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CARCASS YIELD AND ORGANOLEPTIC PROPERTIES OF MEAT FROM RABBITS FED DIETS CONTAINING BREWERS' SORGHUM MASH OFFAL

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ABSTRACT----------
Brewer's Sorghum Mash Offal (BSMO) is a local brewery by-product discarded after extraction of traditional malted alcoholic drink called burkutu in some Northern Nigerian communities. To evaluate the carcass yield and organoleptic properties of weaner rabbits meat fed diets containing non-conventional BSMO as replacement for wheat offal, 30 weaned rabbits aged between 5 to 6 weeks and of mixed breed, weighing between 410-450g were used. The rabbits were allotted into five dietary treatments; T1(0%BSMO), T2(25%BSMO), T3(50%BSMO), T4(75%BSMO) and T5(100%BSMO). Each treatment was replicated three times containing two rabbits per replicate in a completely randomized design and managed for 90 days. Data on carcass yield and organoleptic properties were collected and subjected to analysis of variance (ANOVA). Results indicated that brewers sorghum mash had significantly affected (P<0.05) all carcass characteristics except lungs weight. Rabbits fed BSMO performed better than those fed control diets. Also, rabbits fed T5 (100% BSMO) had higher live weight (1695.0g), carcass weight (1218.0) and dressing percentage (71.9%). Results on organoleptic properties indicated that BSMO had not significantly affected (P>0.05) all organoleptic parameters measured. However, the overall acceptability indicated that meat samples of rabbits fed BSMO had better performance ranking 1st (T5 and T4) and 3rd (T3 and T2) than the samples from the T1 (control diet ranking 5th). It can therefore be concluded that 100% BSMO can be included to conveniently replace wheat offal in the diet of weaned rabbits to improve carcass yield and palatability of rabbit meat.
KEYWORDS: *replacement value, brewer's sorghum mash offal, weaner rabbits, by-product, diets----------*

1. INTRODUCTION

Rabbit carcasses are usually presented in various ways depending on location. In some African countries, rabbits meant for markets are slaughtered, dehaired and eviscerated. Rabbits produces highly nutritious, low-fat, low-cholesterol meat (Teye *et al*., 2020). Therefore, rabbit meat production can be an interesting enterprise with a particular aim of producing high quality animal protein. Rabbit meat consumption is increasing for the following reasons; it is classified as white meat, it has high protein content but low in fat (Usman *et al*, 2020). It has been encourage to consume rabbit meat owing to its less uric acid, low in cholesterol, fat and sodium which is good for patients with high blood pressure, edema which makes them uncomfortable to consume red meat in large quantities (Maigida *et al.* (2008) and Harouz-Cherifi *et al.* (2021). Meat and meat products are termed functional foods because of their beneficial components, and for a more sustainable functional properties of rabbit meat, functional feed is needed (Nutautait *et al.* (2023).

In animal production, feeding is vital in attaining the optimum productivity. However, utilizing conventional feeds is making livestock production difficult due to the high cost of feed and owing to the stiff competition between human and animals for grains and oil seeds (Effiong *et al.* (2016). This necessitated research into available alternative feeds from non-conventional sources that can give better performance with cost effectiveness. Non-conventional feedstuffs

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have been defined by (Amandee, 2016) to include feed resources that were not commonly utilized in feeding livestock and were not usually included as ingredients during commercial formulation of livestock rations. Although non-conventional feedstuffs can conveniently compete with conventional feed resources, but problems of seasonality of production, presence of anti-nutritional factors, location and collection relative to area of utilization, cost of processing, estimation of feeding value and anti-nutritional factors limits their utilization by animals (Kurtong, 2014 and Maidala *et al*., 2016).

Fresh brewers' sorghum mash offal (BSMO) left on the ground outside the breweries can easily get spoilt and become an environmental nuisance, including water and air pollution. Organic recycling of brewers sorghum mash as animal feed has the potential of alleviating the environmental impact of the brewing process at the same time (Lazarevich and Lesnov (2010) and Crawshaw (2004). Small livestock species like rabbits, have potential role to mitigate the protein deficiency in protein malnourishment bedeviling developing nations like Nigeria Kurtong (2014). Rabbits have are very prolific with a short generation intervals, easy to manage. They also have a good capability to utilize wastes from vegetables, kitchen and a vast variety of non-conventional feeds with high ability to feed and utilize forages even with little or no significant amount of concentrates.

