



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

---

## Performance and Haematology of Weaner Rabbits Fed Diets Containing Culture Fermented Cowpea Husk

Ayodeji Adedire<sup>a</sup>, Olutosin Oduguwa<sup>b</sup>, Vincent Jegede<sup>b</sup>

<sup>a</sup>Wesley University of Science and Technology, Agriculture, Nigeria

<sup>b</sup>Federal University of Agriculture, Abeokuta, Dept. of Animal Nutrition, Nigeria

### Introduction

The utilization of fibre in rabbit nutrition has been of major concern to livestock nutritionists (Houndonougbo *et al.*, 2012), largely due to abundant availability of fibrous agricultural and industrial by-products (AIBPs). Unfortunately these AIBPs are lignocellulosic in nature and therefore may require biochemical treatment such as fermentation to degrade the lignocellulose fibre for better utilization by rabbits. Hence, this study was aimed at testing culture fermented cowpea husk in rabbit ration using performance and haematology as response criteria.

### Material and Methods

#### Feed preparation and formulation

Cowpea husks were collected from designated centres and were sundried (DM  $\geq$ 90 %). The sample was then milled (1.0 mm sieve) and labeled as CH. CH were measured into six different double layered polythene bags. The cowpea husks, moistened with distilled water (2.5l kg<sup>-1</sup>) and spore solutions of respective fungi species were added at the rate of 200ml kg<sup>-1</sup> as follows: *Aspergillus niger* (ASP), *Rhizopus oligosporus* (RHZ), *Trichoderma reesei* (TRI), *A. niger* + *R. oligosporus* (ARH), *A. Niger* + *T. reesei* (ATR) and *T. reesei* + *R. oligosporus* (TRH) and the content of each bag were mixed thoroughly. The moistened CH were afterwards allowed to ferment anaerobically for 96 hours and then oven dried (60°C) for 48 hours. Dried fermented and unfermented CH (DM  $\geq$ 90 %) were then incorporated into respective rabbit rations to supply 10% fibre.

#### Animal protocol and dietary treatment

Seventy experimental rabbits were allotted on weight equalization basis (average weight of 550g), in a completely randomized design into 7 treatments, with each treatment having 5 replicates and 2 rabbits per replicate and they were managed intensively for a period of 10 weeks in wooden cages of approximately 76x62x42cm dimension. Feed and water were supplied *ad libitum* throughout the study period. In addition to the experimental diets, 100g of wilted *Tridax procumbens* were supplied to each rabbit. Fermented and unfermented crop residues were used as test ingredients. The test ingredients were incorporated to supply 10% crude fibre while the whole diet will supply 15% crude fibre. Table 1 shows the experimental diets.

**TABLE 1: Experimental diets**

	UCH	ASP	RHZ	TRI	ARH	ATR	TRH
Maize	25.00	25.00	25.00	25.00	25.00	25.00	25.00
Soyabean Meal	16.00	16.00	16.00	16.00	16.00	16.00	16.00
Cowpea husk	29.50	31.41	32.62	33.00	33.68	33.38	33.83
Wheat Offal	24.90	22.99	21.78	21.40	20.72	21.02	20.57
Lysine	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Methionine	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Bone Meal	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Premix*	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Salt	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calculated Analysis							
Energy (MJ/Kg)	10.78	10.79	10.72	10.69	10.72	10.74	10.77
Crude Protein (%)	16.85	16.86	16.87	16.86	16.90	16.82	16.93
Crude Fibre (%)	14.03	14.03	14.00	14.04	14.06	14.00	14.25
Determined Analysis (%)							
Crude Protein	16.92	16.91	16.98	16.96	16.98	16.95	16.99
Crude Fibre	15.15	15.05	15.10	15.07	15.02	15.09	15.00

Note:ASP=*Aspergillus niger*, RHZ=*Rhizopus oligosporus*, TRI=*Trichoderma reesi*, ARH=*A. niger*+ *R. oligosporus*  
ATR= *A.niger* + *T reesi*, TRH=*T. reesi* + *R. oligosporus* UCH=Unfermented Cowpea husk.

Premix: Premix used is broilers premix manufactured by animal care (NIG), contain the following (per kg): Vit A=4000000IU, Vit D3=2500000IU, Vit E=4000mg; Vit K=800mg, Vit B3=300mg; Vit B2=6000mg; Vit B6=5000mg; Vit B12=25mg; Niacin=6000mg, Pantothenic Acid=20222mg; Folic Acid=800mg; Biotin=8mg, Manganese=30000mg; Iron=80000mg; Zinc=20000mg; Copper=25mg; Cobalt=80mg; Iodine=400mg; Selenium=40mg; Chlorine=80000mg.

#### Performance characteristics

The live weights of rabbits per replicate were measured on arrival and subsequently on weekly basis using weighing scale to monitor weight gain. Also the feed consumption was recorded weekly to determine the feed intake and feed conversion ratio.

