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PERFORMANCE AND CARCASS QUALITY OF RABBITS FED DIET SUPPLEMENTED WITH PUMPKIN STEM WASTE

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ABSTRACT

A twelve week study was conducted to evaluate the performance and carcass quality of rabbits fed diets supplemented with varying levels of pumpkin stem waste (PSW). 36 crossbreed (California x New Zealand white) weaned rabbits aged 6 to 7 weeks were divided into three treatment groups of 12 rabbits each with 4 rabbits per replicate and randomly allotted to three dietary treatments. The treatments were basal diet (D1); basal diet plus 5% PSW (D2); basal diet plus 10% PSW (D3). At the end of 12 weeks, 18 rabbits were slaughtered to determine the effects of the treatment on the live weights, dressed weights, dressing %, prime cuts (thoracic cage, forelegs, hindlegs and loins), internal organ weights, meat protein, percentage fat, muscle and bone. Results obtained indicated that feed intake increased significantly ($P<0.05$) with increase in level of PSW even as weight gain, meat protein, muscle , bone, dressing% and fat decreased significantly ($P<0.05$) as PSW increased. However, as dietary PSW increased, fat decreased significantly ($p<0.05$). No significant difference ($P>0.05$) in terms of the prime cutsand organ weights. These results suggest that supplementing rabbit diets with dietary PSW could enhance feed intake, reduced fat and caused no adverse effect on carcass characteristics

Keywords: Carcass,rabbit,pumpkin stem waste, supplemented

1. INTRODUCTION

Animal production is a major component of the agricultural economy of Nigeria, accounting for about 12.36% of the total Agricultural Gross Domestic Product (Bureau of Statistics, 2014). However, animal products such as meat has not been optimized especially in the humid southern partof Nigeria. The country continues to import large quantity of meat to meet the annual increase of 4% in the demand for meat as against the reported meat supply growth rate of 2.4% per annum (FAO, 2005). Presently, the major sources of meat include poultry, pig, cattle, sheep and goat which are still not sufficient to meet both the demand and recommended dietary allowance of protein for every person in a highly populated country such as Nigeria. The viable strategy is to include the exploitation of cheaper and readily available source of animal protein such as rabbits. However, success in rabbit production would be difficult if producers do not give enough attention to the diet and provide wholesome feeds in adequate quantity and quality for rabbits. Forage offered to the rabbit currently depends on what is available. In order to increase the scale of production, adopting an alternative and cheaper source of forage to supplement formulated ration would be an important strategy. In doing this, the effect of nutrition on meat

Vol. 4, No. 02; 2019

ISSN: 2456-8643

quality must be evaluated. This is because fatlevels especially cholesterol content in meat and other animal products are major considerations in the consumption of such foods (Jayaweeraet al., 2007). The ability of rabbits to convert forage, crop residues and agro by-products into meat efficiently is of great importance in the humid southern Nigeria (Ekpoet al., 2015). This study was therefore conducted to assess the performance and carcass quality of rabbits fed diets supplemented with pumpkin stem waste .

2. MATERIALS AND METHODS

The study was conducted in a private farm in Uyo, AkwaIbom State, Nigeria. Uyo lies 70m above sea level, located on latitude 4o58/ and 5o08/N and longitude 8o02/and 9o47/E, temperature range between 25.0oC and 26.0oC , relative humidity of 75-80% while mean annual rainfall vary from 2250mm to 2926mm in a year.

Preparation of Test material

Pumpkin stem waste was collected fresh daily from the University vegetablegarden thereafter washed and chopped (5-7cm) using sharp knife and fed fresh to the rabbit as supplement. Sample of pumpkin stem waste was analyzed to determine its proximate, vitamins, minerals and phytochemicals composition using standard procedures (AOAC, 1990).

