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Comparative Study of Amino Acid Profile of Urea Plus Methionine Supplemented and Fermented Sorghum Beer Residue with that of other Protein Standards

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ABSTRACT

Sorghum beer residue (SBR), a by-product of local brewery was purchased dried, supplemented with urea and methionine at concentrations ratio of 1.5: 0.37 %. It was inoculated with rumen liquor of cow and subjected to four days fermentation in a 5ft deep pit. After 4days fermentation, the urea plus methionine supplemented and fermented sorghum beer residue (RSBR) was sundried for 7days on concrete floor and samples taken for the determination of amino acid composition. The amino acid profile of RSBR sample revealed the availability of all essential amino acids except tryptophan (alanine, arginine, glycine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine and valine) in the sample. The amino acid profile of RSBR were higher than those of SBR, Groundnut cake (GNC), Soya bean cake (SBC), Food and Agricultural Organization (FAO) and other Animal Feed Standards (AFS). The superiority of essential amino acids in RSBR sample is an indication that it can serve as protein sources in place of conventional plant protein sources.

Keywords:

Sorghum beer residue, Urea, Methionine, Fermentation and Amino acid

ABBREVIATIONS

1. SBR = Sorghum beerresidue
2. RSBR = Re-fermented sorghum beerresidue
3. GNC = Groundnutcake
4. SBC = Soya bean cake
5. FAO = Food and Agricultural Organization
6. AFS = Animal Feed Standard

1. INTRODUCTION

In Nigeria today, more than 50% of the country's poultry farms have closed down and another 30% forced to reduce their production capacity because of shortage of feed (Esonu et al., 2001). This feed shortage has been blamed on high cost of the conventional sources of feed ingredients which was rated by Madubuike and Ekenyem, 2006 at 70- 80% of total cost of poultry production. Soya bean and groundnut cakes have been used as protein supplements in poultry diets but their high cost has engineered the need to look for locally available and cheap sources of feed ingredients particularly those that do not attract competition between humans and livestock and for which Pousgha et al., 2007 suggested traditional Sorghum beer residue. The nutritional qualities of sorghum beer residue (SBR) have been evaluated in the diets of chickens with some success (Demeke, 2007 and Pousga et al 2007), its maximum utilization as a plant protein source have been limited by its high fibre content (Aduku, 1993). The fibre fraction of a feedstuff has the greatest influence on its digestibility. The need to further recycle SBR through the process of fermentation in order to reduce its fibre content, obtain a high protein biomass and interesting amino acid composition becomes eminent. Protein quality is measured by the type of amino acids present. There are twenty different types of amino acids, eleven of which are essential in poultry nutrition because they are not manufactured by the animal's body. These include Lysine, Leucine, Isoleucine, Methionine, Phenylalanine, Threonine, Tryptophan, valine, Arginine, Histidine and Glycine (Anhwange et al., 2004). Dietary protein with all the essential amino acids in the proportion required by the animal is said to be a high quality protein. In this study, sorghum beer residue was supplemented with urea and methionine and fermented for 4-days and its amino acids composition compared with those of FAO protein standard and Animal Feed standard.

2. MATERIALS AND METHODS

2.1 Sample collection and Inoculum preparation.

The sorghum beer residue was obtained from the local gin ("Burukutu") producers within Kaduna metropolis, Nigeria. Rumen content of cow was collected fresh just

after slaughter at the Sabon-Tasha abattoir, Kaduna. This was then mixed with water in a 2:1 ratio on a weight by weight (w/w) basis and filtered through a mosquito net of pore size 2.78mm² (Ndams et al., 2011). The residue was discarded and the filtrate used as inoculum.

2.2 Substrate inoculation

The inoculation of sorghum beer residue prior to fermentation was carried out as described by Ndams et al. (2011). SBR was moistened with water at a ratio of 1:5 (w/w). SBR was supplemented with urea and methionine concentrations at a ratio of 1.5: 0.37 % (Fazaeli et al., 2007). The quantities of urea and methionine were first dissolved in the water containing the inoculum before wetting the substrate (SBR).

