Discovery

Author Affiliation:
¹Department of Animal Production and Health
Federal University, P. M. B. 373 Oye-Ekiti, Ekiti State, Nigeria

*Corresponding author:
Oluwatosin M. A. Jesuyon,
Department of Animal Production and Health, Federal University,
P. M. B. 373 Oye-Ekiti, Ekiti State, Nigeria,
Email: dr.oluwatosinjesuyon14@gmail.com;
Orchid id: orchid.org/0000-0003-0901-3556

Characterization of broiler hybrids on nutrient profile and organoleptic characteristics of the thigh meat

Oluwatosin MA Jesuyon[1]*, Blessing Ife Babalola[1], Nafisat A Molumo[1], Emmanuel Opeyemi Oyebanji[1], Idowu Blessing Oladeji[1]

ABSTRACT

In order to evaluate the effect of hybrid on nutrient composition and organoleptic characteristics of broiler thigh meat; broiler hybrids namely, Arbor acre, Cobb 500 and Ross 308 commercial broilers were assessed. These hybrids constituted the treatment. Each hybrid was replicated 3 times, while each replicate contained 51 birds, making a total of 459 birds. The Completely Randomized Design was adopted. GLM-ANOVA and Tukey's HSD (α =0.05) procedures were used for nutrient analysis. The Kruskal-Wallis H, followed by Dunn's mean separation, α=0.05, were used for analysis of sensory scores. The Principal Factor Analytical procedure (score-1) was used to expose the root contributions of hybrids to nutrient profile and sensory attributes. Cobb 500 thigh meat was higher in crude protein, fat, calories, sodium and potassium than Arbor acre and Ross 308 hybrids ($P < 0.05$); but hybrids showed similar average root contributions to nutrient content (PF-1 = -0.142 to 0.154) of the raw thigh. Cooked Ross 308 thigh meat revealed higher colour, aroma and average score (PFS-1 = 0.74-0.83) over Arbor acre and Cobb 500 hybrids; but hybrids were similar in all sensory characteristics except smoothness (K-W X^2 = 9.39; $P < 0.009$), where Arbor acre had lower mean rank of 130 against other two hybrids with minimum of 156. Cobb 500 was better in nutrient content, while Arbor acre hybrid was higher in thigh smoothness, and these could be selected explicitly for improvement.

Keywords: Poultry hybrids, nutrition; sensory attributes, factor scores, root contribution, broiler thigh meat.

1. INTRODUCTION

Broiler hybrids are specifically selected for many economic traits namely: growth rate, feed efficiency, disease resistance and meat yield (Olajide et al., 2020). Broilers bred for high thigh meat yield include Hubbard Flex, Cobb 500, FR strain etc (Hammemi et al., 2024). The above genetic changes also influence carcass yield, nutritional composition and organoleptic characteristics of broiler meat (Uguru, et al., 2022). The thigh meat quality is also influenced by pre-slaughter factors namely: genetics, diet, age, sex, environmental conditions, stress and handling, while post-

slaughter conditions include temperature, pH, chilling rate, aging and processing methods (Mir et al., 2017). Consumer acceptance and satisfaction after consumption of broiler thigh meat could be influenced by chemical composition and sensory quality (Garmyn, 2020). Meat nutrient profile (protein, fat and essential amino acids) is critical for evaluating broiler meat health benefits and market value (Gheorghe et al., 2021, Guinebretiere et al., 2024). Sensory characteristics like aroma, appearance, tenderness, juiciness and flavour are paramount in influencing consumer acceptance and satisfaction (Garmyn, 2020). Hybrid has been reported as having little or no effect on organoleptic attributes (Mueller et al., 2023, Ikusika, et al., 2020) of broiler meat.

The effect of hybrid on broiler thigh meat nutrient composition and sensory attributes was further exploited for greater benefit to the chicken breeder, producer and consumer. The objective of study was to evaluate the effect of hybrid on nutrient composition and organoleptic characteristics of broiler thigh meat. The research hypothesis was that hybrid shall affect differences in nutrient profile and sensory characteristics of the thigh meat.

2. MATERIALS AND METHODS

Ethical Approval for Study
The experimental procedure for this study was approved by the Ethics Committee, Directorate of Research, Innovation and Linkage Programmes, Federal University Oye- Ekiti, Nigeria, with approval number: IACUC/APH/SS1020/2025/08.

