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## SENSORY EVALUATION OF MEAT OBTAINED FROM BROILER CHICKENS FED DIETARY BOVINE RUMEN FILTRATE FERMENTED COCOA BEAN SHELL

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### ABSTRACT

*A sensory evaluation was conducted on meat obtained of broiler chickens fed for 56 days on diet containing graded levels of bovine rumen filtrate Fermented Cocoa Bean Shell (FCBS). Fresh cocoa bean shell was mixed with rumen filtrate obtained at ratio 5:5, fermented and then dried. The dried fermented cocoa bean shell was incorporated into the experimental diets at varying levels; 0, 5, 10, 15 and 20% respectively to formulate five experimental diets. One hundred and fifty one-day old broiler chickens were randomly allotted into five treatment groups with thirty (30) birds per treatment and three replicates containing ten birds each in a completely randomized design. At the end of the feeding trial, after being fasted for 12 h; three birds per replicate were randomly selected and sacrificed; then the sensory evaluation of the cooked samples were carried out by 10 panelists. Parameters; colour, juiciness, flavour, tenderness, aroma and taste were evaluated by the panellist using a nine point hedonic scale. The collected data on sensory traits were analysed using ANOVA at ( $P < 0.05$ ). Tenderness (7.60 – 8.33), juiciness (7.40 – 8.37), flavour (7.37 – 8.43), colour (7.53 – 8.30), aroma (7.53 – 8.37) and taste (7.07 – 8.13) of the cooked meat samples varied significantly across the dietary treatments in which birds fed 10% FCBS based diet recorded the highest values (8.33, 8.37, 8.43, 8.30, 8.37 and 8.00) respectively. Therefore, the meat sample on 10% FCBS based diet recorded highest level of preference across the dietary treatments investigated.*

**Key words:** Broiler chickens, Theobromine, Unconventional feed stuffs, Environmental pollution and Rumen filtrate

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### INTRODUCTION

Insufficient nutrition and human rivalry for feed ingredients among livestock provide challenges to poultry production in tropical climates (Babayemi *et al.*, 2004). In animal nutrition, however, the use of non-traditional feed materials is becoming increasingly acknowledged. This is mostly because conventional feeds are expensive, and this contributes to the high cost of producing poultry in Nigeria. One of these substitute feed alternatives with promising nutritional qualities is cocoa bean shell (CBS). When cocoa beans are broken and winnowed, a rich, unusual feed ingredient is created that can be utilised to make animal feed, (Fakhlaei *et al.*, 2020). Cocoa bean Shell are highly accessible, and farmers who grow them frequently pollute the environment by disposing of their wastes improperly. Its usage as an ingredient in animal feed especially poultry nutrition, is restricted by its 14.5% crude protein, 18.3% crude fibre, and 1.3–2.0% theobromine content (Abiola and Tewe, 1991). Olugosi *et al.* (2019) reported that solid state fermentation enhanced the nutritional value of CBS meal. Sensory evaluation is a key component in overall liking of animal products aside visual appearance. In this study, sensory assessment of broiler chickens fed diets supplemented with varying amounts of bovine rumen filtrate fermented cocoa bean shell.

### MATERIALS AND METHODS

**Experimental site:** This study was carried out at the Poultry Unit, Teaching and Research Farm of the Animal Science Department, Faculty of Agriculture, University of Abuja.

**Collection and Processing of test ingredients and Diets:** At Gwagwalada's abattoir in the Federal Capital Territory, Abuja, the bovine rumen content of four randomly selected slaughtered cattle was collected, while fresh cocoa bean shells (CBS) were obtained from cocoa bean processors in Ondo State. Rumen filtrate (RF) was created by mixing potable water at a 1:1 ratio with the CBS and rumen content, stirring, and sieving. After that, RF was combined with CBS in a 5:5 ratio. After the mixture was manually mixed, it was placed in polythene bags, tied off at the open end, and left to ferment for

twenty-four hours beneath a tree's shade, in accordance with the protocol described by Odunlade *et al.* (2020). Following the process described by earlier researchers, which was initially described for fermenting sweet orange (*Citrus sinensis*) peels with bovine rumen filtrate for use in broilers, pullets, and rabbits, the fermented mixture was then sun-dried within 48 hours to achieve a moisture content of less than 10%.

As shown in Table 1, the dried fermented cocoa bean shell (FCBS) was subsequently added to the experimental diets at different percentages: 0, 5, 10, 15, and 20%. Table 1 lists additional substances that are part of the diets.

