DETERMINATION OF PROXIMATE COMPOSITION, SOME ANTI-NUTRITIONAL FACTORS AND AMINO ACID PROFILE OF MISTLETOE LEAF (T*apinanthus bangwensis*) MEAL

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ABSTRACT
This study was carried out to determine the proximate composition, some anti-nutritional factors and amino acid profile of mistletoe leaves as alternative protein feedstuff. The leaves were harvested in Maiduguri metropolis at the onset of dry season, around September. They were air-dried in a ventilated room for a week, after which they were sun-dried for two hours. They were then reduced to smaller particles using a hammer mill with a mesh size of 1.5 mm. These samples were taken to Nutrition Laboratory, for analysis of proximate composition, amino acid profile and anti-nutritional factors. The results obtained showed that mistletoe leaf meal has good amount of crude protein (20.32 CP %), ether extract (3.72%), crude fibre (10.17%), ash (7.41%) and amino acid profile especially for lysine (3.10) and methionine (1.43). In addition processing was effective in reducing some of the anti-nutritional factors (tannin, saponin, phytates and oxalate). It was concluded from the result obtained that mistletoe leaves can be used as potential protein source.
Keywords: Mistletoe leave, proximate composition, anti-nutritional factors, amino acid profile, protein.

INTRODUCTION
Leaf meals have been observed to have potentials in non-ruminant nutrition and feeding especially in poultry production. The nutrient contents of leaf meals of most leguminous plants have relatively higher crude protein content than the non-leguminous plants and cereals. Also, leaf meals contain crude fibre which is higher than other feed materials utilized by animals. In most cases, the crude fibre content of leaf meal may equal or even exceed the crude protein content (D'Mello, 1992). Leaf meals also provide some essential vitamins such as vitamins A and C, minerals and oxycarotenoids which cause yellow colour of broiler chicken's skin, beak, shanks and egg yolk (Opara, 1996). Lysine concentration in leaf meal is relatively higher than those of grains and some by-products such as coconut oil meal (D'Mello and Acamovic, 1989), but not as high as to be compared with those of fish meal or soya bean meal. They are deficient in sulphur-containing amino acids though their use can be enhanced on supplementation with methionine. Except for cassava leaf meal, the metabolizable energy content of leaf meal is generally low (D'Mello and Acamovic, 1989). This therefore, entails that leaf meals cannot fully replace high quality ingredients as supplements in monogastric nutrition. Leaf meals contain carotenoids which are a class of compounds that include the carotenes, the precursors of vitamin A and the xanthophyll, which do not possess the vitamin activity of pigment. Mistletoe leave is part of the numerous important wild plant species of legume weeds growing in the savannah region of northern Nigeria, functioning as primary producers in the ecosystem. Incorporation of conventional feed ingredients like maize, soya bean meal, groundnut seed cake etc. especially in poultry feed has increased the cost of feed enormously. This is as a result of the seasonal effect on the availability of energy and protein feed ingredients which are basic requirements in commercial feed preparation which again contributes to the high cost of animal protein. This is because the populace in developing countries like Nigeria also relies on these same ingredients as food. Hence, the search for alternative feedstuffs which are cheaper and readily available. Over the last two decades, studies have revealed that wild or semi wild plants are nutritionally important because they contain higher vitamins, minerals, essential fatty acids and fibre contents. Some of the leaves also enhance taste and colour in diets (Okai, 1984)). One of such

unconventional ingredient with great prospect as alternative protein source is mistletoe leaf meal (MLM). The MLM have been reported to contain some anti- nutritional factors such as tannins, saponin, oxalate and phytate which affect the digestibility and utilization of nutrients. Therefore, the aim of this study was to determine the nutritional value of mistletoe leaf meal as alternative protein source for poultry. feed.

MATERIALS AND METHOD

The study was conducted at the Livestock Unit of the Teaching and Research Farm, Department of Animal Production Technology, Ramat Polytechnic, Maiduguri. Maiduguri is located between latitude 11°5' and 12^0 North, longitude 13°09' and 14^0 East and at an altitude of 354 m above sea level (DNMA, 2013). The weather conditions of the area were described by Makinta *et al.* (2022).

