Tropentag 2013, Stuttgart, Germany
September 17-19, 2013

Conference on International Research on Food Security, Natural Resource Management and Rural Development
organised by the University of Hohenheim

Energy Metabolisability and Ileal Digesta Viscosity of Broilers Fed Diets Containing Fungi Biodegraded and Enzyme Supplemented Malted Sorghum Sprouts

Adekoya Osofowora[1], Oluseyi Oduguwa[1], Florence Oke[2], Vincent Jegede[1], S.O. Kareem[3], Adeboye Fafiolu[1], Vasil Pirgozliev[4], Karl-Heinz Südekum[5]

[1]Federal University of Agriculture, Abeokuta, Dept. of Animal Nutrition, Nigeria
[2]Federal University, Jigawa, Dept. of Animal Sciences, Nigeria
[3]Federal University of Agriculture, Abeokuta, Dept. of Microbiology, Nigeria
[4]Haper Adams University, The National Institute of Poultry Husbandry, United Kingdom
[5]University of Bonn, Inst. of Animal Science, Germany

Abstract
Two hundred (200) day-old broiler chickens (Marshall strain) were allotted (40 per treatment, four replicates of ten birds each) to five diets – diets 1 (Control), diet 2 [MSP + *Aspergillus niger* (*An*)], diet 3 [MSP + *Trichoderma viride* (Tv)], diet 4 MSP + (*An* + *Tv*)) and diet 5 (MSP + commercial enzyme {containing amylase (EC 3.2.1.1), beta- glucanase (EC 3.2.1.6), cellulase (EC 3.2.1.4), pectinase (EC 3.2.1.15), protease (EC 3.4.21) and xylanase (EC 3.2.1.8)} added at the rate of 20 g /100kg diet). At day 28 and 58, Apparent Metabolisable Energy (AME), AME corrected for nitrogen retention (AMEn), True Metabolisable Energy (TME) and TME corrected for nitrogen retention (TMEn) were determined. At day 58, ileal digesta viscosity (four birds per replicate, 40 birds in all) were also determined using Brookfield DV-E Viscometer. Data were analysed using ANOVA. Significant means were separated using Duncans Multiple Range test. Highest ($P<0.05$) values of AME and AMEn were obtained for MSP + (*An* + *Tv*) and MSP + *Tv* diets respectively. TME was highest ($P<0.05$) in birds fed MSP + *(An* + *Tv*) at the starter phase but the highest value for this measurement at the finisher phase was for MSP + *Tv* diet. TMEn was not significantly different ($P>0.05$) at the finisher phase. Ileal digesta viscosity did not follow a particular pattern at 60rpm and 100rpm but for 50 rpm, highest value was obtained for birds fed MSP + (*Aspergillus niger* + *Trichoderma viride*) ($P<0.05$), while diets that contained MSP + commercial enzyme elicited the greatest reduction in ileal digesta viscosity. It is therefore recommended that when birds are of tender age (0-4 weeks) inclusion of MSP degraded with combinations of *An* + *Tv* (diet 4) will produce best result, while at finisher phase (5-8weeks) degradation of MSP with only *Tv* in their diets (diet 3) will be sufficient for optimum performance.

Introduction
Malt is extracted from germinated sorghum seeds and the residue consists of sorghum shoots and roots collectively referred to as Malted Sorghum Sprouts (MSP). MSP has prospects as a livestock feed ingredient, but its usefulness is limited by its tannin content and non-starch polysaccharides (Oduguwa *et al.* 2007). Simple procedures in which fungi have been used to improve feeding value of erstwhile denigrated feedstuffs are abound.Some attempts to improve the utilization of MSP have been done but to date reports on exploration of biodegradation of MSP through the use of appropriate micro-organisms is scanty. This study therefore aimed at

evaluating energy metabolisability and ileal digesta viscosity of broilers fed diets containing biodegraded and enzyme supplemented MSP

Material and Methods

A total of 200 day-old Marshall broiler chicks was used for the experiment. The chicks were weighed and allocated to five dietary treatments of four replicates each in a completely randomized design. Each replicate consisst of 10 chicks, making a total of 40 birds per treatment. The birds were reared in two phases: starter (0-4 weeks) and finisher phase (5-8weeks). Records of feed consumption and body weighst were taken weekly on replicate bases. All recommended medication and vaccination were strictly adhered to and the birds were given feed and water *ad libitium* during the trial. The sun-dried MSP ($\leq$ 10% moisture content) were milled to pass through 2mm sieve. The quantity required was measured into plastic buckets and moistened with distilled water to 60% moisture content and autoclaved at 121^{o}C for 15 minutes, after which the samples were allowed to cool and inoculated with loopful spores of the fungi and allowed to ferment for 15 days.whensamples were autoclaved again to stop the biodegradation process and the degraded MSP was then air dried. The degraded MSP (BMSP) were incorporated into the feed. An equal amount of MSP was also autoclaved at 121^{o}C for 15 minutes but without inoculation with fungi. This was tagged undegraded MSP. The degraded and undegraded MSP were used to formulate diets for both starter and finisher broiler diets as follows;

Diet 1 =Basal diet; Diet 2=Basal diet + BMSP (*An);* Diet 3=Basal diet + BMSP (*Tv)*

Diet 4 =Basal diet + BMSP (*An* + *Tv*) Diet 5=Basal diet + EMSP (Commercial enzyme)

Apparent energy metabolisability

At the fourth and eight weeks of age two birds were selected randomly from each replicate and moved into metabolic cages.