**Table 1: Gross Composition of Experimental Diets at Starter and Finisher phase**

| Ingredients                | Starter                     |                     |                      |                      |                         | Finisher                    |                     |                         |                         |                         |
|----------------------------|-----------------------------|---------------------|----------------------|----------------------|-------------------------|-----------------------------|---------------------|-------------------------|-------------------------|-------------------------|
|                            | T <sub>1</sub><br>(Control) | T <sub>2</sub> (5%) | T <sub>3</sub> (10%) | T <sub>4</sub> (15%) | T <sub>5</sub><br>(20%) | T <sub>1</sub><br>(Control) | T <sub>2</sub> (5%) | T <sub>3</sub><br>(10%) | T <sub>4</sub><br>(15%) | T <sub>5</sub><br>(20%) |
| Maize                      | 54.40                       | 51.68               | 48.96                | 46.24                | 43.52                   | 57.00                       | 54.15               | 51.30                   | 48.45                   | 45.60                   |
| FCBS                       | 0                           | 2.72                | 5.54                 | 8.16                 | 10.88                   | 0                           | 2.85                | 5.70                    | 8.55                    | 11.40                   |
| SBM                        | 38.40                       | 38.40               | 38.40                | 38.40                | 38.40                   | 35.00                       | 35.00               | 35.00                   | 35.00                   | 35.00                   |
| Fish meal                  | 1.40                        | 1.40                | 1.40                 | 1.40                 | 1.40                    | 0.50                        | 0.50                | 0.50                    | 0.50                    | 0.50                    |
| BDG                        | 2.50                        | 2.50                | 2.50                 | 2.50                 | 2.50                    | 2.50                        | 2.50                | 2.50                    | 2.50                    | 2.50                    |
| Palm oil                   | 0                           |                     |                      |                      |                         |                             | 1.00                | 1.00                    | 1.00                    | 1.00                    |
| Limestone                  | 1.00                        | 1.00                | 1.00                 | 1.00                 | 1.00                    | 1.00                        | 1.20                | 1.20                    | 1.20                    | 1.20                    |
| Bone meal                  | 1.70                        | 1.70                | 1.70                 | 1.70                 | 1.70                    | 1.20                        | 1.80                | 1.80                    | 1.80                    | 1.80                    |
| Methionine                 | 0.30                        | 0.30                | 0.30                 | 0.30                 | 0.30                    | 1.80                        | 0.30                | 0.30                    | 0.30                    | 0.30                    |
| Lysine                     | 0.20                        | 0.20                | 0.20                 | 0.20                 | 0.20                    | 0.30                        | 0.20                | 0.20                    | 0.20                    | 0.20                    |
| Premix                     | 0.25                        | 0.25                | 0.25                 | 0.25                 | 0.25                    | 0.20                        | 0.25                | 0.25                    | 0.25                    | 0.25                    |
| Salt                       | 0.25                        | 0.25                | 0.25                 | 0.25                 | 0.25                    | 0.25                        | 0.25                | 0.25                    | 0.25                    | 0.25                    |
| Total                      | 100                         | 100                 | 100                  | 100                  | 100                     | 100                         | 100                 | 100                     | 100                     | 100                     |
| <b>Calculated Analysis</b> |                             |                     |                      |                      |                         |                             |                     |                         |                         |                         |
| CP (%)                     | 23.14                       | 23.11               | 23.07                | 23.03                | 23.00                   | 21.49                       | 21.45               | 21.41                   | 21.37                   | 21.34                   |
| CF (%)                     | 4.25                        | 4.48                | 4.71                 | 4.94                 | 5.16                    | 4.11                        | 4.35                | 4.59                    | 4.83                    | 5.07                    |
| ME (Kcal/kg)               | 2889.78                     | 2874.06             | 2858.34              | 2824.62              | 2826.89                 | 2962.32                     | 2945.84             | 2929.37                 | 2912.90                 | 2896.42                 |

<sup>abc</sup> Means along the same row with different superscripts are significantly ( $P < 0.05$ ) different. FCBS: Fermented Cocoa Bean Shele, BDG: Brewer dry grain, SBM: Soybean meal

**Experimental animals and management:** For this investigation, a total of 150 one-day old bird chicks were acquired from a reliable hatchery in Ibadan. The battery cages and other equipment were ready for the experimental birds two weeks prior to arrival. The birds were divided into five treatment groups, each consisting of thirty (30) birds, and three replicates, each with ten birds, in a completely randomized design. Each bird was weighed separately on a digital sensitive scale with a capacity of five kg. The chicks were raised in a battery cage for two weeks during which time they received all the routine vaccinations and treatments in accordance with the guidelines provided by the manufacturer. Other daily managerial operations were completed in accordance with Olumide and Hamzat's (2021) description. Water was given *ad libitum* and the weighed feed was served.

