
DIETARY REPLACEMENT OF YELLOW MAIZE WITH GRADED LEVELS OF RED SORGHUM WITH OR WITHOUT ENZYME (*ENZYBLEND*[®]) ON THE NUTRIENT DIGESTIBILITY, VISCERAL ORGAN AND CARCASS YIELD OF RABBITS

Tarhembra, F., Torhemen, M., Mashi A.M., Wayo S.N and Sarwuan G.D.

Department of Animal Health and Production Technology, Akperan Orshi Polytechnic, Yandev Gboko.

Corresponding author: tarhembrafrancis@mail.com

ABSTRACT

A study lasting 84 days was conducted at the Teaching and Research Farm of the Department of Animal Health and Production Technology, Akperan Orshi Polytechnic Yandev, Gboko to determine the nutrient digestibility, visceral organ and carcass yield of replacing yellow maize with red sorghum in rabbit diets with or without enzyme. A total of 54 weaner rabbits of mixed strains and sexes with initial body weight of 690.84-794.83g were assigned to 9 dietary treatments containing 6 rabbits per treatment with 1 rabbit per replicate in a completely randomized design of 4×2+1 factorial arrangement having two levels of enzyblend supplementation (with & without). Dietary treatments included: D1: 0 %, D2 :25 %, D3: 50 %, D4 :75 % D5: 100 % red sorghum replacement. The results showed that, increase in the replacement level of sorghum had significant ($p<0.05$) higher effects on the apparent digestibility. Carcass characteristics showed no significant ($P>0.05$) difference on % dressed weight and carcass cut except % head which had differed significantly ($P>0.05$) higher on rabbit fed control. All parameters on internal organs weight showed no significant ($P>0.05$) difference except kidney fat and oesophagus which had significantly ($P<0.05$) higher on rabbit fed 100 (2.14 and 0.14 %), The study therefore recommends 100 % sorghum inclusion level to farmers for improved percentage carcass yield and internal organs in rabbit production

Key words: Nutrient digestibility, visceral organ, carcass yield, maize, sorghum, enzyblend, rabbits

INTRODUCTION

Rabbit meat production has increased considerably in order to meet the increasing demand for animal protein, and to seek alternative to poultry meat, which has declined since the advent of avian influenza (Owen *et al.* 2008). Rabbit meat is also increasingly becoming popular due to the fact that it is nutritious, low in fat and cholesterol, compared with most other meats such as beef, chicken, mutton or pork. The meat is white fine grained, delicately flavoured, nutritious and appetizing (Cheeke, 1994). Sorghum (*Sorghum bicolor*) is the species of grasses within the genus Sorghum. These plants are used for grain, fibre and fodder. The plants are cultivated in warmer climates worldwide.

AOAC (2005) reported the following values for proximate value of 90.10 and 87.34 % dry matter, 90.53 and 93.76 organic matter, 9.65 and 11.62 % crude protein, 3.98 and 2.92 % ether extract, 1.99 and 4.83 % crude fibre, 9.47 and 6.24 % ash, 73.46 and 67.97 % nitrogen-free extract and 3271 and 3087 ME, kcal/kg for maize and sorghum respectively. This research was conducted to evaluate the performance and cost effectiveness of replacing maize with sorghum graded level with or without enzymes in rabbit diets.

MATERIALS AND METHODS

The study was conducted in the Teaching and Research Farm of the Department of Animal Health and Production Technology, Akperan Orshi Polytechnic Yandev, Gboko. Fifty-four (54) weaner rabbits of mixed breed and sexes were used for the study. The rabbits were randomly assigned to nine (9) dietary treatments with six (6) replicates each in a Completely Randomized Design (CRD) with one animal per replicate. Each experimental animal served as a replicate using a factorial arrangement. The rabbits were initially fed on respective experimental diets and water *ad libitum* during acclimatization period of seven (7) days while data collection commenced at the end of adjustment period. All health and management practices were strictly adhered to. Data collected were subjected to

Analysis of Variance (ANOVA) (Steel and Torrie, 1980), and Duncan multiple Range Test was used to separate the means (Duncan, 1995).