Experimental Diets, Animals, design and Management

Thirty six (California x New Zealand white) weaned rabbits aged 6 and 7weeks weighing 676± 22.2g were acquired from a private farm in Uyo, AkwaIbom State. The rabbits were preconditioned for two weeks before allotted equally (12 rabbits) to each of the three experiments. Each treatment group subdivided into 3 replicates comprising 4 rabbits per replicate. Each replicate was housed in a hutch measuring 70cm x 40cm. The entire hutch system was of the three-tier model. A rabbit grower diet was formulated and fed alongside three graded levels of pumpkin stem waste (0%, 5% and 10% based on rabbit body weight) as supplement which represented three dietary treatments (D1, D2, D3) respectively.Each treatment group was randomly allotted to one of these three experimental rabbit diets in a completely randomized design (CRD). The feed and water were offered ad libitum twice daily i.e. morning (8.00am) and evening (4.00pm).The body weight of the rabbits were taken (individually) at the commencement of the study thereafter on aweekly basis.The trial lasted 84 days.

Carcassand Internal Organs weight determination

At the 12th week of the feeding trial, 1male and 1female rabbit per replicate whose weights were closest to the average were randomly selected, starved for 12 hours prior to slaughtering. The animals were weighed live, slaughtered and dressed. Weights of liver, kidney, lungs and heart were taken and recorded as percentages of live weight while dressing percentages were determined as the ratio of dressed weight to live weightmultiplied by 100. Thereafter the abdominal fat pad were removed and carcasses divided into primal cuts (loin, forelegs, hind legs, thoracic cage).The leg and loin cuts were separated into muscles and bones, weighed and pooled to obtain meat to bone ratio..

Vol. 4, No. 02; 2019

ISSN: 2456-8643

Data Collection:

The body weight of the rabbits were taken (individually) at the commencement of the study thereafter on weekly basis. Feed intake were measured by obtaining the difference between the quantity of feed offered and quantity left over the following morning while feed conversion ratio was computed by dividing the daily feed intake by the daily weight gain

Table 1: Composition of Experimental Grower rabbits Diet

Ingredients	**%**
Maize	45.00
Soya bean	15.00
Wheat offal	37.00
Fish meal	1.00
Bone meal	1.50
* vit/min. Premix	0.25
Salt	0.25
Total	**100.00**

Calculated chemical composition of experimental diets

Crude protein	17.40
Crude fibre	5.50
Ether extract	3.98
Ash	3.86
Metabolizable energy(kcal/kg)	2530.00

*Hi Nutrient International Premix providing the following per 25kg;Vit.A, 8,000,000in;Vit.D3,16,000,000iu;Vit.E,20,000mg;Vit.K,2000mg; Vit.B1,1500mg,Vit.B2 ,4,000mg,Vit.B6, 2,000mg;Vit.B12,10mg;Niacin PSW = D1 (0%); D2 (5%); D3 (10%)

Statistical Analysis

Data from this experiment was subjected to one-way analysis (ANOVA) in a completely randomized design. Means were compared using the least significant difference (LSD) at 5%

Vol. 4, No. 02; 2019

ISSN: 2456-8643

probability as outlined by Obi (1990). The SAS computer software package (SAS, 2000) was used for all statistical analysis.

3.RESULTS AND DISCUSSION

Proximate composition of Pumpkin Stem Waste (PSW) was as presented in table 2 and indicated that crude protein and ether extract values obtained were higher than 8.8%, 1.5% reported for Crude protein and Ether extract respectively while crude fibre value (26.65%) was however lower than 39.90% and ash was similar to the 13.01% reported by Aregheore,(2007). This variation in the nutrient composition of pumpkin stem waste could be attributed to differences in the environmental conditions, age of stems and soil nutrient (Aregheore, 2007).

