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I Geethasuvani, RM Nikzaad, MM Musthafa

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Enhancing Poultry Meat Quality: A Comparative Study of Conventional Vs Organic Cobb 500 Broiler Production

I. Geethasuvani, R.M. Nikzaad and Muneeb M. Musthafa*

Department of Biosystems Technology, Faculty of Technology, South Eastern University of Sri Lanka, Oluvil, 32400, Sri Lanka

ABSTRACT: Driven by population growth, the demand for poultry meat is escalating. Customer perception of meat from free-range chickens is healthier and more flavourful than meat from poultry raised through intensive methods. This belief arises from insights into consumer awareness regarding chicken meat from free-range production. This study focuses on the quality of poultry meat of organic output using Cobb 500 broilers to assess carcass characteristics, nutritional quality, and sensory evaluation. 30 chickens from the organic production were slaughtered at ages between 42 to 45 days for conventional chickens and 65 days and older for organic chickens. The organic chicken had a protein content of 22.8% and a fat content of 1.6%, while they contained 72.7% moisture and 1.6% ash. The organic meat achieved a mean rank of 6.50 ± 0.51 for overall acceptability in sensory quality. Based on the measured nutritional composition and sensory attributes, organically reared Cobb 500 broiler meat exhibited higher protein content, lower fat content, and greater sensory acceptability compared to conventionally reared meat. These findings indicate differences in meat quality attributes between production systems under the conditions of this study.

Keyword: Carcass Quality; Conventional; Feed; Nutrients; Protein

Correspondence author:
Muneeb M. Musthafa
Department of Biosystems Technology, Faculty of Technology,
South Eastern University of Sri Lanka, Oluvil, 32400, Sri Lanka
E-mail address: muneeb@seu.ac.lk

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INTRODUCTION

The production of poultry worldwide has been expanding rapidly (Mottet & Tempio, 2017; Obakanurhe et al., 2025). By 2050, the world's population is expected to continue to grow, reaching nine billion people (Maharjan *et al.* 2021). Historically, domesticated birds have been used for the production of meat and eggs for human consumption, as well as for commercial goods, restocking, game supply and breeding (Islam & Mustari, 2017). Poultry meat is expected to account for 41% of all protein obtained from meat sources worldwide in 2030, representing a 2% increase over the baseline period (Uzundumlu and Dilli, 2022; Okpara et al., 2022).

Compared with intensive rearing, free-range systems result in lower body weight and feed conversion efficiency in broilers (Bošković *et al*. 2012). Semi-intensive systems with the Cobb 500 strain had a higher intake of feed (Ebsa, 2019). Broilers fed complete diets and raised in an intensive environment had a larger percentage of fat when compared to the free-range system (Kuźniacka *et al*. 2014).

Poultry accounts for roughly two-thirds of the organic meat industry, which is one of the emerging industries in organic food production in European countries (Upto, 2007). Organic poultry production offers several distinct advantages, primarily centered on enhanced public health, superior nutritional quality, and environmental sustainability (Diaz-Sanchez et al., 2015). Health benefits stem from the exclusion of synthetic antibiotics, exogenous hormones, and chemical additives, thereby mitigating consumer exposure to chemical residues and reducing the risk of antibiotic resistance (Alagawany et al., 2018). Nutritionally, organic meat often provides higher quality, potentially exhibiting elevated levels of beneficial compounds, such as omega-3 fatty acids (Du et al., 2024). From an environmental perspective, organic systems champion eco-friendly practices by necessitating the use of sustainable feed sources and minimizing chemical inputs. Crucially, the elimination of synthetic pesticides and fertilizers in these operations contributes significantly to reducing soil and water contamination. This practice provides several advantages, primarily centered on improved public health, enhanced nutritional quality, and environmental sustainability (Boggia et al., 2010). The global demand for organic meat and eggs is increasing due to growing consumer awareness of health and sustainability, and organic poultry products often command a premium price, providing better economic returns for farmers (Bist et al. 2024). Organic poultry farming is said to be more animal welfare friendly than intensive methods, as its standards specifically cover areas like living conditions, nutrition, animal care, breeding, illness control, and veterinary care (Pandurevic et al., 2014). Customers expect that organically produced goods are of higher quality than conventionally produced food (Gomiero, 2018). Even though there are several benefits of organic poultry, there are very scarce scientific studies conducted in the developing world. However, there are several factors, such as climate, local feed sources, disease prevalence, and economic conditions require region-specific studies to determine the feasibility and impact of organic poultry production. Developing countries have unique challenges such as resource constraints, high disease burdens, and limited market access. Studying organic poultry in the developing regions of the world, such as in Sri Lanka, can help identify locally adaptable solutions to improve poultry productivity without relying on synthetic inputs. Therefore, this study aimed to evaluate the broiler meat quality from organic production based on the nutritional analysis, carcass characteristics and sensory attributes in Sri Lanka.