Experimental site
The study was carried out at the Poultry Unit, Teaching and Research Farm, Department of Animal Production and Health, Federal University, Oye-Ekiti, Ikole Campus, Ekiti State, Nigeria; on latitude 7.7979^0N and longitude 5.3286^0E. Average annual temperature of location was 24.60°C (22.40 - 26.80°C).

Source of experimental birds
Arbor Acre, Ross 308 broiler and Cobb 500 chicks were purchased from Repute Agro and Allied Matters located in Akuru, Oluyole, Ibadan, Oyo State, Nigeria.

House preparation
Before chicks's arrival, the house was partitioned with plywood into 12 small pens for treatment levels. The house, roof members, corners and crevices were thorough cleaned with hot water, soap and disinfected with Izal solution (ratio of izal to water = 1:10). Thereafter, the house was left to air-dry. Wood shavings was placed on the floor, up to a height of 10 cm as litter material. Nylon curtains were then installed round the house to fumigate the house, create a sealed environment and preserve extra heat supplied during brooding. The nylon curtains were installed to cover the outside walls during the first two weeks. Liquid fumigation (formalin in water at mixing ratio = 1:5) was carried out 10 days before the chicks' arrival. The house was allowed to rest for a week to eliminate pathogens and pests in the litter. One hour before arrival of chicks, the house was preheated to about 37°C with charcoal in coal-pots. The preheating process served to prevent cold shock in chicks at arrival and maintain a warm, dry and well-ventilated environment. The wood shavings was replaced at regular intervals to maintain dry conditions throughout the experiment. All brooding equipment, drinkers, feeders, keyes feed-trays and flat newspaper were installed and tested for functionality. Feeds were compounded two days before chicks' arrival.

Arrival and daily management
A total of 153 broiler birds of each hybrid (Arbor acres, Cobb 500 and Ross 308), making a total number of 459 birds, were received for the experiment. Upon arrival, the chicks were tested for vigor and overall health. Each hybrid received glucose water to aid in rapid energy recovery. Individual chicks were weighed and recorded (g) on arrival. Chicks were identified with wing tags, randomized to treatment groups, and pens within the house. Daily cleaning, sweeping, sanitation and hygienic conditions were maintained. To regulate room temperature, the nylon covering curtains were rolled up during hot afternoons. The rolling action was based on the reading of the wall thermometer and chick responses to heat source. Chicks were fed add-libitum in the first week, then at 10 % of previous week's body weight in the second week and at 9.0, 8.8,7.7 and 7.4% at 3rd, 4th, 5th and 6th week respectively (virbac.com, 2025).

Specific management

Brooding temperature was gradually reduced weekly by withdrawing charcoal pots, and ultimately achieving room temperature of 25°C by the end of the fourth week. Brooding on deep litter was conducted for four weeks (from day-old to 4 weeks) and rearing took place from 5th week to 6th week of age. The high-density starter and finisher diets were formulated based on the general commercial and nutritional requirements of broiler for each production phase in Tropical Nigeria (Inusa et al., 2024, Dennis-Eboh et al., 2020). The farm-compounded diets offered to the birds consisted of a broiler starter feed from 1-4 weeks of age, and broiler finisher feed from 5-6 weeks. The calculated nutrient composition of the diets is as presented in Table 1. Vaccination and routine medication is as presented in Table 2. Weighing of body weight and measurement of morphometric traits were done at day-old, 2, 4 and 6 weeks respectively.

Data collection

Slaughtering and thigh meat separation

On humane killing of birds, thigh meat (biceps femoris muscle) samples were carefully separated, distinguished by its characteristic darker colour, stronger flavour in appearance and higher water-holding capacity than the breast meat (Choe and Kim, 2019). The samples were coded, cut and labelled to avoid mix-up.

Determination of nutrient profile of raw thigh samples

5gm of each raw meat sample was collected and taken to the laboratory for nutrient analysis for moisture, crude protein, crude fat, ash, calorie, sodium and potassium content. The nutrient content was determined by the AOAC analytical methods (AOAC, 2000).