Many researches used different non-conventional feeds on rabbits; Okpanachi *et al* (2019) studied the growth and hematological response of growing rabbits to diets containing graded levels of Sun dried Bovine Rumen Content. Hadiza (2019) investigated the growth performance and nutrient digestibility of rabbits fed brewers dried grains. Makinde *et al.* (2017) evaluated the response of growing rabbits to diets containing different agro industrial by-products. Kurtong (2014) evaluated the performance of weaner rabbits fed maize husk based diets. Adeniji and Adewole (2015) determined the effects of replacing Brewers dried grains (BDG) on performance. Nelson and Kagya (2013) fed dried pito mash to rabbits for performance, Ashour *et al*. (2019) evaluated the effect of dietary inclusion of dried brewers' grains. Eman *et al.* (2016) utilized guava waste. Salisu, *et al.* (2012) fed carrot leaf meal to rabbits for performance. However, most of these authors studied only performance of rabbit with less attention paid to nutritive and eating qualities of rabbit meat.

2. OBJECTIVE

Brewers' sorghum mash offal is a potential ingredient of rabbit diets in areas where they are available. This by-product is obtained freely or at little cost from local brewers of traditional alcoholic drink commonly called *burkutu* in major towns of Kebbi and Niger states of Nigeria. The by-product is often discarded as a waste and found available in sufficient quantities around the processing areas. Consequently, this study was carried out to evaluate the value of replacing BSMO for wheat offal on carcass yield of rabbit meat.

3. MATERIALS AND METHODS

3.1 Experimental Site

The experiment was conducted at the Animal pen of the Department of Animal Science, Kebbi State University of Science and Technology, Aliero, Nigeria. The University is located in Aliero town between Latitude 12^{o} 16' 42" N and Longitude 4^{o} 27'6" E. Kebbi State is one of the Nigerian states where production of the local burkutu is considerably high is some local governments. This makes the by-product available at little or no cost.

4. Treatments and Experimental Design

A total of thirty (30) rabbits that are apparently healthy, of mixed breed, of same sex and age, between five and six weeks were used for the experiment. They were randomly assigned to five treatments at inclusion levels of 0, 25, 50, 75 and 100% for treatments 1, 2, 3, 4 and 5, respectively, in a completely randomized design (CRD). Each treatment was replicated three times, and each replicate contained 2 rabbits. The rabbits were obtained from Kontagora Market, Niger State. The BSMO was collected at local breweries from brewing communities in Yauri and Zuru, Kebbi State. The wet BSMO was sundried to reduce the moisture content. The dried BSMO was taken to the feed mill where it was prepared for experimental diets.

4.1 Preparation of Experimental Diet

Five experimental diets were formulated to meet the nutritional requirements of rabbit. The diets contained 17% crude protein and 2512-2586 kcal ME/kg diet for treatments one to five. BSM was included at graded levels of 0, 25, 50, 75 and 100% for treatments I to V, respectively as indicated in Table 1.

Volume: 12 | Issue: 1 | January 2024 | Journal DOI: 10.36713/epra0813| Impact Factor SJIF(2023): 8.221| ISSN: 2321 - 7847

4.2 Management of Experimental Animals and Data Collection

The rabbits were housed in wire cages. Feed was provided ad-libitum for 90 days and have free access to water. The cages had wire screen base, which allowed faeces and urine to pass into a collection grid. The rabbits were allowed one week adjustment period before the feeding trial commenced. The rabbits were administered with ivomectin at 0.2 mls per rabbit as a prophylactic measure against endo and ecto-parasites. The drinkers were cleaned daily before water supply. The rabbits were weighed on weekly basis. The performance of rabbits were monitored in terms of feed intake, weight gain and feed to gain ratio.

Two rabbits from each treatments were randomly selected for carcass evaluation and organoleptic analysis. The rabbits were fasted for 12 hours prior to slaughter. They were bled by cutting the jugular vein with the aid of a sharp knife and scalded using fire. Removal of the internal organs (Kidneys, lungs and heart) which was then individually weighed. Dressing percentage was expressed as percentage of carcass weight all over live weight. The skinned carcasses were cut up in to retail cut of loin, fore limb, hind limb, back etc., which was also weighed. The weight of the retail cut and the internal organs was express as percentage of the live weight at the point of slaughter for each rabbit.

