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Qualitative and Quantitative Scores of Amino Acid Content of Feedstuffs Sampled at Different Locations in Nigeria

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Abstract
This study was conducted to determine the quantitative and qualitative acids profiles, scores of amino acids (AA) content of dry brewers spent grain (DBSG), cassava meal (CAM), palm kernel cake (PKC) and groundnut cake (GNC) sampled at different locations in northern and southern Nigeria. The samples were analysed for their essential and non essential AA content at Evonik Industry Laboratory, Germany. Qualitativeand quantitative scores of the AA were calculated and presented in tables and percentages. The quantitative scores showed that on mean Total amino acids (Taa) bases, PKC contained 47.92% essential amino acids, while GNC contained 43.24%, DBSG 42.21% and CAM 41.19%.Percentage essential AA without Histidine + Arginine were 35.25, 34.65 and 28.50% for DBSG, CAM, PKC and GNC respectively. Qualitatively, GNC was rich in all the essential AAs with exception of methionine, while DBSG was rich in four essential AAs (leucine, valine, phenylalanine and arginine), and PKC was rich in arginine and moderate in isoleucine, leucine, valine and phenylalanine. CAM was poor in all essential and non essential AAs contents. It was concluded that Nigerian GNC based diets should be supplemented with synthetic methionine, while DBSG based diets should be supplemented with lysine, methionine and to some extent threonine for them to drive optimal performance in monogastric animals.

Keywords; Qualitative score, quantitative score and amino acid.

Introduction

The nutritive value of proteins depends on their capacity to produce nitrogen and amino acids in adequate amounts to meet the requirements of livestock. Over the years many protein scores have been developed for evaluating the quality of animal feed sources. Scores such as essential amino acids indices comprising chemical scores (essential amino acid of the sample / essential amino acid of the whole egg x 100), chemical score to crude protein ratio and total essential amino acid to crude protein content ratio among others have been used to evaluate the quality of non-conventional feedstuffs (Sogbesan and Ugwumba, 2008).

In this study two simple scoring techniques, qualitative and quantitative scoring of the AA content was used as aguideto farmers on the protein quality ofDBSG, CAM, PKC and GNC.

Materials and methods

The DBSG, CAM, PKC and GNC were sourced from northern and southern parts of Nigeria. At each location1kg of feedstuff was collected with the aid of a plastic scoop and thereafter form the representative sample for that location (Okoli, 2004). One sample each of cassava and brewers spent grain was collected fresh and sun-dried for 3 – 5 days. About 200 grams of each sample was shipped in transparent polyethylene bags to Evonik Industry Laboratory, Germany for amino acid analysis.The analysis procedure is detailed in AminoDat®40 (2010) and complies with the requirements of AOAC (1995).Using the generated amino acid values, severalamino acidsquality score were also calculated for the feedstuffs according to the method reported by Ogbuewu, (2012).

Data obtained were subjected to descriptive statisticssuch as mean, standard deviation,coefficient of variation and across samples valuesusing Statistical Package for Social Sciences (SPSS version 20, 2011).

Results and Discussion

The total amino acids content of the sampled materials ranged from 0.840 ± 0.182% recorded for CAM to 40.025 ±5.831% recorded for GNC as showed in Table 1, with high CVs of 21.744% for CAM and 14.568% recorded for GNC values indicating wide variations in Taa of samples from different locations. The quantitative scores of the amino acid profiles of the sampled feedstuffs are shown in table 2. On mean total amino acids bases PKC contained 47.92% EAAs, while GNC contained 43.24%, DBSG (42.21) and CAM (41.19%). Again, the percentage values of non-essential amino acids in the feedstuffs ranged from 50.26 in CAM to 55.09% in DBSG. These values indicate generally that the proteins in the feedstuffs are of high quality even though lower in quantity in PKC and CAM.