Sources and **processing** of mistletoe (*Tapinanthus bangwensis*) The leaves were air-dried in a ventilated room for a week, after which they were sun-dried for two hours. The leaves were then reduced to smaller particles using a hammer mill with a mesh size of 1.5 mm. Source of was obtained from neem trees within the Maiduguri metropolis. The predominant variety of Mistletoe found on neem tree available in Borno State is *Tapinanthus bangwensis*, which is widely distributed in the study area. Harvesting was carried out at the onset of dry season, around June.

Proximate analysis and determination of some anti-nutritional factors

Laboratory analysis of mistletoe leaves

The following analyses were carried on the test material were; Proximate Chemical analysis of mistletoe leaf meal This refers to the determination of the major constituents of feed and it is used to assess if a feed is within its normal compositional parameters or somehow been adulterated. This method partitioned nutrients in feed into 6 components: water, ash, crude protein, ether extract, crude fibre and nitrogen free extract (NFE) this was done following the procedures of AOAC (2000). NFE was obtained by subtracting the sum of percentages of all the nutrients already determined from 100 (%NFE = 100 - (%CF + %CP + %EE + %Ash) while metabolizable energy (ME) in kcal/kg was calculated according to the formula of Pauzenga (1985) as: *ME (Kcal/kg) =37 x % CP +81 x %EE + 35.5 x % NFE*. The amino acid profile in the samples of mistletoe leaves was determined using method described by Sparkman *et al.* (1958). The sample was dried to constant weight, defatted, hydrolysed, evaporated in a rotary evaporator and loaded into the Technicon Sequential Multi-Sample Amino acid Analyser (TSM). Procedure for determination of anti-nutritional factors in mistletoe leaf meal. The presence of tannin in the samples was estimated according to the procedure of Makkar *et al*. (1993) and the total oxalic acid of the powdered samples was determined by the modified method of Abeza *et al*. (1968) while phytate and saponin contents of the samples were determined using the methods described by AOAC (2000). Samples of the mistletoe leaf meal were taken to Nutrition Laboratory, Department of Animal Science, Department of Animal Production, Faculty of Agriculture, Adamawa State University, Mubi.

RESULTS AND DISCUSSION

Proximate Composition of mistletoe leaf meal

The proximate composition of the Mistletoe leaf meal (MLM) is presented in Table 1. The MLM contained 92.50% dry matter (DM), 20.87% crude protein (CP), 3.72% ether extract (EE), 0.17% crude fibre (CF), 8.02% ash, 49.96% nitrogen-free extract (NFE) and 2847.09 ME (kgcal/kg). These results are comparable with the report of Franklin *et al*. (2012) who reported 92.40% DM, 20.50% CP, 11.66% CF, 3.78% EE, 7.41% ash, 57.43% NFE and 2771.35 ME (kgcal/kg) for mistletoe leaf meal (*Tapinanthus bangwensis)*. Furthermore, the values recorded are similar to the findings of Fasuyi *et al.* (2007), who analysed sun-dried leaves of *Amaranthus cruentus* leaf meal (ACLM) with the following proximate profile: crude protein: 23.0%; crude fat: 5.4%; crude fibre: 8.8% and ash: 19.3%. The protein content of 20.87% of Mistletoe leaf meal in this study is higher than the 19.70% for raw mucuna (Velvet bean) seed (Parr *et al*., 1988) and close to 21.30% CP for palm kernel meal reported by Olomu (2011); these are non-conventional protein sources. The EE of 3.72% obtained in this study is similar to 3.78% reported by Franklin *et al*. (2012). Also, the CF of 10.17%, 8.02% ash and 49.96% NFE contents are similar to the 11.62%, 7.41% and 57.43%, respectively obtained by Franklin *et al*. (2012) for MLM. The moderate ash

content is a reflection of the mineral reserve in the mistletoe leaf. The result therefore suggests high mineral contents in the leaves (Akindahunsi and Salawu, 2005). The NFE (49.96%) of the Mistletoe leaves is in line with reports of other workers (Okai *et al*., 1984; Parr *et al*., 1988; Donkoh *et al*., 2002; Fasuyi *et al.,* 2007 and Franklin *et al*., 2012) who fed leaf meals to poultry.

