

MEAT QUALITY OF WEANER RABBITS FED FERMENTED PRIDE OF BARBADOS (*Caesalpinia pulcherrima*) SEED MEAL

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Abstract

The constraints to large scale production in the developing countries are non-identification of fast growing breeds and unavailability of adequate feed. It is therefore necessary to explore all possible avenues to adequately increase meat production for human consumption through evaluating the carcass characteristics and organ weight of weaned rabbits. Twenty (20) weaned rabbits were allotted into five dietary treatments, each was replicated twice with two rabbits per replicate. The animals were allowed to adjust to the test diets and cages for seven days before the start of the experiment. During the period of acclimatization, the rabbits were dewormed with ivermectin injection. All cages were supplied with feeders and drinkers. The fermented pride of barbados seed meal was included at 0% (T1), 5% (T2), 10% (T3), 15% (T4) and 20% (T5) in weaner rabbit ration. At the end of experiment, two weaner rabbits were selected randomly for evaluation of carcass, internal organ and cut parts analysis. The experiment lasted eight weeks. The result showed significant ($p < 0.05$) difference in the values of final live weight (675.00) and carcass weight (375.00) of rabbit fed experimental diet. The values obtained for cut parts showed significant ($p < 0.05$) difference across the dietary treatment except shoulder, hind feet and tail which showed no significant ($p > 0.05$) difference across the dietary treatment. Inclusion of fermented pride of barbados seed meal in rabbit was found to be effective without adverse effect on the carcass yield and internal organ of rabbits at 20% inclusion level.

Keywords: Carcass; organ characteristics; rabbits; weaned; pride of barbados

Introduction

Rabbits have been identified as a cheap source of high-quality protein that can substantially improve the level of animal protein production and consumption in developing countries (Wafer *et al.*, 2018). Rabbits are efficient converter of agro-industrial by-products and fibrous feed ingredients to meat than other livestock species (Bassey, *et al.*, 2008). Abonyi *et al.* (2012) reported that feeding and nutrition of rabbits requires adequate supply of feed in quantity and quality for optimal growth.

Rabbits play an important role in the supply of animal protein to the Nigeria populace (Amaefule *et al.*, 2005). Rabbit rearing is gaining popularity for meat and besides as pet animal in Nigeria. Das *et al.* (2013) reported that rabbit are reared for several reasons that include that raised on roughage diet solely without affecting productive and reproductive performance and this indicates that it does not compete with human beings and other monogastric animals. Rabbit is very prolific and can be bred throughout the year and gives at least four crops with five litters in each time. It is adaptable to a wide range of climate and can be marketed at 90 days of age. Rabbit meat is

wholesome; tasty which is rich in protein, contain minerals and vitamins but low in fat cholesterol (Elamin, 2013). Olomu *et al.* (2019) opined that in developing countries rabbit production is predominantly based on grasses and legumes, however, their availability and growth during dry season cannot sustain all year round rabbit production. Efforts are being made by animal nutritionists to explore the possibilities of incorporating unconventional proteins feedstuffs in rabbits feed in order to reduce the cost of feed and maximize the return to rabbitary (Esonu *et al.*, (2001). The continued increase in cost of conventional feeding ingredients especially grains, cakes and meals and the effective competition from both the poultry industry and human population are a major constraints for progressive growth of the rabbitary industry in Nigeria.

Pride of Barbados leaflets are less than 12mm long, very numerous flowers with long stalks. Leaflets are opposite. Flowers are conspicuous and scarlet. This handsome ornamental tree is known as the flame of the forest in Nigeria. It is a fast growing tree usually with very wide spreading branches producing a broad

flat of crown. The flowers are borne short and upright terminal racemes. There are five (5) large scarlet petals with one mottle red and white. There are ten (10) free stamens, the fruits are large flat pods up to about 60-70cm long by 5-8cm broad almost black when ripe, hard and woody hanging conspicuously for a long time on the and eventually split open, there are numerous elongated seeds about 2.5cm long arranged lengthwise across the pods. The tree is widely cultivated and self - sown throughout the tropics.