Table 1: Total amino acids content of the sampled feedstuffs

Samples	*DBSG*	*CAM*	*PKC*	*GNC*
Sample 1	24.394	0.982	11.779	44.045
Sample 2	23.509	0.855	11.659	40.681
Sample 3	21.292	1.029	11.548	44.271
Sample 4	23.555	0.590	12.959	41.242
Sample 5	19.364	0.745	12.150	29.903
Mean ± SD	22.42 ± 2.06	0.840 ± 0.18	12.019 ±0.57	40.028 ± 5.88
CV	9.146	21.744	4.782	14.568

DBSG = dry brewers spent grain, CAM = cassava meal, PKC = palm kernel cake, GNC = groundnut cake, S D = standard deviation, CV = coefficient of variation, SEM = standard error of mean.

Table 2: Quantitative scores of the amino acids compositions of the sampled feedstuffs

Parameters	*DBSG*	*CAM*	*PKC*	*GNC*
Mean total and (%) essential amino acids	8.62 ± 1.194 (42.21)	0.31 ± 0.085 (41.19)	4.02 ± 0.164 (47.92)	12.41 ± 1.731 (43.24)
Mean total and (%) non-essential amino acids	12.34 ± 1.041 (55.09)	0.46 ± 0.080 (54.75)	6.05 ± 0.295 (50.26)	21.78 ± 3.230 (54.42)
Mean total and (%) content of essential amino acids without Histidine + Arginine	7.91 ± 0.876 (35.22)	0.29 ± 0.080 (34.65)	3.77 ± 0.152 (31.35)	11.39 ± 1.585 (28.50)
Histidine + Arginine content (%)	1.56 ± 0.115	0.055 ± 0.013	1.99 ± 0.143	5.91± 0.914

Based on the TAA content results, of the feedstuffs were scored qualitatively as poor (<0.1%), low (0.1 – 0.4%), moderate (0.5 – 0.9%) and rich (>1.0%). Table 3 showed that GNC was rich in all EAAs with exception of methionine and all NEAAs except for cysteine, indicating that Nigerian GNC based diets need to be supplemented with synthetic methionine. DBSG was rich in four EAAs (leucine, valine, phenylalanine and arginine) and specifically low in methionine and histidine contents in all the NEAAs except for cysteine and glycine and indicating that Nigerian DBSG based diets will need to be supplemented with lysine, methionine and to some extent threonine for them to drive optimal performance in monogastric animals. PKC was rich in one EAA, arginine, moderate in isoleucine, leucine, valine and phenylalanine and rich in two NEAAs aspartic acid and glutamic acid, while being moderate in glycine, serine, proline and alanine.

Table 3: Qualitative scores of amino acids profile of the sampled feedstuffs

Amino acid	*DBSG*	*CAM*	*PKC*	*GNC*
(a)Essential				
Methionine	L	P	L	L
Lysine	M	P	L	R
Threonine	M	P	L	R
Isoleucine	M	P	L	R
Leucine	R	P	M	R
Valine	R	P	M	R
Histidine	L	P	L	R
Phenylalanine	R	P	M	R
Arginine	R	P	R	R
(b) Non-essential				
Cysteine	L	P	L	M
Glycine	L	P	M	R
Serine	R	P	M	R
Proline	R	P	L	R
Alanine	R	P	M	R
Aspartic acid	R	P	R	R
Glutamic acid	R	L	R	R

Legend: P = Poor (less than 0.1%); L = Low (0.1 – 0.4%); M = Moderate (0.5 – 0.9%); R = Rich (more than 1.0%).

From these results, Nigerian PKC cannot be regarded as a protein source for monogastric animals since it requires fortification with synthetic sources almost all the EAAs. The CAM was score poor in all the amino acids evaluated except glutamic acid for which it scored low, indicating that diets formulated with synthetic amino acids (Ogunjobi and Ogunwole, 2010). However, the proteins of cassava tubers have been shown to be relatively high in arginine, glutamine and alanine (Omeire, 2012). CAM-based diets need to be properly supplemented with essential and specie limiting AAs.

Conclusion

There is the need for farmers to be guided by the reliable protein quality information on important feed raw materials when formulating diets for livestock.

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