Table 2: Proximate Composition and metabolisable energy of Pumpkin Stem Waste (PSW)

Parameters	Composition(%)
Dry matter	91.10
Crude protein	14.03
Crude fat	2.05
Crude fibre	26.65
Ash	13.01
NFE	44.26
Metabolizable energy (kcal/kg)	2520.00

Table 3: Vitamins, Mineral and phytochemical Contents of PSW

Parameters	**Composition (mg/100g)**
Vitamin A	7.75
Vitamin B	6.75
Vitamin C	78.80
Phosphorus	116.50
Potassium	21.11

Vol. 4, No. 02; 2019

ISSN: 2456-8643

Sodium	1.65
Magnesium	1.67
Iron 7.82	
Calcium	11.14
Glycosides 0.23	
Flavonoids	3.31
annins	2.46
Saponins 3.92	

Table4: Proximate composition and Metabolisable energy of rabbit diets supplemented with PSW

Parameters	Dietary supplemental level of PSW		
	D_1(0.00)	D_2(5.00)	D_3 (10.00)
Dry matter	90.91	91.83	92.05
Crude protein	16.85	17.99	17.00
Ether extract	4.50	3.00	3.08
Ash	5.87	6.05	6.67
Crude fibre	5.98	11.72	13.15
Nitrogen free extract	66.80	61.24	60.10
Metabolizable Energy (Kcal/kg)	3751.80	3439.50	3361.20

Feed consumption of rabbits fed the pumpkin stem waste (PSW) diets showed significant ($P<0.05$) differences in feed intake across dietary treatments. The highest values were recorded in diet D3 while the lowest were recorded in D1(Table 4).The significant ($P<0.05$)increase in feed intake could be attributed to the decline in dietary energy as the PSW supplementation increased (Table 3). De blas and Wiseman (2003) observed that rabbits consume more feed if they are fed low energy diet with higher fibre and consume less if they are fed high energy diet. The results from this study corroborate the observations of Agunbiadeet al. (1999) and Olorunsanyaet al. (2007) who included cassava peels and leaves in growing rabbit's diets. Nonetheless, rabbits are capable of consuming low quality forages and still meet their nutritional needs (De blas and Wiseman, 2003). Diets by sex interaction effect indicated significant ($P<0.05$) increase in feed intake for the male rabbits compared to the females. This suggest that the males tolerate higher dietary fibre in PSW than the females. Previous report by Iyeghe-Erakpotobor, (2010) indicated that male rabbits consume forage meals (high fibre diets) more than the females.

Vol. 4, No. 02; 2019

ISSN: 2456-8643

Weight gain of rabbits fed pumpkin stem waste (PSW) (Table 4) indicated that significant differences ($P<0.05$) existed in the final liveweight, total weight gain and daily weight gain among the treatment groups. Weight gain of rabbits on diet D2 increased significantly ($P<0.05$) than other groupswhile those on diet D3 recorded the lower weight gain than other treatments. The highest weight gain observed in D2 might have been in response to the increased feed intake relative to those on diet D1.It is probable that the proportion of fibre in diet D2was optimum compared to diet D3 which indicated reduced digestibility possibly due to fibre level hence limiting nutrient availability for growth(Holness, 1991). Pla, (2004) reported that increased crude fibre especiallythat which is not ground or milled such as PSW could reduce digestibility thereby limit the release of essential nutrients necessary for growth. Diet by sex interaction showed that the male rabbits recorded significantly ($P<0.05$) higher weight gain than the females. This suggests that the male rabbits had the capacity to utilize the nutrients in the PSW diets more efficiently than the females.

Data on feed conversion ratio (FCR) showed that the diet D3 producedsignificantly ($P<0.05$) higher value than D1 and D2 which produced similar ($P>0.05$) value. The poor FCR recorded for rabbits on diet D3 reflected reduced digestibility of the diet possibly due to increased fibre content which might also have contributed to the depressed growth rate earlier observed for rabbits on diet D3. FCR result indicated that diets by sex interaction were similar ($P>0.05$).