MATERIALS AND METHODS

Location of the Study

This research was conducted in Ovisha Organic Farm (Pvt) Ltd – Batticaloa, Sri Lanka, for the field trial and laboratory analysis was accomplished in the Department of Biosystems Technology, Faculty of Technology, South Eastern University of Sri Lanka.

Experimental Design

A completely randomized design (CRD) was used to design the experiment for organic broiler production. One hundred-day-old Cobb-500 broiler chicks were bought from Bairaha Farm PLC, Sri Lanka. Organic birds were housed in an indoor pen (1650 cm^2/bird) and with grass paddock access, with a size of 3.0 m^2 per bird. Conventional birds were housed in a similar indoor pen (500 cm^2/bird) without an outside area. Both groups had the same environmental conditions with a light programme of **16 hours of light and 8 hours of darkness**. Light intensity was 35-40 lux in the chick stage and reduced to **5-10 lux** in the final growing stage. Temperatures (starting at 32-34 °C for chicks and gradually reduced to 23 °C) and humidity (50-70 % to ensure comfort and dry litter) were maintained equally. Both housing systems were equipped with two circular hanging feeders and

an automatic nipple water drinker system. Organic and conventional broilers were fed organic feeds (Table 1: Ovisha's Feed Formula) and commercial feeds, respectively. Organic feed was produced in Ovisha's feed mill, and feed samples were analysed for proximate composition by the Veterinary Research Institute, Sri Lanka (Table 2). Commercial feed was bought in a commercial feed shop. From the 1st to the 21st day of the organic method, starter feed was practiced, then from the 22nd to the 65th day, finisher feed was provided. From the 1st to the 21st day of the conventional method, starter feeds were practiced, then from the 22nd to the 45th day, finisher feed was provided. Approximately equal weights (± 5 % of live weight) of 30 birds were randomly selected in each method for slaughtering and laboratory analysis. Składanowska-Baryza et al. (2025) evaluated meat quality traits in Hubbard broilers using 30 birds per treatment group in a controlled experimental design, demonstrating that this group size is commonly applied in poultry meat quality research. Organically reared birds were slaughtered at 65 days of age, while conventional broilers were slaughtered at 42-45 days of age and mortalities were observed in both production systems was 5 %. It is acknowledged that organic and conventional broilers were slaughtered at different ages in accordance with prevailing production practices. Slaughter age is a known determinant of carcass and meat quality traits; therefore, observed differences reflect the combined effects of production system and slaughter age. The birds were fasted overnight (12 hours) before slaughter, their live weights were then measured, and each was manually eviscerated.