**Data Collection:** A total of 10 panelists were used. Each panelist was first briefed with the important sensory evaluation conceptual knowledge. Then, each panellist was presented with a score sheet which was specifically designed for this experiment, a pen, sachet water for mouth rinsing and chips samples. Twenty cuts of 200g breast meat of the slaughtered chickens were used for sensory evaluation. The cuts in each treatment were cooked without any spices or salt for approximately 30 mins and kept warm in a food flask before serving. Each panellist received and evaluated the same amount of duplicate coded sample chips in a controlled sensory evaluation laboratory with separate boxes for each panellist. The samples were evaluated on the basis of their tenderness, juiciness, flavor, colour, aroma and taste. Furthermore, all panellists scored the samples for each quality feature using a hedonic scoring scale of 1 to 9 on the provided evaluation sheet. with rating expressed as follows: 1- extremely dislike, 2 – dislike very much, 3 – moderately dislike, 4 – slightly dislike, 5 – neither like nor dislike, 6 – slightly like, 7 – moderately like, 8 – like very much and 9 – extremely like.

**Statistical Analysis:** Data obtained was subjected to analysis of variance (ANOVA) using statistical package of SAS (2005). The means among the variable were separated using Duncan multiple range test of the same statistical software.

## RESULTS AND DISCUSSION

Table 2 shows the sensory evaluation of broiler chickens fed diet containing graded levels of bovine rumen filtrate fermented cocoa bean shell. Dietary treatment had significant effect ( $P < 0.05$ ) on all the parameters investigated. The tenderness (7.60 – 8.33), juiciness (7.40 – 8.73), flavour (7.37 – 8.43), colour (7.53 – 8.30) and aroma (7.53 – 8.37) of meat from the broiler chicken used in this study varied significantly across the dietary treatments in which the highest values (8.33, 8.37, 8.43, 8.30 and 8.37) respectively were obtained in birds fed 10% fermented cocoa bean shell (FCBS). The taste (7.07 – 8.13) of the meat sample from the experimental broiler chicken were similar ( $P > 0.05$ ) in birds fed 5% (8.13), 10% (8.00) and 15% (7.90) FCBS but significantly ( $P < 0.05$ ) greater when compared with those on 0% (7.10) and 20% (7.07) FCBS having statistically similar ( $P > 0.05$ ) values.

**Table 2: Sensory Evaluation of Broiler Chickens fed diet containing graded levels of Bovine Rumen Filtrate Fermented Cocoa Bean Shell**

| Parameters | Inclusion levels of BRFFCBS |                     |                   |                    |                    | SEM  |
|------------|-----------------------------|---------------------|-------------------|--------------------|--------------------|------|
|            | 0                           | 5                   | 10                | 15                 | 20                 |      |
| Tenderness | 7.97 <sup>ab</sup>          | 8.03 <sup>ab</sup>  | 8.33 <sup>a</sup> | 8.07 <sup>ab</sup> | 7.60 <sup>b</sup>  | 0.08 |
| Juiciness  | 7.63 <sup>bc</sup>          | 7.93 <sup>abc</sup> | 8.37 <sup>a</sup> | 8.03 <sup>ab</sup> | 7.40 <sup>c</sup>  | 0.09 |
| Flavour    | 7.37 <sup>c</sup>           | 8.10 <sup>ab</sup>  | 8.43 <sup>a</sup> | 8.03 <sup>ab</sup> | 7.67 <sup>bc</sup> | 0.09 |
| Colour     | 7.53 <sup>b</sup>           | 8.00 <sup>ab</sup>  | 8.30 <sup>a</sup> | 7.80 <sup>ab</sup> | 7.80 <sup>ab</sup> | 0.09 |
| Aroma      | 7.57 <sup>b</sup>           | 8.03 <sup>ab</sup>  | 8.37 <sup>a</sup> | 7.90 <sup>ab</sup> | 7.53 <sup>b</sup>  | 0.09 |
| Taste      | 7.10 <sup>b</sup>           | 8.13 <sup>a</sup>   | 8.00 <sup>a</sup> | 7.90 <sup>a</sup>  | 7.07 <sup>b</sup>  | 0.11 |

<sup>abc</sup> Means along the same row with different superscripts are significantly ( $P < 0.05$ ) different.