#### Haematological studies

Blood samples for the determination of haematological and biochemical indices were collected during slaughtering from three representatives of each treatment. Blood samples were analyzed for haematological parameters such as PCV, Haemoglobin, RBC and WBC counts by methods expounded by Bush (1991); biochemical indices such as glucose, total protein, albumin and globulin; Erythrocytic indices such as MCH, MCV and MCHC were calculated using methods of Walker *et al* (1990)

#### Statistical analysis

All data collected from this experiment were subjected to general linear model of analysis of variance (ANOVA) using SAS (2003) statistical software package. Means for treatments showing significant differences in the ANOVA were compared using Duncan's multiple-range test (Steel and Torrie, 1980).

## Results and Discussion

The performance characteristics of the rabbits fed fermented and unfermented cowpea husk is shown in table 2. The results revealed that rabbits fed unfermented cowpea husk (UCH) had the highest final live weight, hence, highest weight gain which is significantly ( $P<0.05$ ) higher than the fermented diets.

**TABLE 2: Performance characteristics of experimental rabbits fed fermented and unfermented cowpea husk**

	Initial weight(g)	Final weight(g)	Weight gain(g)	Average weekly weight gain(g)	Av.wkly FI(g)	FCR
ARH	570	1540 <sup>e</sup>	970 <sup>c</sup>	121.25 <sup>cd</sup>	377.34 <sup>d</sup>	3.11 <sup>b</sup>
ATR	570	1614 <sup>d</sup>	1044 <sup>c</sup>	130.50 <sup>c</sup>	375.72 <sup>d</sup>	2.88 <sup>a</sup>
ASP	575	1530 <sup>f</sup>	955 <sup>f</sup>	119.38 <sup>d</sup>	379.89 <sup>d</sup>	3.18 <sup>c</sup>
TRI	580	1620 <sup>c</sup>	1040 <sup>c</sup>	130.00 <sup>c</sup>	402.49 <sup>c</sup>	3.10 <sup>b</sup>
RHZ	575	1610 <sup>cd</sup>	1035 <sup>d</sup>	129.38 <sup>c</sup>	401.00 <sup>c</sup>	3.10 <sup>b</sup>
TRH	575	1730 <sup>b</sup>	1155 <sup>b</sup>	144.38 <sup>b</sup>	409.47 <sup>b</sup>	2.84 <sup>a</sup>
UCH	571	1780 <sup>a</sup>	1209 <sup>a</sup>	151.13 <sup>a</sup>	537.32 <sup>a</sup>	3.56 <sup>d</sup>
SEM	5.53	5.53	5.53	5.53	5.53	5.53

Note: a – e, means on the same column with different superscript are significantly ( $p < 0.05$ ) different. Av. wkly FI = Average weekly feed intake, FCR = Feed conversion ratio. ASP=Aspergillus niger, RHZ=Rhizopus oligosporus, TRI=Trichoderma reesei, ARH=A. niger+ R. oligosporus ATR= A.niger + T reesei, TRH=T. reesei + R. oligosporus UCH=Unfermented Cowpea husk. SEM = Standard error of mean.

This may be as a result of lower feed intake by the rabbits on fermented CH which is due to coarseness of CH after drying. However, the results of the feed conversion ratio indicated that cowpea husk fermented with *A. niger* + *T. reesei* (ATR) and *T. reesei* + *R. oligosporus* is better significantly ( $P < 0.05$ ) than other treatments. This shows that mixed cultures were able to degrade the lignin in the cowpea husk better than single culture; hence the experimental rabbits were able to convert to more flesh.

Table 3 showed the effect of cowpea husk fermentation on the haematology and serum biochemistry of experimental rabbits.

