Proximate, amino acid profile and mineral composition of fresh and shade-dried *Moringa oleifera* leaves grown in Gwagwalada, Abuja.

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ABSTRACT
Proximate and mineral composition of fresh and shade-dried moringa leaves were determined using the procedures of Association of Official Analytical chemists AOAC, (1990) while their amino acid profiles were determined using methods described by Benitez (1989). Results on proximate showed that shade-dried moringa leaves have higher levels of crude protein (CP), crude fibre and ash while fresh moringa leaves has higher ether extract and moisture content. Amino acid results showed that shade-dried leaves had higher values of both essential and non-essential amino acids that were identified. Mineral composition values were also observed to be higher in shade-dried leaves than in fresh leaves.
Key words: Proximate, Amino Acid profile, Mineral composition, Analysis.

INTRODUCTION
According to Kakengi *et al*.(2001), the scarcity of animal feed is one of the major constraints to livestock production in the tropics particularly during the dry season where farmers rely on crop residues and low quality hay to feed their animals. The energy and protein intake of animals raised on such feeds cannot sustain adequate levels of animal performance. Studies have shown that multipurpose trees like *Moringa oleifera* can be used as cheap supplements to improve voluntary intake, digestibility and overall performance in animal production (Kakengi *et al*., 2001).

Over the years, a high degree of renewed interest has been placed on the nutritional properties of moringa in most countries (Oduro *et al.*, 2008). Since every animal has its nutrient requirement for optimal growth and productivity and feeding therefore becomes crucial to the animal system, it becomes very important not to give feed on a trial and error basis without a basic knowledge of the exact nutrient in such feed. Hence, this research aims at knowing the nutrient composition in moringa leaves and also to ascertain the levels of such components in the leaves before and after shade-drying.

MATERIALS AND METHODS
Collection of Plant Materials
The moringa leaves were harvested from moringa farms in Gwagwalada, Abuja. The leaves were properly washed and divided into two; one part was analysed fresh while the other was shade-dried appropriately before analysis.

Chemical Analysis for Proximate, Amino Acid Profile and Mineral Composition
Crude protein determination was carried out using the micro Kjeldahl method while crude fibre and fat were determined using standard scientific procedures according to AOAC (1990).The Amino Acid profile of the sample was determined using methods described by Benitez (1989). The sample was dried to constant weight, defatted, hydrolyzed, evaporated in a rotary evaporator and loaded into the Technicon sequential Multi-Sample Amino Acid Analyzer (TSM) and then analyzed. The atomic absorption method according to AOAC (1990) was used to determine the mineral composition.

RESULTS AND DISCUSSION
Proximate analysis of Fresh and Shade-dried *Moringa oleifera* Leaves
The results for proximate analysis of fresh and shade-dried leaves of *Moringa oleifera* are presented in Table 1. The crude protein value (36.50%)obtained for dried leaves is lower than the 39.14% for moringa leaf protein concentrate reported by Sodamade *et al*. (2013). ThisCP valueis however higher than those reported by Gidamis *et al*. (2003) and Sarwatt *et al*.,(2004) who reported lower values of 16 and 22.42% respectively.The results also show an appreciable ash level (10.89%) in dried leaves which is higher than 7.64% and 6.0% reported by Moyo*et al*., (2011) and Sodamade*et al*. (2013), respectively. These levels of crude protein and ash are of nutritional significance as they can meet the protein and mineral requirements of various animals and boost their immune system against diseases.The level (7.58%) of crude fibre

obtained for dried moringa leaves in this study is higher than the 5.43% reported by Sodamade *et al*. (2013) but lower than the value (9.25%) reported by (Ibok *et al.,* 2008). It was observed that nutrient values are higher in dried leaves than in fresh ones with the exception of ether extract and moisture. Drying the leaves help to concentrate the nutrients and also facilitate conservation. This is advantageous in animal nutrition as feed can be made available for the animal during periods of scarcity.

Amino Acids Profile of Fresh and Shade-dried *Moringa oleifera* Leaves

Table 2 shows the amino acid profile of fresh and shade-dried moringa leaves. 17 amino acids were identified in both fresh and shade-dried moringa leaves which included; lysine, arginine, histidine, threonine, phenylalanine, valine, methionine, leucine, isoleucine, tyrosine, aspartic acid, serine, glutamic acid, proline, glycine, alanine and cystine. In this study, only tryptophan was not detected from the common ten essential amino acids. It was observed that amino acid profile showed that values for both essential and non-essential amino acids were higher in shade-dried leaves than in fresh ones and this agrees with the reports of Anhwange *et al*. (2004). According to Brisibe *et al*.(2009), amino acids are building blocks of proteins and are required for; the production of enzymes, immunoglobins, hormones, growth, repair of body tissues and also forms the structure of the red blood cells.

Mineral composition of Fresh and Shade-dried *MoringaOleifera* Leaves

Table 3 shows the mineral composition of fresh and shade-dried moringa leaves used in this study. It was observed that shade-dried moringa leaves had high concentration of both macro and micro mineral elements than fresh leaves. Even though the result from this study differ from the report of Makker and Becker, (2001), the dried leave values are similar to the values reported by Moyo *et al*., (2011). The results obtained for mineral composition in this study is a good indication that moringa leaves has significant nutritional, medicinal and therapeuticvalues.

Conclusion

The results obtained in this study indicate that moringa leaves are rich in nutrients like minerals, proteins and amino acids. The shade-dried leaves were found to be higher in these nutrients than the fresh ones. Moringa leaves can therefore be used as feed component especially when shade-dried to meet up the nutritional requirement of most livestock, thus, serving as alternative raw material in animal feeding. The development of *Moringa oleifera* as a plant in the farming systems of the tropics could be the panacea for the much needed alternative feed material for increased livestock productivity.

Table 1- Proximate composition of both fresh and dried leaves of *Moringa oleifera*

Nutrient (%)	Fresh Leaves	Shade-dried Leaves (in DM)
Moisture	61.00	6.59
Crude protein	8.90	36.50
Crude fibre	3.24	7.58
Ash	4.16	10.89
Ether extract	13.76	7.10

Table 2: Amino acid profile of fresh and shade-dried Moringa oleifera leaves

Amino acid	**Fresh leaves**	**Shade-dried leaves**
Lysine*	3.30	4.56
Histidine*	1.78	2.03
Arginine*	4.25	5.95
Aspartic acid	7.32	9.34

Threonine*	2.95	4.03
Serine	2.29	3.88
Glutamic acid	8.24	10.80
Proline	2.09	3.83
Glycine	4.30	9.62
Alanine	3.23	5.14
Cystine	0.76	1.11
Valine*	3.65	7.30
Methionine*	1.34	2.20
Isoleucine*	3.91	6.13
Leucine*	4.58	9.04
Tyrosine	2.81	3.97
Phenylalanine*	3.52	5.54

*General essential amino acids.

Table 3: Mineral composition of fresh and shade-dried *Moringa oleifera* leaves

Minerals	Fresh leaves	Dried leaves
Macro minerals (%)		
Calcium	2.08	3.61
Phosphorus	0.16	0.30
Magnesium	0.12	0.42
Potassium	0.90	1.48
Sodium	0.10	0.17
Ssulphur	0.28	0.60
Micro minerals (mg/kg)		
Zinc	29.00	31.01
Copper	7.32	8.20
Manganese	74.5	85.7
Iron	360	483
Selenium	130.06	363
Boron	40.32	49.93

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