). The results of phytochemical and anti-nutrients analysis showed the presence of tannins (15.15% ±0.24), phytates (2.05% ±0.12), trypsin inhibitor (2.01% ±0.10), saponins (1.47% ±0.23), oxalates (0.71% ±0.16) and cyanide ((0.06% ±0.01). The level of anti-nutrients and cyanide detected in the melon husks were low. The presence of essential nutrients and minerals imply melon husks could be utilized as a potential feed ingredient in poultry diets. The benefits of essential nutrients and minerals in maintaining health and growth performance were highlighted. It was therefore recommended that melon husks (shells), which are either burnt as agricultural waste materials or discarded in large quantities to pollute the environment in some parts of Nasarawa State, could be utilized as a possible feed ingredient in poultry diets.

Key Words: Melon husks, nutritional and chemical composition, poultry diet.

Introduction

Poultry are monogastric animals, which depend on highly digestible feed ingredients to improve their growth performance and health. Energy-providing feed (such as maize or corn) and body building food like soybean and groundnut in form of cake as protein sources are required by poultry (birds). However, these feedstuffs are stable food for many people. In Nigeria, soybean is utilized for making soybean milk which is taken as fresh drink by many people. Soybeans are not readily available[1]. Maize is expensive and groundnut cake (GNC) is scarce, thereby limiting the availability of the feed ingredients. Thus, there is competition for these feed ingredients between animals and humans, making them more expensive and their inclusion in poultry diet also increases the cost of poultry production. Under normal conditions the cost of poultry feed have been reported to account for over 70% of the total cost of poultry production[1]. This proportion has been on the increase as a result of the volatibility of the feed market and the competition for feed resources between human food sector and animal feed industries[1]. Poultry feed ingredients can be supplemented with amino acids, but the amino acid sources are scarce and expensive. Consequently, nutritionists and research scientists are turning attention to alternative sources of feed ingredients such as agricultural by-products.

Melon husks are shells that are discarded after processing or shelling of melon seeds (*Citrullus vulgaris*). Melon is a cucurbit crop belonging to the family cucurbitaceae[2]. Melon (seed) crops are grown, harvested and processed in large tonnage in Nasarawa Local Government Area of Nasarawa State, Nigeria. The seeds are removed from the fruit, washed, sun-dried and sold in large quantities (tonnage) annually for commercial purpose (as a special soup condiment). They are also used as domestic remedy for urinary tract infection, hepatic congestion, intestinal worms and abnormal blood pressure[3]. The freshly shelled seeds were reported contained 34.24% crude protein, 45.95% fat, 7.18% crude fibre, 4.05% ash, 8.03% moisture and 0.56% carbohydrate[4]. Storage for long duration can decrease the percentage fat, ash, fibre and mineral contents[4, 5].

However, large quantities of the melon husks are discarded and burnt, which pollute the environment. While the poultry industry is threatened with acute shortage of conventional feed ingredients leading to low productivity. It may be possible to utilize melon husks as non-conventional source of feed ingredient for poultry. Information in literature on the nutritional composition of melon husks and its potential as a feed ingredient for poultry is scarce. The aim of this study therefore was to determine the proximate, mineral and anti-nutrient composition of melon husks. The main objective was to evaluate its potential as possible feed ingredient for poultry.

Material and Methods

Collection and processing of melon husks: Dried melon husks (shells) where collected from the rural women who process melon seeds for commercial purpose (also called "egusi" by the people) in Nasarawa Local Government Area of Nasarawa State. The melon husks were milled into powder form using a locally made miller machine (unbranded) and then sun-dried (at 35^{o}C) for 3-5h.