Cutting and storage method

At approximately 1-hour postmortem, 700g raw thigh samples were cut and weighed from the central portion of the thigh with a sharp knife, and placed in coded, sealed, airtight, transparent polyethylene bags and stored in the refrigerator at 4°C to age for 24 hours.

Preparation and cooking procedure

Immediately after slaughter, coded raw thigh meat (biceps femoris muscle) samples were inspected for quality. The preparation method followed the standardized approach described by Giri et al. (2016), which emphasizes the importance of uniform and defect-free samples in meat quality analysis. Sample selection was based on visual uniformity in size, color and texture. Samples with defects were excluded. Sanitized boning knife was used to remove visible fat, skin and connective tissues. This was to ensure consistency in appearance, texture across samples and minimize variability in sample physical appearance. Individual meat sample was placed in a vacuum-sealed polythene nylon to prevent nutrient loss into the cooking water and coded appropriately.

Cooking of coded samples was done with gas cooker and non-sticky pot. All samples were placed in the pre-heated water at 75-80^{0}C in the cooking pot. The samples were cooked at for about 30 minutes (Giri et al.,2016), till the internal core temperature of samples read 75^{0}C on the thermocouple. The internal meat temperature was monitored with a calibrated digital probe-thermometer (thermocouple) to ensure each sample reached the safe internal temperature (Schilling et al., 2015). Each sample was allowed to cool at room temperature for 10 minutes in the polythene bags before sensory evaluation.

Sensory evaluation procedure

Ethical approval for meat processing and sensory evaluation was obtained (January 2025): IACUC/APH/SS1020/2025/08. The sensory evaluation of the cooked thigh meat was conducted by a 20-man, sex-balanced, trained tasters (aged 25-40 years). The evaluation employed the 9-point hedonic scale (Peryam and Pilgrim, 1957, Meilgaard et al. 2016). This allowed judges to rate each sensory trait individually and provide an overall assessment of each meat sample's acceptability. Before evaluation, the panel of tasters were informed of the purpose of the exercise, given clear instructions on the procedure, confidentiality was to be maintained. A written consent was obtained from each taster prior to participation. They undertook two sessions of training, 30 minutes each, to familiarize themselves with the sensory attributes to be assessed. The training included explanation of attributes: appearance, aroma, flavour, juiciness, tenderness, texture, mouthfeel, smoothness and overall acceptability. Panelists were also trained on the 9-point hedonic scale, where '1' represented "dislike extremely" and '9' represented "like extremely," to ensure consistency and accuracy during the evaluation process (Combs, 2018).

Sensory evaluation was conducted between 14.00 and 16.00 hours. Individual stands were used to minimize distractions and eliminate external influences on panelists' judgment. Each stand was well-ventilated, equipped with neutral lighting and was at room temperature of 22 ± 1°C to ensure consistent sensory perception. About 20g of each coded sample was presented in a randomized order to prevent order bias, and 3 to 4 coded meat samples were given to each panelist per session. Water and unsalted cracker biscuits were offered between samples to cleanse the palate and prevent carryover flavour from affecting subsequent evaluation. Each attribute was scaled on the 9-point hedonic scale (Murata et. al., 2024).

Table 1: Proximate and calculated nutrient composition of experimental diets (g/100g)

Ingredients	Starter Diet	Finisher Diet
Ground Yellow Maize	54.00	50.00
Fishmeal (65%)	10.00	5.00
Groundnut cake	27.00	15.00
Soyabean meal	3.00	7.00
Beweries dry grain	4.75	18.75
Bone meal	0.25	0.25
Di-calcium phosphate	-	0.25
Limestone	0.25	0.25
Salt	0.25	0.25
Methionine	0.25	0.25
Vitamin-Mineral Premix	0.25	0.25
Slack	0.75	5.10
Total	100.00	100.00
Calculated Nutrient Composition		
Energy (Kcal/kg ME)	3003.88	3001.24
Crude Protein	22.05	17.99
Energy/Protein ratio	136.23	166.83
Ether Extract	5.64	4.57
Crude Fibre	3.48	4.28
Calcium	1.04	0.72
Phosphorus	0.88	0.58
Lysine	1.02	0.84
Methionine	0.64	0.63
Cystine	0.37	0.31
Price (₦/kg)	**503.48**	**361.30**

Experimental design

The experimental design adopted was a Completely Randomized Design (CRD). The treatment in the experiment was hybrid (with three levels: Arbo acre, Cobb 500 and Ross 308). Each level was replicated 3 times. Each replicate was composed of 51 birds. A total sample size of 459 broiler birds was used in the experiment.

