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NUTRITIVE VALUE OF MALTED SORGHUM SPROUT

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Target Audience: Animal nutritionists, brewers, food industries, livestock farmers.

ABSTRACT

An experiment was conducted with weanling albino rats of winster strain to determine the nutritive value of malted sorghum sprout (MSP). A basal diet (Nitrogen free) was formulated along with four (4) different 10% protein diets as follows (I) Soybean meal (reference) (2) MSP, (3) MPS + Methionine + Lysine The 30 weanling rats used in the experiment were divided into 5 group of 6 rats each, and each group was alloted to the different diets. The rats were housed individually.

Rats fed soybean meal diet had retention and growth rates which were significanly ($P<0.05$) better than other retention and growth rates. Supplementation of MSP with either methionine alone or methionine and lysine improved the performance of rats compared to the unsupplemented MSP diet which ranked lowest.

Serum PO_4^{2-} were increased ($p<0.05$) in rats fed MSP while the serum Ca^{2+} levels did not vary significantly with the dietary treatment

There was no difference among treatment means for relative organ weight ($p>0.05$). It was concluded that the protein quality of MSP is poor but can be slightly improved by supplementation with synthetic methionine and lysine.

Keywords: Nutritive value, malted sorghum sprout, albino rats.

DESCRIPTION OF PROBLEM

Malting in simple term means controlled germination of cereal grains usually barley or sorghum, this is followed by appropriate drying to develop the endosperm starch protein and cell wall material into useful extraction. The resultant malt extract is a useful input in breweries and food processing companies where it is utilized for the manufacture of malt drinks, syrups, beverages, baby food, microbiological and other useful products. Malt extraction from the germinated cereal seeds, leaves the residue of shoot and root which are reffered to as malted sprouts. Brewing and food processing industries in this part of the world had depended on barley malt to meet this demand while efforts are being made to produce malt extracts locally. Sorghum (Sorghum vulgare) being an indigenous cereal in tropical African is more favoured to the exotic barley, large scale production of which (barley) might pose some problems in the tropical environment prevalent in such areas.

Developments in this sector over the last two decades have shifted the malting process which was erstwhile restricted to laboratories and pilot plants into the industrial sector. Consequently, commerical scale malting of sorghum has since begun in breweries and food industries (especially in Nigeria) with concomitant production of large quantities of Malted Sorghum (MSP). some of these industries have processing plants with capacity to produce 200,000 metric tons of malted and unmalted extracts per annum (1).

MSP has a lot of prospects as a feeding stuff and as expected it was reported to be rich in organic nitrogen (350g/kg crude protein) (1). Sorghum sprout also contains a considerable number of amino acids with low levels of methionine lysine and threonine. These amino acids are reported to be translocated into the roots and shoots during the germination of seedlings (2). With the increasing search for cheap locally available raw materials as feed stuff, studies on the usefulness of this product become needful. The present study seeks to determine the nutritive value of MSP using albino rats.

MATERIALS AND METHOD

Thirty (30) weanling albino rats of similar weight were alloted to five treatment groups and kept in individual cages. The semi-purified diets fed *ad libitum* individually to the group of rats are as follows: a basal diet which was nitrogen free, the reference diets which contained soybean meal as the only source of protein. The remaining 3 diets contained only MSP as their protein sources. While the last but one diet contained in addition 2.5gkg-1 supplementary synthetic methionine only, the last diet contained a combination of 2.5gkg-1 synthetic methonine and 1.5gkg^{-1} lysine.

The protein sources were added to supply 100gkg-1 crude protein at the expense of corn starch in the basal diet (Table 1). The rats were given unrestricted access to water. Records of daily feed intake and weekly body weights were taken; protein efficiency ratio (PER) and Net Protein retention NRP were calculated.

The experiment lasted for 21 days. Faecal output of rat was collected during the last seven days of the experiment and bulked for nitrogen analysis. Respective apprarent protein digestibilities were determined.

At termination of the experiment all the rats were weighted, euthanised, decapitated and blood samples were collected in bottles without

Table 1: Gross Composition of Experiment II diets (gkg~')

Ingredient	Basal Diet	SBM (reference)	MSP +methionine	MSP +methionine+lysine	MSP
Corn Starch	647.5	425.3	146.8	1442.3	142.8
Glucose	50.0	50.0	50.0	50.0	50.0
Sucrose	100,0	100.0	100.0	100.0	100.0
Non nutritive Cellulose	50.0	50.0	50.0	50.0	50.0
Vegetable Oil	100.0	100.0	100.0	100.0	100.0
Premix	20.0	20.0	20.0	20.0	20.0
Oyster Shell	10.0	10.0	10.0	10.0	10.0
Bone meal	20.0	20.0	20.0	20.0	20.0
Salt	2.5	2.5	2.5	2.5	2.5
Protein source	-	222.2	500.7	500.7	500.7
Total	1000	1000	1000	1000	1000

anticoagulant. Serum was decanted after a while and serum urea, creatinine, Ca^{2+} and $P2O4^{2-}$ were determined. The lung, liver, heart, kidney and spleen were immediately removed from the carcass, washed in a cold buffer and weighed. the values were expressed as percent body weight at slaughter. Serum urea was determine by the urease enzyme (3), while serum creatinine was determine by the foiln Wu filterate method.

Analysed for nitrogen in feed and faeces were done using AOAC (4) methods.

The data generated were subjected to analysis of variance (5). Significant means were separated using the Duncan multiple range test (5).