Experimental Diets: Nine dietary treatments were formulated with diet 1 (control diet) containing 100% maize. In the other remaining diets maize was replaced 25, 50, 75 and 100% sorghum inclusion level with or without enzymes. Each of the diets (2, 3, 4 and 5) was formulated twice with T2, T4, T6 and T8 containing no enzyme while T3, T5, T7 and T9 were contained enzyme (*Enzyblend*[®]). The diets were formulated to meet the nutritional requirements of the rabbits as presented in Table 1

Apparent Nutrient Digestibility: The apparent nutrient digestibility of the nine (9) diets were determined in the last week of the feeding trial lasted. At the beginning of the digestibility trial, the mean live weights of four rabbits per replicate groups (treatment) were selected respectively and weighed quantity of feed were offered to the rabbits. The faecal samples were collected per replicate using a nylon net placed under each floor of the cages, to avoid urine contamination. The faecal samples of each group was collected and pooled daily over a period of five days, at approximately 09.00 hrs. before the next daily ration were offered. Each daily pooled faecal samples were placed in a two-layer plastic bag to prevent the loss of moisture, the sample were oven dried to a constant weight and result obtained was used to calculate moisture and dry matter content. The samples were sent for proximate fraction in Animal Nutrition Laboratory of College of Animal Science, Joseph Sarwuan Tarka University, Makurdi for nutrient digestibility analysis according to the procedure outlined by AOACA (2012).

Carcass Evaluation: At the end of the experimental period (12 weeks), four (4) rabbits per treatment group were selected for slaughter for carcass analysis. Prior to slaughtering, the experimental rabbits to be slaughtered were deprived of feed for 12 hours as recommended by Dalle (2002) and Shaahu *et al.* (2014) but provided with water *ad-libitum*. Deprivation of feed for 12 hours before slaughter reduces the volume of gut content and hence bacteria and therefore reduces the risk of contamination of the carcass during dressing without adversely affecting the meat yield and quality as opined by the latter. The, rabbits to be slaughtered were weighed, stunned and slaughtered by severing the jugular vein, carotid arteries, trachea and the esophagus (at the neck region), the rabbits were suspended head down and allowed to bleed thoroughly. The bled rabbits were singed and weighed and there after eviscerated by opening along the median line of the belly and internal organs removed and weighed separately using an electronic weighing balance. The carcasses were weighed and cut into carcass parts via; head, neck, rack, fore limb, hind limb, loin, offal's individually.

3.8 Organ Weights: - The detached visceral organs (heart, large intestine, small intestine, liver, spleen, lungs, kidney, pancreases, oesophagus, caecum, kidney fat, and stomach) were also weighed using sensitive weighing balance as recommended by Dalle (2002) and Shaahu *et al.* (2014). The warm weight of these organs were expressed as a percentage of the slaughter weight. [Internal organs (%) = $\frac{\text{Weight of organ}}{\text{Slaughter weight}} \times 100$]

RESULT

Table 1 shows the feeding of sorghum at different levels and enzyme supplementation on dry matter and nutrient digestibility of the experimental rabbit. Dry matter digestibility ranged between 73.50 and 89.64 % across the treatment groups. A similar trend as in dry matter digestibility was observed for crude protein digestibility. There were comparable values of ether extract digestibility in rabbits on 0, 25, 75 and 100 % sorghum. Crude fibre (CF) digestibility increased ($P < 0.05$) in the sorghum diets and ranged between 47.12 and 72.98 % across the diets. Higher CF digestibility was found in 50 % sorghum. This was however, comparable in 25 and 100 % sorghum. The digestibility of CF was less ($P < 0.05$) in the control group. Digestibility of nitrogen free extract (NFED) was higher ($P < 0.05$)

Table 1: Main Effect of Feeding Sorghum and Sorghum with Enzyme on Apparent Nutrient Digestibility by Rabbits

Parameter	Levels of Sorghum					SEM	Levels of Enzyme		
	Control	25	50	75	100		0	+	SEM
DM (%)	73.50 ^c	79.03 ^{bc}	89.64 ^a	81.95 ^b	79.59 ^{bc}	1.20	80.06	81.42	1.20
CP (%)	83.07 ^c	86.44 ^{bc}	94.10 ^a	88.36 ^b	86.91 ^{bc}	0.82	88.09	87.47	0.82
EE (%)	78.11 ^a	69.63 ^{ab}	65.37 ^b	73.30 ^{ab}	75.70 ^a	1.71	72.15	72.69	1.71
CF (%)	47.12 ^c	59.09 ^{abc}	72.98 ^a	57.50 ^{bc}	62.65 ^{ab}	2.32	58.31	61.42	1.32