There is need for greater utilization of the relatively neglected leguminous seeds particularly the pride of Barbados (*Caesalpinia pulcherrima*) abundant locally, compare their nutritive values to the traditional feed resources for feed formulation in order to reduce escalating cost of monogastric animal production (Adeola and Olukosi, 2008). These feed sources are however not fully and appropriately integrated into livestock feed, this may be as a result of very little knowledge of their potential as feed materials, the presence of anti-nutritional substances as well as lack of proper knowledge of storage capabilities especially over long periods (Ben *et al.*, 2002)

A large number of alternative feedstuffs that have potential as rabbits feed ingredients abound in Nigeria (Ologhobo, 2012). Fadipe (2010) opined that the search for cheaper sources of feeding ingredients for livestock feeding in Nigeria and many developing countries, as long as protein requirement in human diet has not been met. The search for cheaper and available feedstuff that can sustain all year round rabbit production has been the focus of animal nutritionist in recent years.

Materials and methods

Experimental location

The experiment was carried out at the rabbitary unit of the Teaching and Research farm of the Oyo State College of Agriculture and Technology, Igboora, Nigeria. The experimental area lies within 7° 15 North 3° 30 East of Equator with average rainfall of 1278mm and average annual temperature of 27° C (Google Earth, 2021).

Experimental animals and management

Twenty (20) weaned rabbits weighed between 400 to 500g were used for the experiment, they were randomly assigned to five treatment diets (0%, 5%, 10%, 15% and 20%) made up of four rabbits per treatment. Each rabbit served as a replicate. The weaner rabbits were assigned to individual pen and dietary treatments were offered to the animal on commencement of the feeding trial. The animals were

acclimatized for a period of one week and prophylactic treatment against ecto and endo parasites using ivermectin at 0.30kg during the adaptation period. The experiment lasted eight (8) weeks.

Processing of experimental diet

Ripened pods of pride of Barbados seeds were collected within Igboora metropolis. The mature pods were opened to remove the seeds in lateral arrangements. Over 100kg seeds were collected and ground by hammer mill before subjecting the meal to fermentation. Fermentation was carried out by first soaking the ground pride of Barbados seed meal in water after which the water was decanted to eliminate soluble tannin and dough packed in air tight nylon bags to prevent air from entering. The materials prepared in this way was fermented as described by Annongu *et al* (1996) after which it was removed for sun drying.

Determination of proximate composition:

Samples of fermented pride of Barbados seed meal and experimental diet were analyzed in triplicate. The dry matter content was determined based on the weight loss after twenty-four hours in an oven at 100° C, (A.O.A.C, 2018).

Quantification of toxins in fermented pride of Barbados seed meal

The fermented pride of Barbados seed meal were determine for tannin using Swain (1975), oxalate according to Day and Underwood (1986), phytate by Maga (1983) and Saponin by spectrophotometric method of Brunner (1984).

Carcass and internal organs evaluation

At the end of the experimental period, two rabbits per replicate were selected for carcass analysis. The animals were starved overnight to clear the guts. They were weighed, stunned, slaughter by cutting the jugular vein. The tail was cut very close to the base followed by removal of the pelt, head, feet and evisceration. The cut parts, internal organs and gastrointestinal components were weighed using sensitive electronic balance (Ohans^R, 0.01g) and expressed in gram. The cut parts measured were live weight, slaughter weight, deffured weight and carcass weight.

Statistical analysis

Data obtained were subjected to analysis of variance using Statistical Package System Software (SAS, 2019) and where differences exist between the means,

Duncan Multiple Range Test was used to separate the means at 5% level of probability.