RESULTS AND DISCUSSION

The approximate composition of MSP is shown in Table 2. MSP contained higher crude protein than the sorghum grain which has crude protein value varying between 8 and 15% (7). This may be due to the fact that nitrogen and mineral are mobilized toward the roots and shoots during germination (2). The crude protein value of MSP obtained in this study (221.0gkg-1) is simialr to that reported 226.0gkg-1) (8) but lower than 350gkg-1 reported (1). One may expect that values of crude fibre to be higher than these but the figure s probably cannot be out of place if it is considered that the roots and shoots that comprise MSP are those of freshly germinated seedlings which would not have undergone kind of structural hardening.

The nitrogen free extract and ash content of this product are appreciable and quite expectedly, the either extract value is low. There is also the presence of cyanide in MSP (51.3mgkg-1). It was reported that the cyanide content of MSP are those of freshly germination.(9)

Table 2: Proximate Composition of MSP (gkg-1)

	MSP
Dry matter	920.0
Crude fibre	80.0
Crude Protein	221.0
Ether extract	8.3
Ash	74.9
NFE	511.0
HCH(mgkg-1)	513.0

Performance characteristics and apparent digestibility of experimental rats.

The rats on reference diet had the highest ($p<0.05$) weight gain. (Table 3) followed by their counterparts on MSP + lysine diet while those on unsupplemented MSP had the least gain which was probably due to the effect of cyanide and deficiency of some essential amino acids. Chronic cyanide consumption depressed net protein utilization and hence animal performance (10,11).

The weight gain recorded for the MSP diet indicated that the diet hardly supported the growth of the rats. This points to the fact that portein quality of MSP is very low. The observed low feed utilization efficiency, protein efficiency ratio and net protein utilization for these group of animals lend credence to this fact.

MSP diets supplemented with methionine + lysine induced higher ($p<0.05$) growth rates than the supplemented MSP diet. The deficiency in the amino acid profile of MSP was probably marginally made up for in the supplemented diets The supplementation of MSP with methionine + lysine gave rise to rats with higher weight gains than those supplemented with methionine only. This was obviously a direct effects of enhanced amino acid profile.

Table 3: Performance, Nutrient Utilization and some food components of experimental rats.

Parameter	SBM Reference	MSP	MSP +methionine	MSP+methspionine +lysine	SEM
Daily feed intake (g)	7.97[a]	4.32[c]	4.74[c]	5.70[b]	0.45
Daily weight gain (g)	2.28[a]	0.04[d]	0.26[c]	0.58[b]	0.06
Protein Efficiency ratio	1.65[a]	0.095[d]	0.45[c]	081[b]	0.12
Net protein Retention	1.58[a]	0.49[d]	0.33	072[b]	0.14
Apparent Protein Digestibility%	78.33[a]	55.9[bc]	57.06[b]	50.75[c]	4.25
Serum Ca2+ mg/dl	8.70	8.60	8.50	8.80	0.30
Urea (Mg/dl)	160[b]	18.0[a]	11.7[d]	14.30[c]	1.79
Creatinine (mg/dl)	0.80	0.90	0.80	0.70	0.07

mean values on the same row having different superscripts were significantly different ($P<0.05$)
*SEM - Standard error of mean.

The feed intake followed the same trend as the weight gain. In fact the latter was derived from the former. The high intake of the reference (Soybean meal) diet was definitely due to the palatability and preference of the rats for the diet because it has a more balanced profile of animo acid. Some authors (12,13) have reported that ingestion of imbalance protein led to transitory changes which directly affected appetite.

The trend for protein efficiency ratio (PER) and that Net protein retention (NPR) were largely similar which were in consonance with that observed for the performance parameters earlier discussed. In fact, the NPR values for rats on supplemented MSP diet was negative indicating very poor protein qulity. However, the better values for supplemented MSP diets also confirmed that the protein quality of MSP can be improved on supplementation with synthetic methionine and lysine. The latter giving better results than the former.

The apparent protein digestibility values did not deviate much from the trend observed above and the earlier reasons are also valid in the case. But the lowest ($p<0.05$) value recorded for this parameter for the MSP diet supplemented with methionine and lysine was unexpected because it did not conform with the performance characteristics discussed above.

Some blood components and relative organ weights of Experimental rats.

The serum PO_4 were found to be relatively higher in the MSP diets compared to the reference diet, MSP actually contained appreciable level of this mineral (0.379%) (14).

However, there was no significant difference ($P>0.05$) in the level of Ca2+-

in the serum of the rats. Rats on unsupplemented MSP diets had higer (P<0.05) level of urea compared to those on reference diets which points to an imbalance in the protein mixture.

An amino acid imbalance caused an increase in the blood urea concentration and the concentration could be decreased by restoring dietary balance,(!5) This gave credence to the low level of blood urea when the MSP diets were supplemented with methionine or methionine and lysine (Table3).

The various dietary treatments did not significantly affect the relative organ weight of lungs, liver, heart, kidney and spleen (Table 4).

Table 4 : Relative Organ weights of Experimental Rats. (g/100g live weight)

Parameter	SBM Reference	MSP	MSP +methionine	MSP+methspionine +lysine
Lungs	0.58 ± 0.02	0.85 ± 0.11	0.70 ± 0.06	0.76 ± 0.08
Liver	4.73 ± 0.40	4.65 ± 0.31	5.86 ± 0.50	5.40 ± 0.41
Heart	0.37 ± 0.01	0.57 ± 014	0.64 ± 0.11	0.58 ± 0.04
Kidney	0.74 ± 0.03	0.86 ± 0.11	0.91 ± 0.07	0.77 ± 0.06
Spleen	0.33 ± 0.03	0.42 ± 0.04	0.043 ± 0.00	0.42 ± 0.05

The organs being delicate are not easily affected by changes in the nutrition of animal and also , the duration of the trial may be too short to cause pronounced effect.

CONCLUSION AND APPLICATION

1. The protein quality of MSP is poor
2. The feeding value of MSP can be slightly improved by supplementation with synthetic methionine and lysine.

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