5. DETERMINATION OF ORGANOLEPTIC QUALITIES

Determination of organoleptic qualities was conducted subjectively using the quantitative descriptive analysis (QDA) based on the principle of a panelist's ability to verbalize perception of a product. Nine point Hedonic scale according to Stone and Sidel (2004) was used to evaluate the Flavour, Tenderness, Juiciness, Leanness, Aroma and overall acceptability of the samples. Using a panel of ten (10) judges, blind coded samples were presented to them and were asked to taste and judge the samples. Crackers biscuits were given to the panelist after every tasting session in orderto mar the effect of the previous sample.

6. DATA ANALYSIS

All data were analyzed using General Linear Model (GLM) multivariate analysis of variance (ANOVA) using IBM SPSS version 20. Significant means were separated using Tukey test at 5% probability level.

7. RESULTS AND DISCUSSION

7.1 Carcass yield of Weaner Rabbits fed Graded Levels of Brewers Sorghum Mash offal

The result of carcass characteristic of rabbits fed graded level of brewers sorghum mash as replacement for wheat offal is presented in Table 2, Table 3 and Table 4. Results indicated that brewers sorghum mash had significantly affected ($P<0.05$) all carcass characteristics except lungs weight. Rabbits fed BSMO performed better than those fed control diets.

Rabbits fed T5(100% BSMO) higher live weight, carcass weight and dressing percentage. Generally, BSMO treated samples had performed better that the rabbits fed control diet. The results of this study agrees findings of Enu (2009), Oloruntola (2018), Ekpo *et al.* (2019). Eman *et al.* (2016) also recorded similar carcass weight. Makinde *et al.* (2016) recorded similar dressing percentage. On the primal cuts, BSMO fed rabbits performed better than rabbits on the control diet. Hind limb, neck and chest weights were significantly higher in rabbits fed 100% BSMO while head, forelimb and loin were significantly higher in weight in T4(75%BSMO). Ekpo *et al.* (2009) and Okpanachi *et al.* (2019) recorded similar results. Highest Kidney weight gain was recorded T3 (13.00g), T4 (12.00g) and T5(12.00g) followed by T2(11.00g,) and T1(10.00g). The best result in T3 (13.00g) while lowest value obtained in T1 (10.00g). The result obtained in this trial were almost within the values (6.80 – 9.97g) obtained by Patience and Adekemi (2018). Highest heart weight of rabbits obtained in T5 (7.00g) followed by T3 (6.00g) and T2 (5.00g,) while T1 and T4(4.00g) had the lowest similar heart weight. The result disagreed with the values (0.44 – 0.57g) obtained by Ogunsipe *et al.*(2014) who fed sorghum offal to rabbits to determined performance response and carcass evaluation.

Table 5 shows results for organoleptic properties of meat from rabbits fed graded level of Brewers Sorghum Mash offal as a replacement for wheat offal. Results indicated that BSMO had not significantly affected ($P>0.05$) all organoleptic parameters measured. However, the overall acceptability indicated that meat samples of rabbits fed BSMO had better performance ranking 1st (T5 and T4) and 3rd (T3 and T2) than the samples from the T1 (control diet

Volume: 12 | Issue: 1 | January 2024 | Journal DOI: 10.36713/epra0813| Impact Factor SJIF(2023): 8.221| ISSN: 2321 - 7847

ranking 5th). Wognin *et al.* (2018) also reported that supplementing rabbits feed with leafy vegetables had not significantly affected (P>0.05) the appearance, juiciness and tenderness of rabbit meat.

8. SUGGESTION

The study suggests that further meat quality analysis should be conducted using BSMO at the current percentages.

9. CONCLUSION

From the results of this study, it was observed that rabbits raised on diets containing BSMO have higher performance on carcass characteristics and organoleptic properties than those raised on control diet. Similarly, 100% BSMO had higher dressing percentage and primal cuts which are the desirable attributes (output) and also ranked better in organoleptic properties. It can therefore be concluded that 100% BSMO can be included to conveniently replace wheat offal in the diet of weaned rabbits to improve carcass yield and palatability of rabbit meat.