Table 5: Effect of pumpkin stem waste (PSW) and sex on growth performance of rabbits

Dietary level of PSW	Initial liveweight (g)	Final liveweight (g)	Total weight gain (g)	Daily weight gain (g)	Daily feed intake (g)	Feed conversion ratio
0% (D_1)	699.5	1800.50^b	1101.00^b	13.11^b	72.17^c	5.50^b
5% (D_2)	690.00	1881.50^a	1191.50^a	14.18^a	80.77^b	5.69^b
10% (D_3)	640.50	1675.00^c	1034.50^c	12.32^c	89.32^a	7.25^a
SEM	22.75	21.83	3.79	0.20	2.51	0.39
Sex:						
Male	627.66	1752.33	1124.67^a	13.38^a	93.05^a	6.95
Female	655.00	1733.00	1078.00^b	12.83^b	84.62^b	6.60
SEM	22.67	43.13	20.36	0.47	3.57	0.29
Diet by sex interaction	NS	NS				NS

Vol. 4, No. 02; 2019

ISSN: 2456-8643

c a,b,cMeans in the same column bearing different superscripts differ significantly (p<0.05); NS = Not significant.

Muscle, Bone and Muscle/Bone ratio

The significantly (P<0.05) higher muscle percentage of rabbits on diet D2 compared to those on diets D1 and D3(Table5) might be attributed to the antilipogenic activity and crude protein of diet D2 as well as liveweight gain ofrabbits on diet D2 earlier observed(Table 4). This implies that significant increase in muscle due to fat reduction might have direct relationship with liveweight gain. It is also possible that higher dietary protein content of diets D2 could contribute to the muscle increase (Berresetal., 2010). The mechanism as explained by Holness (1991) indicated that when protein is eaten by monogastrics it is broken down to the amino acids which are then used for the building up of the skeletal muscle (lean tissue) and essential organs of the body.The increasing percentage(P<0.05) in bone valueof rabbits fed pumpkin based diets,D2 and D3might have been made possible by the high calcium and phosphorus content of the Pumpkin(Table2). Recent report by Aregheore, (2007) also indicated that pumpkin is rich in calcium and phosphorus which play major role in bone formation. Result however indicate that in terms of the ratio of muscle to bone, there was no dietary effect (P>0.05).This implies that the increase in bone did not affect growth in muscleand vice versa across the treatment groups.This corroborates Oteku and Igene (2006) who reported non-significant effect of feed on muscle/bone ratio of crossbred rabbits in humid southern Nigeria. In addition, themeat/bone ratio (3.25 to 4.04) obtained in this study is comparable to the ratio of 2.8 - 4.06 documented for normal rabbits by Oteku and Igene, (2006).Results presented Table 5 shows that diets by sex interaction expectedly was significantly (P<0.05) different between male and female rabbits'values ofmuscle. This is a reflection of the higher liveweight gain of the male rabbits compared to females earlier observed. For muscle/bone ratio and bone percentage, there were no significant (P>0.05) differences between male and female rabbits. However, there were slight increases inpercentage of bone and muscle/bone ratio of male rabbit's meat compared to the females. This implies possibly that even rabbits fed diets with zero pumpkin stem waste content, bone and muscle/bone ratio of male and female rabbits were similar (P<0.05).

Abdominal fat and meat protein

Results for abdominal fat are presented in table 5. Abdominal fat value was highest in rabbits fed diet D1 and lowest in rabbits fed diet D3. The significant (p<0.05) decrease in fat percentage as dietary pumpkin stem increased suggests increasing effect of PSW with increasing level of inclusion in the diet. This might not be unconnected with the presence of antioxidants such as flavonoid, tannins and saponins in the PSW diets which has been known to have hypolipidaemic effect (Ezekwe and Obidoa, 2001). Meat protein values presented in Table 5 also showed significant increase (P<0.05) in rabbits fed pumpkin stem waste relative torabbits fed the control diet. This is a reflection of the slight increase in dietary protein content of Pumpkin stem diets2 and 3 compared to control diet (Table 3) as well asantilipogenic activity of PSW resulting in the proportionate increase of protein component in the meat. Xicatto (1999) similarly reported that protein content in meat increased as fat content reduces and vice versa.