Results and discussion

The results of the proximate composition of fermented pride of Barbados seed meal is presented in Table 1. The crude protein, crude fibre, ash, ether extract, moisture, nitrogen free extract, dry matter and metabolizable energy were 19.95%, 9.00%, 5.00%, 6.30%, 13.00%, 59.75%, 87.00% and 3595.48Kcal/kg ME, respectively. The results of carcass characteristics, internal organs and cut part are presented in Table 2. The highest value of live weight (675.00g) was recorded in rabbit fed diet T1 (0% inclusion level of fermented pride of Barbados seed meal) while the lowest value (475g) was obtained in diet T5. For slaughter weight, the rabbits fed diet T2 had the highest value (525g) while the lowest value (375g) was obtained in rabbit fed diet T3. The highest value (175g) of deffurred weight was obtained in rabbit fed diet T2 while diet T3 recorded the lowest value (50g). The highest live weight (675g) was recorded in diet 5. The highest dressed weight (375g) was obtained in diet 1 (0% inclusion level of fermented pride of Barbados seed meal) while the least carcass weight (325g) was recorded in diet 3 and 5 (10% and 20% inclusion level of fermented pride of Barbados seed meal). The level of inclusion of pride of Barbados seed meal in the diet had no significant ($p>0.05$) effect on the kidney, hearts and spleen of rabbits fed at various levels. For stomach, rabbits fed diet 2 (5% inclusion of fermented pride of Barbados seed meal) had the highest value (37.40g) while the lowest value was recorded in diet 4 (11.00g). The effect of fermented pride of Barbados seed meal on the cut parts of weaner rabbits revealed that there were significant ($p<0.05$) difference in the value obtained from the cut parts except shoulder, hind feet and tail which show no significant ($p>0.05$) difference across the treatment.

The crude protein content of the fermented pride of Barbados seed meal (19.95%) was lower than that of fermented castor seed meal that is (24.20%) (Oso *et al.*, 2005). This might be as a result of the processing method employed to detoxify the anti-nutritional factors (tannin, saponin, oxalate and phytate). The reduction in the crude protein content of the fermented pride of Barbados seed meal could be as a result of difference in soil content, age of the plant and storage length. The crude fibre content of fermented pride of Barbados seed meal (6.30%) was found to be lower than that of fermented castor seed meal (12.52%). This reduction could be advantageous to monogastric animals which are known to have little ability to digest

fibrous materials. The ether extract of the fermented pride of Barbados seed meal (9.00%) was lower than the 22.8 - 23.5% reported by Salunkle *et al.* (1985) for soya bean. These result confirmed the findings of (Ega, 1986) that whole seeds of legume are richer than detoxified seeds in the lipid content and indicate fermented pride of Barbados seed meal as a low fat feedstuff that is good for lean rabbit production. The ash content of fermented pride of Barbados seed meal (5.00%) was found to be lower than that of fermented castor seed meal (84.90%) which implies that the seed is not a good source of mineral (Ekop, 2007). Fermented pride of Barbados seed meal have a higher dry matter content than that of the soya bean meal and this shows that most of moisture content of the fermented pride of Barbados seed meal had been removed during fermentation and that the seed is rich in organic matter. The nitrogen free extract of fermented pride of Barbados seed meal (59.73%) was higher than those obtain in conventional protein sources such as groundnut cake (23.84%) and soya bean (28.60%) as reported by Amafuele (1998). The value observed for nitrogen free extract in fermented pride of Barbados seed meal fall within the ranged reported by Okorie and Amachi (2003) who reported the proximate composition of some selected tropical legumes. The 3395.48MEKcal/kg recorded for fermented pride of Barbados seed meal is appreciable energy which comparably higher than the value of groundnut cake (2640Kcal/kg) and boiled jack bean (2970Kcal/kg) as recorded by Ogbonna *et al.* (2000). The carcass weight of (375g) fell below the value obtained by Memieth *et al.*, (2004) who reported a dressing percentage of 50.7-58.5%. The lower value reported was due to the removal of skin, head and legs and similar to the standard value reported in Europe and United State of America (Aduku and Olukosi, 1990). This result confirmed the findings of Afolabi *et al.* (2013) who reported the live weight (1463g) of rabbit in diet (0% inclusion level of cooked rubber seed meal) and the lowest live weight (1047g) in diet 5 (40% inclusion level of cooked rubber seed meal). The result of this research showed that the lowest live weight was recorded in diet 5 (20% inclusion level of fermented pride of Barbados seed meal) and this result negated the findings of Fanimio *et al.* (2013) who reported the highest final live weight and weight gain in diet containing 20% to 30% cashew apple waste respectively. This result recorded for carcass yield supported the findings of Afolabi *et al.*, 2013 who reported the highest carcass yield in diet 1 (0% inclusion level of fermented pride of Barbados seed meal and the least in diet 5 and 6 (40% and 50% inclusion level of cooked rubber seed meal