Statistical model:

$$Y_{ij} = \mu + T_i + \varepsilon_{ij}$$

where,

.i = Levels of the Treatment = 3

.j = Treatment replicate = 1-3

Y_{ij} = Observation of a trait in replicate i of treatment j.

μ = Overall mean

T_i = Effect of treatment/hybrid i (i = Arbor acre, Cobb 500, Ross 308)

ε_{ij} = Random error component committed haphazardly NID (0, δ^2) in treatment
i, and replicate j.

Statistical analysis

All data collected on nutrient composition were analyzed by the one-way analysis of variance (ANOVA) and the multivariate method of the rotated Principal Factor Analysis (PFA). The PFA procedure used the Factor Score -1 as tool of comparison. Treatment means were separated with Tukey's HSD test procedure, $\alpha = 0.05$. The PFA procedure served to reduce meat quality attributes into a smaller number of underlying factors, for identifying the pattern within and between hybrids. It also allowed the rotation of the principal components matrix to facilitate straightforward interpretation of the underlying factors in data. Sensory data were tested by the Shapiro-Wilk Test for normality of residuals. Then data were transformed using the z-score method to satisfy the normality condition. Subsequently, data were analyzed by the non-parametric statistical procedure of Kruska-Wallis H (χ^2), followed by the Dunn's post-hoc pairwise comparison with bonferonni correction for test of multiple means. Data were analyzed with the SPSS v29 (2022) software. The statistical hypothesis was that the effect of the hybrid would not be important at 5% significant level.

3. RESULTS

Nutritional composition of thigh meat

In Table 2, the thigh meat samples reveal that ABA had superior values on crude protein and calorie (P <0.05), CBB reported higher crude protein, while RSS thigh meat was the least on crude fat (lean meat), calorie, sodium and potassium but reported higher ash (2.69%) content.

Table 3 reveals that factor scores were generally low (FS-1 = - 0.142 to 0.154). All hybrids were similar in root contribution to the nutrient content of the thigh meat. Moisture contribution of hybrids to the thigh meat was negative and very low (FS-1 = - 0.135 to - 0.142). Similarly, the CBB and RSS hybrids contributed low ash content (PFS-1 = - 0.136 to - 0.142), but ABA contributed positively to the ash content (PFS-1 = 0.146) of thigh meat.

Table 2: Effect of hybrid on nutrient content of 24-hour chilled uncooked broiler thigh meat

Component	Broiler hybrids			SEM	P>Tukey
	Arbo acre	Cobb 500	Ross 308		
Moisture (g/100g)	54.36	55.46	54.37	2.031	0.969
Crude Protein (g/100g)	27.2[a]	27.8[a]	23.6[b]	0.327	0.001
Crude Fat (g/100g)	5.20[b]	6.02[a]	4.55[c]	0.115	0.001
Ash (minerals, g/100g)	2.41	2.27	2.69	0.274	0.820
Calorie (Kcal/g)	1.72[a]	1.74[a]	1.61[b]	1.275	0.001
Na (mg/100g)	73.4[b]	85.6[a]	61.4[c]	1.716	0.001
K (mg/100g)	284.97[b]	310.58[a]	271.27[c]	3.650	0.001

[abc] Means with different superscripts on the same row differ significantly (p < 0.05), n = 12.

Table 3: Effect of hybrid on rotated Factor score-1 of nutrient content of 24-hour chilled uncooked broiler thigh meat

	Rotated Factor Scores-1 for Hybrid			
	Characteristic	Arbor acre	Cobb 500	Ross 308
1	Moisture	-0.140	-0.142	-0.135
2	Crude Protein	0.142	0.148	0.153
3	Crude Fat	0.147	0.146	0.152
4	Ash	0.146	-0.142	-0.136
5	Calorie	0.147	0.149	0.154
6	Sodium	0.147	0.146	0.153
7	Potassium	0.148	0.149	0.153
	Total Variance Extracted	6.772	6.702	6.487
	% Variance	96.746	95.746	92.677
	Major Loadings	-	-	-
	Common Loadings	1	1, 4	1, 4
	Differences in Loadings	4	4	4

Notes: PCA scores were used to derive the rotated Factor scores by the Varimax method with Keizer normalization. n = 12.