NFE (%) 71.20^c 75.44^{bc} 87.32^a 79.04^b 78.34^{bc} 1.31 77.92 78.61 1.31
 =No enzyme mean value += Enzyme supplementation mean value. SEM= Standard error of mean, DM= Dry matter, CP= Crude protein, EE= Ether extract, CF= Crude fibre. NFE=Nitrogen-free extract, Enzyme= Enzyblend[®] 0.05 g

rabbits on 50 % sorghum and reduced ($P<0.05$) in all the groups. The supplementation of enzyme did not affect ($P>0.05$) any of the digestibility indices measured in this experiment.

Table 2 shows the of feeding different levels of sorghum and enzyme supplementation on carcass yield of rabbits. Live weight of the rabbits was highest ($P<0.05$) in 100 % replacement of sorghum compared to other levels which had similar live weights. Dressed weight was higher ($P<0.05$) in 100 % sorghum replacement compared to the other levels similar to the trend found in live and slaughter weights. carcass parts measured were not significantly ($P>0.05$) affected by the level of

Table 2: Main Effect Between Sorghum and Enzyme on Carcass Yield of Rabbits

Parameter	Levels of Sorghum					SEM	Levels of Enzyme		
	Control	25	50	75	100		0	+	SEM
Live weight (g)	1767.00 ^b	1693.88 ^b	1719.88 ^b	1758.25 ^b	1942.13 ^a	59.37	1782.00	1770.45	37.55
Slaughter weight (g)	1695.50 ^b	1673.63 ^b	1644.63 ^b	1704.13 ^b	1897.88 ^a	57.42	1728.70	1717.60	36.32
Eviscerated weight (g)	1429.50 ^{ab}	1376.88 ^{ab}	1310.25 ^b	1322.63 ^b	1500.88 ^a	47.87	1404.95	1371.10	30.28
Dressed weight (g)	1093.00 ^b	1074.75 ^b	1101.00 ^b	1076.00 ^b	1246.63 ^a	48.21	1130.75	1105.80	30.49
%dress. weight	61.79	63.28	64.17	61.53	64.36	1.91	63.40	62.61	1.21
% Head	12.84 ^a	12.22 ^{ab}	11.73 ^{ab}	11.91 ^{ab}	11.27 ^b	0.47	11.83	12.16	0.30
% Neck	3.50	3.57	3.37	3.48	3.03	0.22	3.44	3.34	0.14
% Fore limb	15.47	16.00	15.23	15.42	15.76	0.41	15.88	15.28	0.26
% Hind limb	32.12	31.77	30.67	31.25	29.85	0.75	31.47	30.80	0.48
% Rack	13.84	14.05	13.17	13.50	14.86	0.56	14.09	13.67	0.35
% Back	21.04	23.30	23.19	21.36	22.33	0.82	22.43	22.05	0.52

^{abcd}=Means on the same row having different superscripts significantly ($P<0.05$) different. SEM= Standard error of mean. Enzyme= Enzyblend[®] 0.05 g. 0=No enzyme supplementation mean value. += Enzyme supplementation mean value

sorghum replacement in the diets of rabbits except from head. Also, the supplementation of enzyme in the diet did not significantly ($P>0.05$) impact all carcass parameters measured in this experiment while Table 3 represent the result of effect of feeding different levels of sorghum as well as enzyme supplementation on organs and offals of rabbits. Kidney fat, oesophagus, small intestine weight and length were significantly ($P<0.05$) affected by levels of sorghum utilized in the experiment. The supplementation of enzyme in the diet did not significantly ($P>0.05$) impact on all organs and offals of the rabbits.