**TABLE 3: Haematology of rabbits fed fermented and unfermented cowpea husk**

	ARH	ATR	ASP	TRI	RHZ	TRH	UCH	SEM
Haemoglobin	11.70 <sup>ab</sup>	8.70 <sup>d</sup>	11.53 <sup>abc</sup>	9.47 <sup>d</sup>	9.87 <sup>cd</sup>	10.17 <sup>bcd</sup>	12.41 <sup>a</sup>	0.32
Red blood cell	2.09 <sup>a</sup>	1.55 <sup>c</sup>	2.02 <sup>ab</sup>	1.64 <sup>c</sup>	1.73 <sup>bc</sup>	1.46 <sup>c</sup>	2.18 <sup>a</sup>	0.07
White blood cell	13.00 <sup>a</sup>	10.49 <sup>c</sup>	12.47 <sup>a</sup>	10.20 <sup>c</sup>	11.89 <sup>ab</sup>	12.27 <sup>a</sup>	10.88 <sup>bc</sup>	0.25
Packed cell volume	35.67 <sup>a</sup>	25.33 <sup>d</sup>	35.00 <sup>ab</sup>	28.67 <sup>cd</sup>	30.00 <sup>bcd</sup>	30.67 <sup>abc</sup>	35.00 <sup>ab</sup>	0.96
Glucose	49.00 <sup>d</sup>	68.67 <sup>ab</sup>	77.67 <sup>a</sup>	54.00 <sup>c</sup>	57.33 <sup>bc</sup>	47.33 <sup>d</sup>	75.33 <sup>a</sup>	2.91
Total protein	60.33 <sup>b</sup>	49.67 <sup>d</sup>	52.00 <sup>cd</sup>	69.00 <sup>a</sup>	51.67 <sup>cd</sup>	54.67 <sup>c</sup>	53.67 <sup>cd</sup>	1.44
Albumin	38.00 <sup>b</sup>	33.00 <sup>bc</sup>	30.00 <sup>c</sup>	47.33 <sup>a</sup>	31.67 <sup>c</sup>	33.67 <sup>bc</sup>	34.00 <sup>bc</sup>	1.33
Globulin	22.33 <sup>a</sup>	16.67 <sup>b</sup>	22.00 <sup>a</sup>	21.67 <sup>a</sup>	20.00 <sup>ab</sup>	21.00 <sup>a</sup>	19.67 <sup>ab</sup>	0.58
MCV	56.20 <sup>ab</sup>	56.32 <sup>ab</sup>	56.61 <sup>a</sup>	56.76 <sup>a</sup>	55.00 <sup>b</sup>	57.47 <sup>a</sup>	56.61 <sup>a</sup>	0.21
MCH	16.78	16.84	16.81	16.65	16.86	16.44	16.56	0.05
MCHC	33.42 <sup>ab</sup>	33.44 <sup>ab</sup>	33.56 <sup>ab</sup>	33.61 <sup>ab</sup>	33.20 <sup>b</sup>	33.45 <sup>ab</sup>	33.77 <sup>a</sup>	0.06

Note: a – d, means on the same row with different superscript are significantly ( $p < 0.05$ ) different. ASP=Aspergillus niger, RHZ=Rhizopus oligosporus, TRI=Trichoderma reesei, ARH=A. niger+ R. oligosporus ATR= A.niger + T reesei, TRH=T. reesei + R. oligosporus UCH=Unfermented Cowpea husk. SEM = Standard error of mean.

The results showed that values obtained for Haemoglobin falls within the normal range (8 – 17g/100ml) for a healthy rabbit (Igwebuike *et al.*). This is an indication of a good nutritional status. The PCV also falls into the normal range (31 – 50%) except rabbits on ATR and TRI. This may be as a result of lower feed intake by the experimental rabbits on these treatments. Lower feed intake normally leads to reduced nutrient intake including iron needed for the formation of haemoglobin. WBC counts were much lower than what was expected. This may be attributed to stress such as temperature and lower feed intake by the experimental rabbits during data collection.

The serum biochemistry showed that total protein was within the normal range except ATR, which was slightly lower than the normal. This result is not complementing the results obtained for albumin and globulin as these falls within the expected values for healthy rabbit. Nevertheless the overall results for serum biochemistry indicate a normal nutritional status for rabbits fed fermented and unfermented cowpea husk.

### **Conclusions and Outlook**

Rabbits fed cowpea husk fermented with TRH performed better ( $p < 0.05$ ) than rabbits on other treatments in terms feed conversion ratio. The haematology and serum biochemistry of the experimental rabbits indicates that the experimental feed were nutritionally adequate for the experimental rabbit. These results have shown the potential usefulness of fermented cowpea husk as a source of fibre and to a lesser extent as a protein source in practical rabbits' feed.

The authors are currently working on fortifying these fermented crop residues with, vitamins, minerals, amino acids and anti oxidants to develop feedstock that rabbits will utilize to meet daily weight gain of 40 - 45g/day, which is the normal weight gain in developed countries.

### **References**

- Bush, B. M. 1991. Interpretation of laboratory results for small animal clinicians. Blackwell Scientific Publications, U.K. pp 32 – 67.
- Clinical Methods, 3<sup>rd</sup> edition. The history, physical and laboratory examinations. Ed: H Kenneth Walker, MD, W Dallas Hall, MD, and J Willis Hurst, MD. Emory University School of Medicine, Atlanta, Georgia. Boston: Butterworths; 1990.
- Houndonougbo, M. F., Chrysostome, C. A., Attakpa, S. E., Sezan, A. and Dehou, H. B. 2012. Growth performance of rabbits fed palm-press fibre-based diets. ISRN Veterinary Science. Vol 2012.
- Igwebuike, J. U., Anugwa, F. O., Raji, A. O., Ehiobu, N. G. and Ikurior, S. A. 2008. Nutrient digestibility, haematological and serum biochemical indices of rabbits fed graded levels of *Acacia albida* pods. ARPN Journal of Agricultural and Biological Science, 3(4), pp 33 – 40.
- SAS Institute Inc. 2003. SAS/STAT User's guide, version 8 for windows. SAS institute Inc., SAS campus drive, Cary, North Caroline, USA.
- Steel, R.G.D. and Torrie, J.H. 1980. Principle and Procedure of statistics. 2<sup>nd</sup> edition. McGraw Hill Book company. New York.