2.3 Substrate inoculation

On quantitative measurement, 2.67kg of methionine and 10.80kg of urea were dissolved in 3600kg of water in which 72.00kg of rumen liquor has been introduced before wetting 720kg (twelve bags of 60 kg each) of SBR. The SBR was inoculated on concrete floor and then turned into a 5ft deep pit lined with polythene materials. It was properly compacted by feet to maintain perfect anaerobic condition. The urea and methionine supplemented SBR was allowed to ferment for 4 days. After fermentation, the pit was opened, and the fermented material removed. The fermented product (RSBR) was sundried for 7 days on concrete floor and samples taken for determination of amino acids composition.

2.4 Determination of amino acids composition

The determination of amino acids profile in SBR, RSBR and GNC samples were carried out at the Department of Zoology, University of Jos using methods described by Sparkman et al. (1958).

3. RESULTS

The amino acids profile of RSBR sample revealed the

availability of all essential amino acids except tryptophan (alanine, arginine, glycine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine and valine) in the samples.

Table 1 and figure 1 shows the amino acids profile of SBR, RSBR, GNC and other animal feed protein standards. The amino acids profile of the protein biomass (RSBR) produced after 4days fermentation, except for arginine, glycine and valine which were lower, all other

essential amino acid concentrations were higher in RSBR than those of GNC. The amino acid concentrations of RSBR was numerically higher than those of Soya bean and FAO standards (with the exception of lysine which was lower compared to both) as well as that of Animal Feed Standard. Moreover, it had a superior profile in amino acid concentrations when compared to plantproteins.

Table 1: Comparison of the amino acid profile (g/100g protein) of the protein biomass of re-fermented sorghum beer residue with that of other protein standards

Amino acid	SBR	*RSBR	GNC	FAO ^a	(SBC) ^b	Animal feed standard (AFS) ^c
Alanine	8.66	8.89	2.10	-	-	-
Arginine	4.66	5.18	6.35	-	8.3	-
Cysteine	2.18	2.38	2.1	2.0	1.0	0.74
Glycine	3.17	3.60	7.8	-	4.5	2.43
Histidine	2.40	2.9	2.8	-	3.0	-
Isoleucine	4.18	4.63	2.1	4.20	5.6	2.57
Leucine	13.17	14.31	9.9	4.80	8.2	3.80
Lysine	2.38	3.02	2.1	4.20	6.8	3.20
Methionine	1.93	2.19	0.49	2.20	1.4	0.72
Phenylalanine	5.15	5.48	4.3	2.80	4.9	2.20
Threonine	3.48	4.53	4.3	2.80	4.0	1.97
Tyrosine	4.13	4.44	1.4	-	4.2	-
Serine	4.56	4.99	7.8	-	-	-
Valine	5.27	5.62	10.0	4.20	5.50	2.70

^aFood and Agricultural Organization

*Urea and methionine treated and fermented sorghum beer residue, GNC= Groundnut cake, SBC = Soy bean cake. Sources: a= Araujo D'Souza (1986), b = Adapted from Park et al., 2002 (1991), c = Lo and Morean (1986). RSB = Unfermented sorghum beer residue.