Proximate and mineral analysis: The melon husks samples (in duplicates) were analyzed for their proximate composition, according to the methods of AOAC[6] for determination of moisture, crude fibre, nitrogen for protein evaluation, fat and cyanide content of the mushroom. Minerals (calcium, magnesium, potassium, sodium, iron, zinc, manganese and copper) were determined using Atomic Absorption Spectrophotometer (AAS-Buck 205 model). Phosphorus was determined colorimetrically, according to the methods of AOAC[6]. All determinations were done in duplicates. The values of calcium, magnesium and potassium were reported in percentage while sodium, iron, zinc, phosphorus, manganese and copper were reported in parts per million (ppm). Total soluble carbohydrate was determined by the difference of the sum of all the proximate composition from 100%. The calorific (energy) value was obtained according to the methods of Akinyeye *et al.*[7,8]. This was done by multiplying the value of carbohydrate, protein and crude fat by the Atwater factors of 17, 17 and 37 respectively. The crude fat was converted into fatty acid by multiplying the value with a conversion factor of 0.80, according to the method of Akinyeye *et al.*[8] and Greenfield and Southgate[9]. The proximate determinations were performed in duplicates. All the proximate values were reported in percentage.

Phytochemical analysis and anti-nutrients: The methods of Sofowora[10] were used for the quantitative phytochemical and anti-nutrients analysis of the melon husks. All determinations were done in duplicates.

Statistical analysis: All data generated were analyzed using descriptive statistic as described by Olawuyi[11]. Statistical values that were calculated include mean and standard deviation.

Results and Discussion

Proximate and mineral composition of melon husks (shells): The results of proximate (nutrients) analysis showed the melon husks contained appreciable amounts of crude protein (19.14% ±0.46), carbohydrates (61.01% ±0.35), crude fibre (8.12% ±0.85), ash (7.73% ± 0.12), crude fat (1.71% ±0.04) and fatty acid (1.37% ± 0.03) (table-1).

Table-1
Proximate composition of melon husks (shells) from Nasarawa State, Nigeria

Nutrients analyzed (% DW)	Mean composition (% ± SD)
Crude Protein (CP)	19.14 ± 0.45
Crude Fibre (CF)	8.12 ± 0.85
Crude Fat (lipid)	1.71 ± 0.04
Ash Content	7.73 ± 0.12
Moisture	2.42 ± 0.70
Nitrogen (N)	3.19 ± 0.25
Carbohydrate (CHO)	61.01 ± 0.35
Fatty acid	1.37 ± 0.03
Dry Matter (DM)	97.58 ± 3.56
Energy value (Kcal/100kg)	1440.11 ±0.30

*Data are mean ± standard deviation (SD) of duplicate results; DW = dry weight.

The results of mineral analysis showed the presence of calcium, Ca (2.1% ±0.13), potassium, K (1.3% ±0.04) and magnesium, Mg (0.42% ±0.1) (table-2). Other minerals detected include, sodium, Na (259.85±1.78), iron, Fe (98.42±1.55), manganese, Mn (58.83±0.54), zinc, Zn (47.77±1.06), phosphorus, P (30.11±0.2) and copper, Cu (5.94±0.3) in parts per million (ppm) (table-2). The presence of these essential nutrients and minerals imply melon husks could be utilized as a feed ingredient for poultry. Minerals are essential nutrients, which are said to be present in small amounts in the body or in several parts per million[12].They are essential because they each play important role in metabolic processes of the body and their absence can cause deficiency symptoms in animals[12,13]. The essential mineral elements of nutritional importance are macro (major) elements such as Ca, P, K, Na, and Mg. The micro (trace) elements are Fe, Zn, Cu, Mn, and Cu.

Table-2
Mineral composition of melon husks from Nasarawa State, Nigeria

Elements	Mean composition (±SD)
Calcium (%)	2.10±0.13
Magnesium (%)	0.42 ±0.10
Potassium (%)	1.30 ±0.04
Sodium (ppm)	259.85 ± 1.78
Iron (ppm)	98.42 ±1.55
Zinc (ppm)	47.77 ± 1.06
Phosphorus (ppm)	30.11 ±0.20
Manganese (ppm)	58.83 ± 0.54
Copper (ppm)	5.94 ± 0.30

*Data are mean values ± standard deviation (SD) of duplicate results; ppm = parts per million (1mg/kg = 1ppm)

Some minerals are required for normal body growth, activities of muscles and skeletal development (such as calcium), cellular activity and oxygen transport (copper and

iron), chemical reaction in the body and intestinal absorption (magnesium), fluid balance and nerve transmission (sodium and potassium), as well as the regulation of acid-base balance (phosphorus). Iron is useful in prevention of anaemia and other related diseases[14]. Manganese plays a role in energy production and in supporting the immune system[15]. It also works with vitamin K to support blood clotting, and with B complex vitamins to control the effects of stress[15]. Zinc is useful for protein synthesis, normal body development and recovery from illness[15].