Organoleptic attributes of thigh meat

In Table 4, the Kruskal-Wallis test revealed that hybrid significantly (X^2 =9.39, N=3, P <0.009) influenced the mean rank of smoothness of thigh meat, but a marginal difference among hybrids (X^2 =5.85, N=3, P >0.10) was revealed on the mean rank of texture of the thigh meat.

Similarly, Table 5 reveals important underlying differences in root sensory characteristics among hybrids. Both ABA and CBB were similarly loaded on Taste, flavour and average score (RFS = 0.72-0.86). Furthermore, ABA differed from the other two hybrids with heavy loadings on appearance, colour and aroma (RFS=0.74-0.81). The RSS hybrid revealed very low loadings (PFS = 0.11-0.16) on all sensory characteristics.

Table 4: Effect of hybrids on the mean rank scores of organoleptic characteristics of cooked broiler thigh meat

| Characteristic | Mean ranks | | | | Assymptotic |
	Arbo acre	Cobb 500	Ross 308	K-W (X^2)	P
Appearance	139.17	162.13	150.21	3.682	0.159
Colour	143.03	155.99	152.49	1.264	0.532
Aroma	145.58	150.44	155.49	0.681	0.711
Taste	149.09	150.07	152.23	0.071	0.965
Flavour	144.15	151.07	154.83	0.820	0.664
Texture	133.82	159.55	158.14	5.854	0.054
Mouth-feel	144.19	160.17	147.15	2.036	0.361
Smoothness	130.15[a]	165.39[c]	155.97[b]	9.394	0.009
Average score	*139.64*	*159.75*	*152.12*	*2.742*	*0.254*
Overall acceptability	139.39	154.58	157.54	2.680	0.262

Notes: The lower the mean rank, the more important the attribute. Unit of measure of parameters was point score on a hedonic scale of 1-9. [abc] mean ranks with different superscripts on the same row differ significantly (p < 0.05). n =20.

Table 5: Effect of hybrid on rotated Factor score-1 of organoleptic characteristics of cooked broiler thigh meat

| | Characteristic | Rotated Factor Scores-1 for Hybrid | | |
		Arbor acre	Cobb 500	Ross 308
1	Appearance	0.738	0.622	0.135
2	Colour	0.800	0.672	0.133
3	Aroma	0.735	0.658	0.107
4	Taste	0.808	0.863	0.125
5	Flavour	0.718	0.769	0.115
6	Texture	0.223	0.336	0.114
7	Mouthfeel	0.627	0.616	0.124
8	Smoothness	0.265	0.054	0.124
9	*Average score*	*0.853*	*0.817*	*0.157*
10	Overall Acceptability	0.178	0.400	0.115
	Total Variance Extracted	4.166	3.928	6.328
	% Variance	41.659	39.279	63.280
	Major Loadings	1, 2, 3, 4, 5, 10	4, 5, 10	-
	Common Loadings	4, 5, 10	4, 5, 10	-
	Differences in Loadings	1, 2, 3	-	-

Notes: All characteristics were measured on a hedonic point scale of 1-9. PCA scores were used to derive the rotated Factor scores. n = 20.

4. DISCUSSION

Nutritional composition of raw thigh meat

The thigh meat of ABA with high crude protein and calorie (27.22%, 1.74 kcal/g), sodium and potassium could produce a balanced mix of flavour, texture and increased acceptability to consumers with higher sensory perception; however, these could interact to make the meat easily prone to drying-out and becoming tough during processing (Leeson, 2009). The CBB thigh with higher crude protein, fat,

calorie, sodium and potassium reveals a superior nutritional profile than ABA and RSS. The interaction of these nutrients could improve meat tenderness, water-holding capacity, texture, juiciness and flavour due to higher fat deposition (Saki and Famini, 2014; Pearce et al., 2011). This also impacts acceptability in health-conscious consumers (Pearce et al., 2011). Interactions of these nutrients could also lead to complex effects on meat quality and sensory attributes. The right balance of these nutrient components would produce high-quality and acceptable Cobb thigh meat. Also, the high crude protein, calorie, potassium and sodium could interact to make the thigh meat easily prone to drying-out and becoming tough during processing (Leeson, 2009). The meat could be tender, juicy and flavourful, due to high protein and fat content. It could retain more moisture due to its high fat content, while its naturally insignificant fibre content could render it softer, pliable, tender with increase in chewiness (Marczak and Mendes, 2024).