Table 1: Proximate Composition Mistletoe Leaf Meal

Nutrient	Percentage (%)
Dry Matter (DM)	92.00
Crude Protein (CP)	20.89
Crude Fibre (CF)	10.17
Ash	8.02
Ether Extract (EE)	4.72
Nitrogen-free extract (NFE)	49.96
Metabolizable Energy (kcal/kg)	2847.09

AMINO ACID PROFILE

The amino acid profile of mistletoe leaf meal (MLM) is presented in Table 2. The findings of this study showed that the leaves have very good amino acid content which is comparable to the values obtained from other non-conventional feeds and legumes (e.g. soya bean meal). The different amino acid contents were lysine 4.01 g/100g protein, threonine, 2.18 g/100 g protein, arginine 4.63 g/100g protein, valine 4.21 g/100g protein, tryptophan 2.45 g/100g protein, methionine 1.66 g/100g protein, isoleucine 3.73 g/100g protein, leucine 6.81 g/100g protein, histidine 2.41g/100g protein and phenylalanine 3.21 g/100g protein for the essential amino acids. The MLM showed slightly higher amino acid values than soya bean for both essential and non-essential amino acids. The methionine and lysine contents of 1.66 and 4.01 g/100g protein, respectively, being the major limiting essential amino acids, compare with that of soya bean (1.40 and 2.37 g/100g protein, respectively). The findings in this study is in line with the report of Fasuyi *et al.* (2007) who analysed *Amaranthus cruentus* leaf meal (ACLM) and found that methionine and to a lesser extent, lysine, arginine, leucine and aspartate were high. The lysine concentration in the leaf meal is relatively higher than those of grains and some by-products such as coconut oil meal (4.65, 1.81 and 1.69 g/100g protein, respectively (D'Mello and Acamovic, 1989). Based on the proximate and amino acid profile of MLM, the leaf meal could be used as a protein source in the diets of broiler chickens.

Anti-nutritional factors of Mistletoe Leaf Meal (MLM)

The results of the anti-nutritional components of mistletoe leaf meal are presented in Table 3. The value obtained showed that MLM contains saponin (234.59 mg/100g), tannins (198.87 mg/100g), oxalate (62.60 mg/100g) and phytates (84.39 mg/100g). The anti-nutritional factors analysed were all within tolerable levels reported by Walter *et* al. (2002) for saponin 100–600 mg/100g, tannins 80–250 mg/100g, oxalates 100–150 mg/100g and phytates 50-100 mg/100g. This finding is consistent with the report of Asaolu *et al*. (2009) although a slightly lower value was recorded for oxalate (62.60 mg). EFSA (2010) studied the safety and efficacy of tannic acid when used in feed for all animal species and inferred that the use of tannic acid as feed additive up to 150 mg/100g is safe for all animal species. Saponin plays an active role as anti-inflammatory and immune-stimulating remedies (Cheeke *et al.,* 2006). Tannins have been reported to perform antibacterial and antiviral activity (Enzo *et al*., 2007) but could reduce the availability of nutrients and cause growth inhibition when consumed in higher quantities. The anti-nutrients analysed for MLM are found to occur in low amounts as shown in Table 3. Based on the results obtained, the MLM can be included in the diets of chickens with minimal or no adverse effects.

Table 2: Amino Acid Profile of Mistletoe Leaf Meal (MLM)

Amino Acid	MLM (g/100g protein)	Amino Acid	MLM (g/100g protein)
Lysine	4.01		
Tyrosine	3.41		
Threonine	2.18		
Cysteine	1.16		

Arginine		4.63			
Aspartic Acid		7.79		Valine	4.21
Serine		4.00		Tryptophan	2.45
Glutamic Acid		8.36			
Methionine		1.66			
Proline		2.73		Isoleucine	3.73
Glycine		3.36		Leucine	6.81
Alanine		2.73			
Histidine		2.41	Phenylaline		3.21

Table 3: Anti-nutritional factors of Mistletoe Leaf Meal

Anti-nutritional factors	(mg/100g) 1		(mg/100g) 2
Saponin	351.87	Tannins	198.88
	80–250	Oxalates	62.60
			100–150
Phytates	84.39		50-100

Source: 1= Values from the present study (2019), 2= Walter *et al.* (2002)

CONCLUSION AND RECOMMENDATION

Based on the proximate and amino acid profile of MLM, the leaf meal could be used as a protein source in the diets of broiler chickens. The lysine concentration in the leaf meal is relatively higher than those of grains and some by-products such as coconut oil meal. The ash content is a reflection of the mineral reserve in the mistletoe leaf. The result therefore suggests high mineral contents in the leaves. The anti-nutrients analysed for MLM are found to occur in low amounts. Based on the results obtained, the MLM can be included in the diets of chickens without any adverse effects.

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