The birds were fasted for 24 hours to empty their digestive tracts of feed residue and known quantities of feed were fed. Another group of birds were randomly selected, and were used to determine the endogenous losses. At the lapse of 48 hours, excreta were collected quantitatively from the two groups of birds weighed and dried at 70^{o}C. The samples of the test diets as well as that of the excreta were pooled, milled and assayed for gross energy. Apparent and true metabolisable energy were then calculated as described by Sibbald, 1989.

The viscosity of ileal digesta

At the end of the experiment one bird from each replicate were selected randomly sarificed, the intestinal content exposed. The ileal digesta content were collected from the Merckel's diverticulum to the ileo-caecal junction. The ileal digesta for each replicate was emptied into a sample bottle and properly labelled. A uniform weight of sample was taken from each sample bottle using sensitive scale and diluted to a volume of 400ml. Viscometer BROOKFIELD DV-E, UK was used to determine the viscosity of the digesta following manufacturers' caliberation of 50rpm, 60rpm and 100rpm respectively.

Statistical analysis

All data collected were subjected to general linear model ofAnalysis of Variance (ANOVA) using SAS (2002) statistical software package. Means for treatments showing significant differences were compared using Duncan's Multiple-Range test (Steel and Torrie, 1980).

Results and Discussion

Table 1 shows the AME and AMEn for both starter and finisher phases. At each of the phases, there was a significant different ($P<0.05$) in the parameter measured with birds fed MSP biodegraded with *An* + *Tv* having the highest value for AME and AMEn at the starter phase and AME and AMEn at the finsher phase. AME at the starter phase was highest for birds fed MSP biodegraded with *An* + *Tv*. The TME values were highest with birds that received MSP + (*An* +*Tv*); the same was observed for TMEn when MSP + *Tv* was fed at the starter phase. At the finisher phase, TME was highest with birds fed MSP + *Tv*. TMEn values also were significantly

different (P>0.05) at the finisher phase with highest values for diets containing BMSP + *Tv* and MSP + enzyme. Table 2 shows the ileal digesta viscosity of broilers fed biodegraded malted sorghum sprout BMSP) and enzyme supplemented MSP (EMSP). At 50rpm, the digesta viscosity was significantly (P<0.05) different among the treatment. At the 60rpm and 100rpm there was no significant difference (P>0.05) among the mean values for digesta viscosity.

Table 1: Apparent energy metabolisability of broilers fed biodegraded malted sorghum sprout (BMSP) and enzyme supplemented MSP (EMSP)

Measurements (MJ/kg)	Control	BMSP + *An*	BMSP + *Tv*	BMSP *An* + *Tv*	MSP + enzyme	SEM	P value
Starter Phase							
AME	12.26^{e}	12.40^{d}	12.61^{b}	12.87^{a}	12.46^{c}	0.05	0.00
AMEn	12.24^{b}	12.39^{ab}	12.56^{a}	12.64^{a}	12.44^{ab}	0.05	0.04
TME	12.44^{e}	12.56^{d}	12.79^{b}	13.10^{a}	12.66^{c}	0.06	0.00
TMEn	10.68^{e}	10.94^{b}	11.31^{a}	10.69^{d}	10.73^{c}	0.07	0.00
Finisher Phase							
AME	10.63^{e}	10.91^{b}	11.29^{a}	10.67^{d}	10.71^{c}	0.06	0.00
AMEn	10.11^{b}	10.67^{a}	10.69^{a}	10.50^{ab}	10.65^{a}	0.07	0.06
TME	10.69^{e}	10.94^{b}	11.32^{a}	10.69^{d}	10.73^{c}	0.06	0.00
TMEn	9.77	9.49	10.45	9.49	10.51	0.23	0.55

^{a,b,c,}Means on the same row having different superscripts are significantly (P<0.05) different.
AME – Apparent metabolisable energy; AMEn – Apparent metabolisable energy corrected for nitrogen retention; TME – True metabolisable energy; TMEn - True metabolisable energy corrected for nitrogen retention

Table 2: Ileal digesta viscosity of broilers fed biodegraded malted sorghum sprout (BMSP) and enzyme supplemented MSP (EMSP)

Measurements	Control	BMSP + An	BMSP + Tv	BMSP An + Tv	MSP + enzyme	SEM	P value
50rpm	94.72^{b}	103.90^{ab}	103.37^{ab}	115.52^{a}	88.72^{b}	0.67	0.01
60rpm	105.82	118.72	110.00	120.95	103.32	2.34	0.03
100rpm	142.02	151.70	135.52	148.42	144.80	6.11	0.53

^{a,b}Means on the same row having different superscripts are significantly (P<0.05) different.

Conclusions and Outlook

It is therefore recommended that when birds are of tender age (0-4 weeks) inclusion of MSP degraded with combinations of *An + Tv* (diet 4) will produce best result.
At finisher phase (5-8weeks) however, degradation of MSP with only *Tv* in their diets (diet 3) will be sufficient for optimum performance.

References

Oduguwa, O.O., Pirgozliev, V.R. and Acamovic, T. 2007. Energy metabolizability and digestibility of amino acids by broilers fed on malted sorghum sprouts supplemented with polyethylene glycol, charcoal, phytase and xylanase. *British Poultry Science.* 48(1): 55-63.

SAS 2002. User's Guide. Statistical Analysis Institute Inc. Cary, N.C.

Sibbald, I. R. 1989. Metabolizable energy evaluation of poultry diets. Pages 12–26 in Recent Developments in Poultry Nutrition. D. J. A. Cole and W. Haresign, ed. Butterworths, Essex, UK.

Steel, R.G.D. and Torrie, J.H. 1980. Principle and Procedure of statistics. 2nd edition. McGraw Hill Book company. New York.