Vol. 4, No. 02; 2019

ISSN: 2456-8643

Table 6: Effect of pumpkin stem waste and sex on abdominal fat, protein and muscle to bone ratio

Level of pumpkin stem waste	Protein (g/100g)	Abdominal fat (%)	Muscle (%)	Bone (%)	Muscle/bone ratio
0% (D_1)	20.42^{c}	10.83^{a}	70.81^{b}	17.50^{c}	4.04
5% (D_2)	22.68^{a}	6.50^{b}	73.08^{a}	20.38^{b}	3.58
10% (D_3)	21.68^{b}	5.89^{c}	71.38^{b}	21.91^{a}	3.25
SEM	0.29	0.18	0.45	0.28	0.93
Sex:					
Male	23.20^{a}	6.62	72.95^{a}	18.95	4.31
Female	22.91^{b}	7.46	68.58^{b}	17.58	3.47
SEM	0.12	1.02	1.98	1.92	0.89
Diet by sex interaction		NS		NS	NS

a,b,cMeans in the same column bearing different superscripts differ significantly ($p<0.05$); NS = Not significant

Carcass and Internal organs weight

The results of the carcass and internal organs weight of rabbits fed pumpkin stem waste (PSW) are presented in table 7. The dressing percentage range (51.94-54.29%) obtained in this study fell within the range of 50 to 60% recommended by Fielding (1991) for normal mature rabbits. Prime cuts (forelegs, thoracic cage, loin, hindlegs) and internal organs (kidney, liver, lungs and heart) weights were however, similar ($P>0.05$) in all the treatment. This is an indication that inclusion of PSW in the diets was not deleterious to physiological development of the rabbits' parts and organs.

4. CONCLUSION AND RECOMMENDATION

Supplementation of rabbit diets with 5% PSW produced optimum performance in terms of live weight gain, dressing percentage and muscle percentage. In all the parameters measured except abdominal fat and lungs weights, male rabbits recorded higher values than the females. It is recommended that forpractical rabbit production 5% PSW supplementation will be the best regime

Vol. 4, No. 02; 2019

ISSN: 2456-8643

Table 7: Effect of pumpkin stem waste and sex on carcass and Internal organ weights of rabbits

Levels of Pumpkin stem waste(PSW)	Pre-slaughter weight(g)	Dressed weight(g)	Dressing percentage (%)	Liver weight (%l.w)	Heart (%l.w)	Lungs (%l.w)	Kidney (%l.w)	Fore legs(g)	Thoracic cage(g)	Loin (g)	Hind legs(g)	Breast muscle(g)
0% (D_1)	1850.00[b]	980.00[b]	53.00[b]	2.99	0.28	0.67	0.78	161.00	160.00	277.00	295.00	5.97
5% (D_2)	1875.00[a]	1018.00[a]	54.29[a]	2.87	0.26	0.62	0.72	158.00	153.00	261.00	283.00	5.68
10% (D_3)	1675.00[c]	870.00[c]	51.94[c]	2.90	0.25	0.48	0.73	139.00	125.00	225.00	250.00	5.63
SEM	22.20	29.90	0.27	0.21	0.04	0.18	0.05	9.02	11.10	18.3	11.68	0.64
Sex:												
Male	1777.66	952.6	53.33	2.98	0.24	0.45	0.75	158.33	148.33	258.66	280.00	5.79
Female	1766.66	927.6	52.43	2.86	0.28	0.58	0.72	147.00	144.00	250.00	271.66	5.73
SEM	37.52	37.97	3.56	0.29	0.04	0.09	0.05	10.97	14.94	25.22	14.49	0.85
Sex by dietary level interaction	NS	NS	NS	NS	NS		NS	NS	NS	NS	NS	NS

a,b,cMeans in the same column bearing different superscripts differ significantly ($p<0.05$); NS = Not significant.

l.w = Liveweight

Vol. 4, No. 02; 2019

ISSN: 2456-8643

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Vol. 4, No. 02; 2019

ISSN: 2456-8643

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