respectively). The result of the study showed that there were significance ($p < 0.05$) difference in the value obtained for liver weight across the dietary treatments. The values obtained for the lung of rabbit fed fermented pride of Barbados seed meal showed significant ($p < 0.05$) difference across the dietary treatment which was in contrary to the findings of Afolabi *et al.* (2013) who reported that no significant ($p > 0.05$) difference in the value obtained for lung of rabbit fed cooked rubber seed meal across the treatments. Fanimu *et al.* (2003) also reported no significant ($p > 0.05$) difference in the value obtained for lung of rabbit fed cashew apple waste. The value obtained for kidney and heart of rabbit fed fermented pride of Barbados seed meal showed no significant ($p > 0.05$) difference across the treatment, this was contrary to the findings of Kaga, (2013) who reported significant ($p < 0.05$) difference in the value obtained for the kidney of rabbit fed processed *Delonix regia* meal. This might be due to better utilization of fermented pride of Barbados for tissue formation and growth. It is probably that as the animals advanced in age, the muscle and bones that constitute the weight of the carcass develop at a faster rate than the offal (Ewuola, 2009). Diet 1 recorded the highest rib weight (23.6g) while the lowest rib weight (14.25g) was obtained in diet 3. The highest value of the hind limb weight (11.5g) was obtained in diet 3. The highest value of the thigh weight (26.3g) was obtained in diet 2 while lowest thigh weight (15.00g) was recorded in diet 3. The highest value of the head (39.8g) was recorded in diet 4, while the lowest value (28.28g) in diet 3. The highest value of the fore limbs (14.73g) was obtained in diet 1 while the least fore limb (8.67g) was recorded in diet 3. The highest value of fore feet

(2.36g) was obtained in diet 5 while the lowest forefeet (1.23g) was recorded in diet 1. The result of this research shows significant ($p < 0.05$) differences in the hind limb of rabbit fed fermented pride of Barbados seed meal. This result confirms the findings of Afolabi *et al.*, 2013 who reported a significant ($p < 0.05$) difference in the value obtained for hind limb of rabbit fed cashew apple waste. The value obtained for the fore limb of rabbit fed fermented pride of Barbados seed meal show significant ($p < 0.05$) difference across the dietary treatment, the result of this research negate the finding of Afolabi *et al.*, 2013 who reported no significant ($p > 0.05$) difference in the forelimb of rabbit fed cooked rubber seed meal across the dietary treatment. There was significant ($p < 0.05$) differences in the value obtain for the head of rabbit fed fermented pride of Barbados seed meal across the treatments. The result confirmed the finding of Afolabi *et al.* (2013) who reported a significant ($p < 0.05$) difference in the value obtained for head of rabbit fed cooked rubber seed meal across the treatment. The high fibre content of fermented pride of Barbados based diets might have stayed longer in the large intestine and caecum where secondary microbial fermentation and digestion take place therefore stimulation the strengthening and lengthening of these organs (Ojewola *et al* 2000).

Conclusion and Recommendation

The results of this research revealed that fermented pride of Barbados seed meal is a good alternative feed resources that could be effectively used in diet of weaner rabbits up to 20% inclusion level without adverse effect on the carcass and internal organ of the rabbits.