Ross 308 with lowest crude protein, fat, calorie, sodium and potassium contents reveals low implication for meat quality compared to ABA and CBB hybrids. These observed nutrient levels could make Ross thigh meat more acceptable to consumers who prefer lower calorie in meat. The moderate protein content in RSS thigh meat could make it suitable for grilling and roasting (Singh and Singh, 2017). The moisture content of 54 -55 % obtained in present study is lower than the optimum moisture content of 69 -73% in literature. The generally low moisture obtained in present study could contribute to improved shelf life and quality of thigh meat. High moisture content could lower water holding capacity, leading to higher risk of dripping or leakage during storage, cooking and higher microbial growth. These conditions affect food safety (Alexa et al., 2023). Also, the high moisture content could make thigh meat prone to sticking or clumping of meat particles together during processing (Pearce et al., 2011). Findings support Winiarska-mieczan et al. (2016) and Garmyn (2020) who reported the favourable influence of chemical composition on consumer acceptance and satisfaction on consumption of broiler meat, and the use of chemical composition for evaluating broiler meat health benefits and market value (Gheorghe et al., 2021; Guinebretiere et al., 2024).

The low rotated nutrient factor scores of the hybrids signify average and similar contributions to the nutrient profile of the thigh meat samples. Although, moisture contribution to the thigh meat by hybrids decreased similarly, their contributions to the ash content differ with higher positive contribution by Arbor acre, but reducing contribution by Cobb and Ross hybrids. Thus, Arbor acre hybrid thigh could possess better ash content which could make it darker in appearance and higher mineral content, which may affect meat texture by making it slightly tougher, salty or bitter. Smith et al. (2012) reported that variation in normal ash content - of 1% of total meat composition - due to strain of broiler, may not result in significant differences in flavour or after-taste during sensory analysis.

Organoleptic Attributes of cooked thigh meat

The cooked thigh meat samples of hybrids were differentiated on smoothness scale by the Kruskal-Wallis procedure and Dunn's mean separation method. The ABA thigh meat with the least mean rank was considered better than RSS and CBB in descending order. In the cooked thigh meat sample, ABA hybrid displayed strong loadings on appearance, colour and aroma (PFA=0.74 - 0.81); although in the raw meat the general appearance, colour and aroma were reported similar in commercial broiler breeds. The thigh meat has higher myoglobin than the breast meat, and thus darker red coloured than the pale breast meat (Panpipat et al., 2022). The higher scores translate to better appearance, colour and aroma. The interaction of these traits in Arbor acre thigh meat could contribute to higher acceptance by consumers. In contrast, ABA and CBB thigh meat samples were similarly high on taste, flavour and average score scales. The RSS thigh meat however displayed average sensory characteristics with correlation scores close to zero (PFS =0.11 - 0.16). The PFA technique also detected underlying organoleptic attributes distinguishing the breast and thigh meats among hybrids. This study therefore negated previous reports (Mueller et al., 2023, Ikusika et al., 2020) that hybrid had no or little effect on organoleptic attributes of broiler meat.

Future scope of study:

The exposed root components thus identified the key body components contributing to live body development and sensory attributes. These could be selected - as desirable traits - for body development and meat quality improvement in respective broiler hybrids.

Limitations of Study:

Important limitations of this study include low variability in sensory perception, individual stimuli, preferences and fatigue among panel of tasters.

5. CONCLUSION

The Cobb 500 thigh meat was denser in nutrients than Arbor acre and Ross 308 hybrids. The breast meat of Ross 308 was associated with better colour, aroma and average acceptability. The Arbor acre thigh meat showed better appearance, colour and aroma; while both Arbor acre and Cobb 500 revealed high and similar taste, flavour and average acceptability than Ross 308 hybrid.