10. TABLES AND REFERENCES

Table 1: Gross Composition of weaner rabbit diets containing graded levels of brewers sorghum mash

INGREDIENTS	TREATMENTS				
	T1 (0%BSMO)	T2 (25%BSMO)	T3 (50%BSMO)	T4 (75%BSMO)	T5 (100%BSM0)
Maize	25.25	15.75	20.00	20.25	25.25
Soybean Cake	10.00	10.00	10.00	10.00	10.00
Groundnut Cake	11.50	11.00	6.75	6.50	11.50
Wheat Offal	50.00	40.00	30.00	20.00	0.00
Sorghum mash	0.00	20.00	30.00	40.00	50.00
Bone Meal	2.50	2.50	2.50	2.50	2.50
Salt	0.30	0.30	0.30	0.30	0.30
Premix	0.25	0.25	0.25	0.25	0.25
Methionine	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10
Total	100	100	100	100	100
Calculated Analysis					
ME (kcal/kgdiet)	2578	2512	2556	2558	2586
Crude Protein (%)	17.00	17.00	17.00	17.00	17.00
Crude Fibre (%)	10.95	10.65	11.12	11.40	12.65
Phosphorus (%)	0.62	0.61	0.61	0.60	0.60
Calcium (%)	0.89	0.87	0.86	0.86	0.87
Methionine (%)	0.73	0.72	0.71	0.70	0.70
Lysine (%)	1.21	1.11	1.10	1.11	0.25

Table 2. Live weight, carcass and dressing percentage of Rabbits fed graded level of Brewers Sorghum Mash offal as a replacement for wheat offal

PARAMETERS	TREATMENTS					SEM
	T1 (0%)	T2 (25%)	T3 (50%)	T4 (75%)	T5 (100%)	
Live weight (g)	1510.00^{e}	1645.00^{b}	1605.00^{d}	1642.00^{c}	1695.00^{a}	1.73
Carcass weight (g)	995.00^{e}	1133.00^{c}	1080.00^{d}	1175.00^{b}	1218.00^{a}	1.73
Dressing (%)	65.89^{c}	68.88^{abc}	67.29^{bc}	71.56^{ab}	71.86^{a}	1.73

abcde = means with different superscripts along the same row differ significantly (P<0.05)

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Table 3. Primal cuts of Rabbits fed graded level of Brewers Sorghum Mash offal as a replacement for wheat offal

PARAMETERS	TREATMENTS					SEM
	T1 (0%)	T2 (25%)	T3 (50%)	T4 (75%)	T5 (100%)	
Head (g)	117.50^{d}	133.00^{b}	111.00^{e}	132.00^{a}	127.00^{c}	1.73
Hind limb (g)	221.00^{e}	225.00^{d}	251.00^{b}	249.00^{c}	252.00^{a}	1.73
Fore limb (g)	117.00^{e}	154.00^{b}	129.00^{d}	182.00^{a}	148.00^{c}	1.73
Loin (g)	107.50^{d}	155.00^{b}	104.00^{e}	165.00^{a}	132.00^{c}	1.73
Neck (g)	27.50^{e}	44.00^{b}	39.00^{d}	42.00^{c}	45.00^{a}	1.68
Chest	97.50^{e}	122.00^{b}	118.00^{c}	96.50^{d}	124.00^{a}	1.73

abcde = means with different superscripts along the same row differ significantly (P<0.05)

Table 4. Organs weight of Rabbits fed graded level of Brewers Sorghum Mash offal as a replacement for wheat offal

PARAMETERS	TREATMENTS					SEM
	T1 (0%)	T2 (25%)	T3 (50%)	T4 (75%)	T5 (100%)	
Liver (g)	44.00^{ab}	41.00^{ab}	38.00^{b}	47.00^{a}	44.00^{ab}	1.80
Kidney (g)	10.00^{b}	11.00^{ab}	13.00^{a}	12.00^{ab}	12.00^{ab}	0.58
Heart (g)	4.00^{b}	5.00^{ab}	6.00^{ab}	4.00^{b}	7.00^{a}	0.58
Lungs	9.50	11.00	10.00	12.00	13.00	0.93

abcde = means with different superscripts along the same row differ significantly (P<0.05)

Table 5. Organoleptic properties of meat from rabbits fed graded level of Brewers Sorghum Mash offal as a replacement for wheat offal

Treatment	Flavour	Tenderness	Juiciness	Leanness	Aroma	Acceptability	Rank
T1(0%BSMO)	6.00	7.00	7.67	7.67	7.00	6.93	5
T2(25%BSMO)	7.67	7.00	6.33	7.00	6.33	6.73	3
T3(50%BSMO)	6.67	7.67	7.33	7.67	6.67	6.73	3
T4(75%BSMO)	7.00	6.33	6.00	6.33	6.33	7.13	1
T5(100%BSMO)	7.33	7.67	6.33	7.00	7.33	7.13	1
SEM	0.73	0.730	0.745	0.730	0.745	0.327	

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