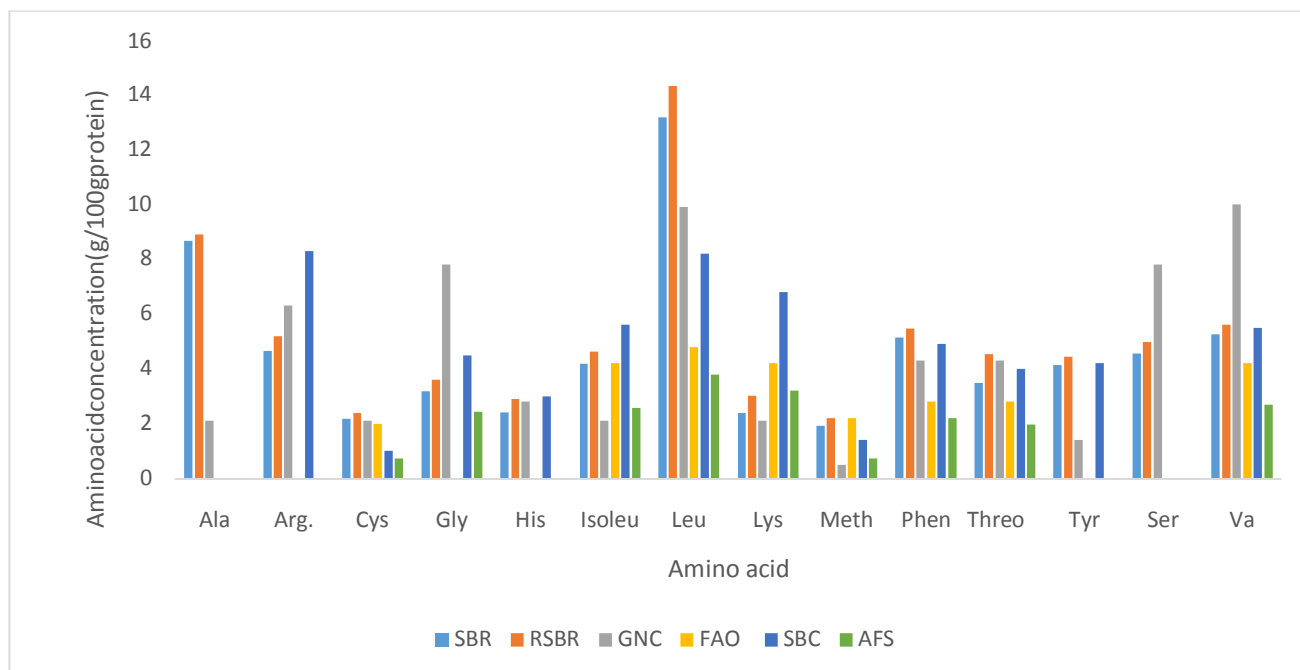


Figure 1: Comparison of the amino acid profile (g/100g protein) of the protein biomass produced (RSBR) with other protein standard

4. DISCUSSION

The availability of essential amino acids in SBR and RSBR is an indication that RSBR can serve as protein sources in non-ruminant nutrition (McDonald *et al.*, 1998). The amino acid content of all the essential amino acids of RSBR samples were numerically higher compared to the unfermented (SBR) sample in this study. This is not in agreement with Spear *et al.*, (1978) who observed numerical decrease in essential amino acids in lambs fed tall fescue supplemented with L-methionine Sulphur at 0.05 and 0.15% compared to the control (0%).

The amino acid profile of the protein biomass (RSBR) produced in this study, was observed to be higher numerically than those of GNC. It was also superior to the amino acid profile of other plant proteins. The quality of the RSBR protein produced was equal or greater than that of the conventional ingredients in terms of its amino acid profile and the standard set for animal feed. This revealed that RSBR has all the essential amino acids for animal feed. This is in agreement with Ofuya and Obilor (1993) who observed that *Rhizopus* fermented cassava peel feedstuff contained all the essential amino acids that were far more digestible than the control. Also Almeida *et al.* (1995) observed that the protein obtained (34% of the biomass) contained all the essential amino acids for animal feeds when eucalyptus hydrolyzate was fermented using *paecilomyces variottii* (fungus).

When compared to the FAO and soya bean standards, one can see that the protein standards and the protein biomass produced after 4days fermentation of

SBR with urea and methionine supplementation contains all the essential amino acids for animal feeds. Moreover, it has a superior amino acid profile when compared to other plant proteins.

5. CONCLUSION

In conclusion, the results of this study indicates that 4-days fermentation of sorghum beer residue supplemented with urea and methionine resulted in a protein biomass (RSBR) with superior amino acid profile compared to GNC, Soyabean cake, FAO and Animal Feed Standards and can be used as an alternative to conventional feed ingredients in animal feed.

6. AUTHORS' CONTRIBUTIONS

- The authors after the study was proposed to them participated in the conception and design of the study.
- Assistance was also received in the area of data graphical interpretation and in the editing of the manuscript for publishing

7. ACKNOWLEDGEMENT

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