Authors contribution

OMAJ conceived and designed the study. BIB, NAM, EOO & IBO gathered the data. GOG, GBD & DK assisted in Laboratory processes, OMAJ performed statistical analyses. OMAJ & GOG wrote the article.

Informed consent

Not applicable.

Conflicts of interests

The authors declare that they have no conflicts of interests, competing financial interests or personal relationships that could have influenced the work reported in this paper.

Ethical approval & declaration

The research proposal and its experimental procedures comply with the FUOYE ethical standards on the use and care of animals during experiments. It has been reviewed and approved by the FUOYE Institutional Animal Care and Use Committee (IACUC), with the approval number: IACUC/APH/SS1020/2025/08.

Data and materials availability

All data associated with this study are present in the paper.

REFERENCES

1. Alexa EA, Papadochristopoulos A, O'Brien T, Burgess CM. Microbial contamination of food. In: Food packaging and preservation. Antimicrobial materials and technologies by Jaiswal, A. K. and Shankar (Eds), 2023, Science Direct Book. doi: 10.1016/B978-0-323-90044-7.00001-X

2. AOAC. Official methods of Analysis. 17th Edition. 2000, The Association of Official Analytical Chemists, Gathersburg, MD, USA.

3. Choe J, Kim H. Physicochemical characteristics of breast and thigh meats from old broiler breeder hen and old laying hen and their effects on quality properties of pressed ham. Poultry Science 2019, 99, 4: 2230-2235. doi:10.1016/j.psj.2019.10.076.

4. Combs LD. Effect of cooking method on meat texture in normal and woody broiler breast fillets using instrumental analysis and descriptive sensory analysis. Graduate Thesis and Dissertations 2018. University of Arkansas, Fayetteville. Retrieved from https://scholarworks.uark.edu/etd /3048.

5. Dennis-Eboh U, Aganbi E, Avwioroko OJ, Tonukari NJ. Proximate analysis of commercial starter feeds and Effects of the consumption on some blood parameters in broiler chicks. Nigerian Journal of Science and Environment 2020;18(1):68-76.

6. Garmyn A. Consumer preferences and acceptance of meat products. Editorial. Foods 2020;9(6):708.

7. Gheorghe A, Hăbeanu M, Lefter N, Turcu R, Tudorache M, Custură I. Evaluation of muscle chemical and amino acids composition in broiler chicks fed sorghum or sorghum-pea diets. Brazilian Journal of Poultry Science 2021, 23(4): eRBCA-2021-1447. doi: 10.1590/1806-9061-2021-1447

8. Giri AK, Biswas AK, Shrman K, Kumar D. Quality and shelf-life of precooked spent broiler breast fillets during

Refrigeration storage under aerobic packaging conditions. Journal of Animal Research. 2019;9(2):281-290.

9. Guinebretiere M, Warin L, Moysan JP, Meda B, Mocz F, Le Bihan-Duval, Thomas R, Keita A, Mignan-Grasteau S. Effect of strain and stocking density on leg health, activity, and use of enrichments in conventional broiler chicken production. Poultry Science 2024, 103 (9): 103993

10. Hammemi C, Askri A, Letourneau-Montminy MP, Alnahhas N. Current state of breast meat quality in standard-yielding broiler strains. Journal of Applied Poultry Research 2024;33(1): 100383, doi: 10.1016/j.japr.2023.100383

11. Ikusika OO, Falowo AB, Mpendulo CT, Zindowe TJ, Okoh AI. Effect of strain, sex and slaughter weight on growth performance, carcass yield and quality of broiler meat. Open Agriculture 2020. doi: 10.1515/opag-2020-0056.

12. Inusa SK, Sulaimon AS, Abdulsalam A. Effects of Ginger powder on haematological indices of the broiler birds and proximate composition of the experimental diet. Nigerian Journal of Animal Production 2023. doi: 10.51791/njap.vi.6611

13. Leeson S. Vitamin and mineral nutrition of poultry. In: Summers, JD, Leeson S. (Eds), Poultry Nutrition 2009, pp211-234. University Books.