Table 3: Main Effect of Sorghum and Sorghum With Enzyme on Organs and Offals Characteristic on Rabbit

Parameter	Levels of Sorghum					SEM	Levels of Enzyme		SEM
	Control	25	50	75	100		0	+	
%									
Heart	0.22	0.22	0.21	0.21	0.21	0.02	0.20	0.23	0.01
Liver	2.11	2.25	2.03	2.16	2.10	0.15	2.10	2.16	0.09
Kidney	0.51	0.58	0.50	0.52	0.48	0.03	0.50	0.53	0.02
Spleen	0.07	0.10	0.09	0.08	0.07	0.01	0.07	0.09	0.01
Pancreases	0.08	0.11	0.10	0.09	0.10	0.01	0.10	0.10	0.01
Kidney fat	1.20 ^b	1.99 ^a	1.54 ^{ab}	1.65 ^{ab}	2.14 ^a	0.22	1.92	1.49	0.14
Oesophagus	0.10 ^b	0.09 ^b	0.11 ^{ab}	0.11 ^{ab}	0.14 ^a	0.01	0.11	0.11	0.01
Stomach	1.06	1.06	0.87	0.97	0.93	0.06	1.01	0.94	0.04
Small intestine	2.16 ^a	1.84 ^{ab}	1.64 ^b	1.59 ^b	1.52 ^b	0.15	1.69	1.81	0.10
Large intestine	1.46	1.62	1.57	1.37	1.66	0.16	1.55	1.53	0.10
Caecum	1.53	1.45	1.31	1.34					
Lungs	0.45	0.49	0.49	0.50	1.45	0.09	1.38	1.45	0.05
					0.43	0.03	0.48	0.46	0.02

^{abcd}=Means on the same row having different superscripts significantly ($P<0.05$) different. SEM= Standard error of mean. Wt.=Weight. Enzyme= Enzyblend[®] 0.05g. 0=No enzyme supplementation mean value. += Enzyme supplementation mean value.

DISCUSSION

The nutrient digestibility recorded in this study showed that, rabbits on diet without sorghum inclusion digested less of the nutrient compared to those on sorghum based diets. This is indication that sorghum may be a highly digestible feedstuff for rabbits compared to maize. Contrary to findings in this study, a decrease in nutrients digestibility with increased sorghum offal inclusion was observed

in the report of Ogunsipe and Agbede, (2017), such action was ascribed to the tannin that is likely to be more at higher sorghum offal inclusion. It is possible that higher tannin content could be found in the offal than whole sorghum feedstuff. The improved digestibility in sorghum based diets compared to control will suggest availability, digestion, absorption and utilization of nutrients by rabbits in feeds high in sorghum.

This study recorded a dressed weight of 1038.50 to 1324.00 g across the treatment groups which were higher than that of 689.50 – 947.00 g for dressed weight by Shaahu and Tiough (2019) when maize was replaced with graded levels of sweet potato vine – cassava composite meal in growing rabbits. The retail primal cut (carcass yield) of the rabbit observed were in consonance with the report by Kpehe *et al.* (2021) of rabbits fed diets containing graded levels of rumen filtrate-fermented rice offal. Enzymes supplementation in the sorghum based diets could not however influence carcass characteristics and could not also influence the percent head when it interacted with sorghum. The kidney Fat weight of rabbit fed experimental diet differ significantly ($P<0.05$) higher than that the report recorded by Shaahu *et al.* (2017) but lower than report by Kpehe *et al.* (2021). Weight of esophagus is similar to the report of kpehe *et al.* (2021) but lower than report by Gboshe *et al.* (2019) which rabbits were fed graded levels of maize cob meal as replacement for dietary maize. The results of small intestine weight were in consonant with report by Kpehe *et al.* (2021) and Gboshe *et al.* (2019) but lower than report by Shaahu *et al.* (2017) respectively. Even though enzyme supplementation did not influence the organs of the rabbits, their interactions sorghum levels improved the functionality of the organs with varying responses observed for kidney fat in the rabbits.

CONCLUSION AND RECOMMENDATION

From the result obtained, it can be concluded that; Incorporation of sorghum in the diets of rabbits had no deleterious effects on nutrient digestibility, carcass yield and internal organs characteristic of the rabbits. Enzyme supplementation however, positively influenced the action of sorghum to have higher percent kidney fat in the rabbits. Based on the **CONCLUSION** drawn from the study, 100 % sorghum level replacement is recommended to farmers for improved carcass yield and internal organs in rabbit production

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