Dietary FCBS had significant effect on the tenderness, juiciness, flavour, colour, and aroma of the breast sample among the treatment groups. The meat breast samples of the broiler chicken on 10% FCBS were ranked overall best. Highest aroma obtained in this study could be attributed to a high total cholesterol and increased high density lipoprotein content probably influenced aroma in the breast meat of the broilers (Ponte *et al.*, 2004; Haechang *et al.*, 2014; Uguru *et al.*, 2022). Increasing levels of fermented cocoa bean shell up to 10% appeared to influence positively the accretion of fatty tissue in the breast, mostly in the intramuscular fat depot (since there was little abdominal fat), thus the improvement in aroma and juiciness. Cholesterol is an important molecule that has roles in membrane structure in addition to being a precursor for the synthesis of molecules such as steroid hormones, vitamin D, and bile acids. It should be remarked that during the sensory evaluation, the panellists expressed strong preference for the meat sample from the birds fed 10% FCBS based diet.

**CONCLUSIONS:** It is therefore concluded that fermented cocoa bean shell can be supplemented up to 10% as it improved the meat quality of broiler chicken

## REFERENCES

- Abiola, S. S. and Tewe, O. O. (1991). Chemical evaluation of cocoa byproducts. *Tropical Agriculture* (Trinidad). Vol. 68:4-6
- Babayemi, O. J., Demeyer, D. and Fievez, V. (2004). Nutritive Value and Qualitative Assessment of Secondary Compound in Seeds of Eight Tropical Browse, Shrub and Pulse Legumes. *Comm. App. Biol. Scientist University*, 69(1): 103-110.
- Fakhlai, R., Rozzamri, A. and Hussain, N. (2020). Composition, color and antioxidant properties of cocoa shell at different roasting temperatures. *Food Research* 4 (3): 585 – 593
- Haechang, Y., Hwang, K. T., Regenstein, J. M. and Shin, S. W. (2014). Fatty acid composition and sensory characteristics of eggs obtained from hens fed flaxseed oil, dried white bait and/or fructo -oligosaccharide. *Asian Australian Journal of Animal Science*, 27:1026-1034.
- Olugosi, O. A., Agbede, J. O., Adebayo, I. A., Onibi, G. E. and Ayeni, O. A. (2019). Nutritional enhancement of cocoa pod husk meal through fermentation using *Rhizopus stolonifer*. *African Journal of Biotechnology*. 18(30): 901–908.

- Olumide, M. and Hamzat, R. (2021). Evaluation of performance, Carcass characteristics, serum biochemistry and haematological parameters of broilers fed graded level of raw cocoa beans shell based diet. *Nigerian Journal of Animal Production* (4): 730 - 743
- Odunlade, T. A., Oluremi, O. I. A. and Abang, F. B. A. (2020). Effect of the Nutrient Composition of Biodegraded Sweet Orange (*Citrus sinensis*) Fruit Peel on the Growth Performance of Starter Broiler Chicks. *Animal and Veterinary Sciences*. 8(5): 104-109
- Ponte, P.I.P., Mendes, I., Quaresma, M., Aguiar, M.N.M., Lemos, J.P.C., Ferreira, L.M.A., Soares, M.A.C., Alfaia, C.M., Prates, J.A.M. and Fontes, C.M.G.A. 2004. Cholesterol levels and sensory characteristics of meat from broilers consuming moderate to high levels of alfalfa. *Poultry Science*, 83: 810-814
- Uguru, J. O., Amah, U. J., Umoren, E. P., Unigwe, C. R., Obinna-Echem, P. C., Onainor, E. R., Torhemen, M. and Ucheji, C. C. (2022). Carcass traits, nutrient composition and sensory properties of broiler chickens fed diets containing graded levels of fermented cassava (*Manihot esculenta* Crantz) tuber meal as replacement for maize meal. *Nig. J. Anim. Prod.* 49(1):268-283
- SAS (2005). *SAS/STAT User's Guide*, version 8, Cary, NC: SAS Institute Inc.