14. Malomo GA, Suleiman ZG, Bolu SA, Egberuare TA. Assessment of the nutritional contents of broiler starter and finisher diets in Nigeria. Journal of tropical Agriculture, Food, Environment and Extension 2014;13(1):18-25.

15. Marczak A, Mendes AC Dietary fibres: shaping textural and functional properties of processed meats and plants-based meat alternatives. Foods. 2024;13(12):1952. doi: 10.3390/foods13121952.

16. Meilgaard MC, Civille GV, Carr BT. Sensory evaluation techniques. CRC Press, 4th Edition, 2016, Taylor and Francis Group. London.

17. Mir NA, Rafig A, Kumar F, Sigh V, Shukla V. Determinants of broiler chicken meat quality and factors affecting them: a review. Journal of Food Science and Technology. 2017, 54 (10): 2997-3009. doi: 10.1007/s13197-017-2789-z

18. Mueller AJ, Maynard CJ, Jackson AR, Mauromouatakos A, Kidd MT, Rochell SJ, Caldas-Cueva JP, Sun X, Giampietro-Ganeco A, Owens CM. Assessment of meat quality attributes of commercial broiler strains processed at various market weights. Poultry Science 2023;102(5):102571

19. Murata S, Sasaki K. Sensory and physicochemical characteristics of Japanese jidori chicken (Choshu-Kurokashiwa) and broiler thigh meat: Effect of cooking procedure. Animal Science Journal 2024, 95 (1): e13932. doi: 10.1111/asj.13932.

20. Olajide R, Laoye OA, Banjoko OJ. Breed effects of three commercial broiler chickens reared in the tropics on performance, carcass, serum and haematological parameters. Nigerian Journal of Animal Production 2020;47(1):140–152. doi: 10.51791/njap.v47i1.198

21. Panpipat W, Chaijan M, Karnjanapratum S, Keawtong P, Tansakul P, Panya A, Phonsatta N, Aoumtes K, Quan TH, Petcharat T. Quality characterizaion of different parts of broiler and ligor hybrid chickens. Foods 2022, 11(13):1929. doi: 10.3390/foods11131929.

22. Pearce KL, Rosenvold K, Andersen HJ, Hopkins DL. Water distribution and mobility in meat during the conversion of muscle to meat and ageing and the impacts on fresh meat quality attributes - A review. Meat Science 2011;89(2):111-124. doi: 10.1016/j.meatsci.2011.04.007

23. Peryam DR, Pilgrim FJ. Hedonic scale method of measuring food preferences. Food Technology 1957, 11(9): 9-14.

24. Saki AA, Famini A. Effect of dietary protein and energy levels on performances, carcass characteristics and meat quality of broiler chickens. Journal of Animal Science and Technology, 2014, 56: 1-9.

25. Schilling M, Radhakrishnan V, Vizzier-Thaxton Y, Christensen K, Williams J, Joseph, P. Sensory quality of broiler breast meat influenced by low atmospheric pressure stunning, deboning time and cooking methods. Poultry science 2015;94(6):1379-88.

26. Singh G, Singh R. Effect of grilling on quality characteristics of chicken breast meat. Journal of Food Science and Technology 2017, 54 (4): 1010-1016.

27. Smith DP, Northcutt JK, Steinberg EL. Meat quality and sensory attributes of a conventional and a label Rouge-type broiler strain obtained at retail. Poultry Science 2012;91:1489-1495, doi: 10.3382/ps.2011-01891.

28. SPSS. IBM SPSS Statistics 20 Core System Users' Guide. 2022, IBM Incorporation. Stat.psu. Applied multivariate statistical analysis - interpretation of the principal components. 2022. https://online.stat.psu.edu/stat505/lesson/11/11.4#

29. Uguru JO, Amah UJ, Umoren EP, Unigwe CR, Obinna-Echem PC, Onainor ER, Torhemen M, Ucheji CC. 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. Nigerian Journal of Animal Production 2022, 49(1): 268–283.

30. Winiarska-Mieczan A, Kwiecien M, Grela ER, Tomaszewska E, Klebaniuk R. The chemical composition and sensory properties of raw, cooked and grilled thigh meat of broiler chickens fed with Fe-Gly chelate. Journal of Food Science and Technology. 2016;53(10):3825-3833.