Phytochemical composition and anti-nutrients: Results of phytochemical analysis and anti-nutrients showed that melon husks (shells) contained tannins (15.15% ±0.24), phytates (2.05% ±0.12), trypsin inhibitors (2.01% ±0.10), saponins (1.47% ±0.23), oxalates (0.71% ±0.16) and cyanide ((0.06% ±0.01) [table-3]. The anti-nutrients were low. Boiling in hot water reduces anti-nutrients of plant products[16]. Trypsin inhibitor is an anti-nutrient that inhibits trypsin and chymotrypsin, which play a role in digestion of protein in animals. Trypsin also causes pancreatic enlargement and growth depression[17]. Hydrogen cyanide is toxic when ingested by monogastric animals in large quantity. The trypsin inhibitor and cyanide content of the melon husks were low.

Table-3
Phytochemical composition of melon husks from Nasarawa State, Nigeria

Phytochemical/anti-nutrients	Mean values (% ±SD)
Phytates	2.05 ± 0.12
Oxalates	0.71 ± 0.16
Saponins	1.47 ± 0.23
Tannins	15.15 ± 0.24
Trypsin inhibitors	2.01 ± 0.10
Hydrogen cyanide (HCN)	0.06 ± 0.01

*Data are mean values ± standard deviation (SD) of duplicate results

Tannins were reported as one of the most important of the bioactive constituents of plants[18]. The phytoconstituents (which includes saponins and other bioactive compounds) are antibiotic principles of plants[18]. Tannins are plant polyphenols, which have ability to form complexes with metal ions and with macro-molecules such as proteins and polysaccharides[19]. Dietary tannins are said to reduce feed efficiency and weight gain in chicks[20,21]. Soaking and boiling of plant materials in water is said to improve their utilization in terms of feed intake and protein digestibility[22]. Environmental factors and the method of preparation of the plant samples may influence the concentration of tannins present. Saponins were also detected in the melon husks (shells). Saponins are glycosides, which include steroid saponins and triterpenoid saponins[23]. High levels of saponins in feed affect feed intake and growth rate in poultry[21,22]. Reduction in feed intake was ascribed to the bitter or irritating taste of saponins[23,24]. Saponins (in excess), causes hypocholestrolaemia because it binds cholesterol making it unavailable for absorption[25]. Saponins also have haemolytic activity against RBC[26]. Saponins-protein complex formation can reduce protein digestibility[27,28].

The anti-nutrients such as phytates in foods are known to bind with essential minerals (like calcium, iron, magnesium and zinc) in the digestive tract, resulting in mineral deficiencies[29]. They bind minerals to form insoluble salts, thereby decreasing their bioavailability or absorption[30, 31]. Oxalate binds with calcium to form calcium-oxalate crystals which are deposited as urinary calcium (stones) that are associated with blockage of renal tubules[32]. Proper food processing would reduce anti-nutrients. Bacteria and fungi have often been identified as cyanide detoxifying microorganisms[33].

In this study, the levels of anti-nutrients and cyanide detected in the melon husks were very low. The presence of nutrients in melon husks imply they could be utilized as a feed ingredient in poultry diets. Nutrients are known to improve the performance and health of birds. Nutrients are required for proper bone development and improved eggs quality.

Conclusion

In conclusion, the result of this study showed that melon husks contained appreciable amounts of carbohydrate, protein and minerals, and could be useful as feed supplement for poultry. Adequate processing and enzyme treatment could be carried out to improve utilization of melon husks in poultry diets.

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