Table 1: Gross composition of experimental diets (FPBSM)

Percentages	Replacement Level				
	0%	5%	10%	15%	20%
	T1	T2	T3	T4	T5
Ingredients					
Maize	59.15	57.94	56.74	55.53	54.33
Soya bean meal	20.00	19.00	18.00	17.00	16.00
Wheat offal	14.86	14.86	14.86	14.86	14.86
Fish meal	1.02	1.02	1.02	1.02	1.02
Bone meal	2.27	2.27	2.27	2.27	2.27
FPBSM	0.00	2.21	4.41	6.62	8.84
Limestone	2.00	2.00	2.00	2.00	2.00
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Premix	0.25	0.25	0.25	0.25	0.25
TOTAL	100.00	100.00	100.00	100.00	100.00



Determined Analysis					
Dry matter %	91.31	91.92	91.95	92.06	92.76
Crude Protein	18.20	19.25	16.80	16.80	17.50
Crude fibre	4.00	4.11	4.30	4.20	4.10
Ether extract	7.00	7.00	7.00	7.00	7.00
Ash	4.00	5.00	7.00	6.00	6.00
Energy (ME kcal/kg)	3617.40	3453.98	3498.15	3537.20	518.65

FPBSM = Fermented pride of barbados seedmeal

Table 2: Proximate composition of fermented pride of Barbados seed meal

Nutrients	Values
Crude Protein (%)	19.95
Crude Fibre (%)	9.00
Crude Fat (%)	6.30
Ash (%)	5.00
Dry matter (%)	87.00
Energy (ME Kcal/ Kg)	3595.48
Moisture (%)	13.00
Nitrogen free extract (%)	59.75

Table 3: Effect of fermented pride of Barbados seed meal on the carcass characteristics, internal organ and cut part of weaner rabbits

Parameters/ Inclusion levels	0% T1	5% T2	10% T3	15% T4	20% T5	SEM
Live weight	675.00 ^a	600.00 ^b	565.00 ^c	575.00 ^{bc}	575.00 ^{bc}	8.71
Bled weight	475.00 ^b	525.00 ^a	375.00 ^c	465.00 ^c	410.00 ^d	3.37
Dressed weight	375.00 ^a	350.00 ^c	325.00 ^d	355.00 ^b	325.00 ^d	1.11
Defurred weight	100.00 ^b	175.00 ^a	50.00 ^d	100.00 ^b	100.00 ^b	5.00
Liver (g)	8.85 ^a	8.60 ^b	8.02 ^b	5.00 ^d	6.00 ^c	0.18
Kidney (g)	2.30	2.05	1.90	2.00	1.90	0.06
Heart (g)	0.74	0.60	0.71	0.60	0.60	0.03
Lung (g)	1.40 ^b	1.70 ^a	0.80 ^d	1.00 ^c	1.00 ^c	0.05
Spleen (g)	0.20	0.20	0.20	0.20	0.20	0.00
Stomach (g)	25.10 ^b	37.40 ^a	8.15 ^d	11.00 ^c	14.00 ^c	0.82
Rib	23.60 ^a	20.50 ^b	14.25 ^c	21.00 ^b	22.00 ^{ab}	0.52
Loin	43.30 ^b	51.95 ^a	24.60 ^d	36.00 ^c	29.00 ^d	1.38
Hind limb	8.90 ^c	11.00 ^b	11.50 ^b	11.00 ^b	15.00 ^a	0.58
Thigh	20.10 ^c	26.30 ^a	15.00 ^d	20.13 ^c	22.00 ^b	0.62
Shoulder	13.33	11.35	11.65	10.00	11.60	0.47
Head	32.00 ^b	32.40 ^b	28.28 ^d	39.80 ^a	30.00 ^c	0.76
Hind feet	6.30	5.25	6.30	5.00	6.84	0.31
Tail	0.91	0.55	1.50	1.00	10.00	0.14
Fore limb	14.73 ^a	12.61 ^b	8.67 ^d	10.00 ^c	10.00 ^c	0.27
Fore feet	1.23 ^c	1.76 ^b	2.35 ^a	2.00 ^a	2.36 ^a	0.17

a, b, c, and d means on the same row but with different superscripts are statistically ($P < 0.05$) significant

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