Table 1. Composition of Ovisha's Organic Feed

Ingredient	Percentage (%) of 1kg of Feed
Cassava powder	30 %
Gliricidia dried leaves	15 %
Organically derived maize	25 %
Organically derived coconut	10 %
Dried Aloe vera	5 %
Black seeds (*Nigella sativa*)	5 %
Locally dried fish	10 %

Table 2. Feed analysis of Ovisha's Organic Feed and Commercial Feed

Nutrient	Value per 100g of Feed	
	Organic Feed	Commercial Feed
Crude Protein (%)	20±2 %	22±2 %
Crude Fat (%)	7±1 %	8.5±1 %
Crude Fiber (%)	11±1 %	11±0.5 %
Carbohydrates (%)	47.5±2.5 %	55.6±1 %
Ash (Minerals) (%)	6±1 %	4±0.5 %
Calcium (%)	1.0±0.2 %	1.8±0.1 %
Phosphorus (%)	0.75±0.15 %	1±0.15 %
Energy (kcal/kg)	3200±100	3400±100

Data collection

Treatment effects

To evaluate the treatment effect, following the slaughtering process, carcass weight, and weights of the internal organs (heart, liver, gizzard, pancreas, and Full small intestine) were recorded, dressed cut-out out percentage, breast percentage, drumstick percentages were calculated.

$$\textit{Dressing out weight}\ \% = \left(\frac{CW}{LW}\right) 100$$

CW = Carcass Weight
LW = Live Weight

Carcass Weight: This refers to the weight of an animal's body after it has been slaughtered, bled, and skinned, but before it has been further processed or divided into cuts. It typically includes the bones, fat, and some internal organs, but excludes the head, feet, and inedible parts.

Eviscerated Weight: This is the weight of an animal after it has been slaughtered, and the internal organs (viscera) have been removed. This term is often used in the poultry industry, where it refers to the weight of the bird after it has been plucked and gutted but before additional processing like removing the head or feet. Eviscerated weight is typically less than carcass weight because the internal organs are excluded.

Analytical determination

Moisture (MC %), crude protein (CP %), ether extract (fat) (EE %), and crude ash (CA %) were determined according to standard AOAC procedures (AOAC, 2005; Thiex, 2009) (da Silva et al., 2017). Meat pH was measured using a calibrated digital pH meter following homogenization of the sample. Two grams of a homogenized breast chicken meat sample were taken for pH determination.

Sensory evaluation

A sensory evaluation was conducted with 30 panellists using a 9-point hedonic scale to assess colour, taste, flavour, texture, and overall acceptability of organic and conventional broiler cooked meat. The preparation procedures ought to be articulated, such as cuts, tagging, cooking temperature or mins, addition of brine, and jute bags.

Statistical analyses

Treatment effects and analytical data were analysed by Student's T-test and sensory analysis was done by the Friedman test. All the analysis was done through SPSS version 25.0.

Ethical clearance

All research animal activity, handling and euthanasia (Halal method) were performed under the approval of the ethics review committee of South Eastern University of Sri Lanka, Sri Lanka (Ref. No. ERC/FT/2023/03).

Table 4. Effects of conventional and organic broiler chicken on carcass characteristics traits

Treatments	Mean ± SD
Live weight (g)	
Organic	2391 ± 186[a]
Conventional	2942 ± 175[b]
Carcass weight (g)	
Organic	1687 ± 116[a]
Conventional	2076 ± 130[b]
Dressing out (CW/LW) (%)	
Organic	70.64 ± 1.33[a]
Conventional	70.58 ± 1.06[a]
Eviscerated weight (g)	
Organic	1908 ± 193[a]
Conventional	2356 ± 99[b]

For each group n=30, [a, b] are superscript, similar superscript significantly no difference in column-wise ($P < 0.05$)

RESULTS

Effects of conventional and organic husbandry on nutritional content

The results of the nutritional content of the organic chicken and conventional poultry are shown in Table 3. The moisture, ash, protein, fat, pH, and energy contents exhibited statistically significant differences between the two treatments evaluated in this study.

Effects of conventional and organic husbandry on carcass characteristics traits

Table 4 presents the carcass characteristics of conventional and organic broiler chickens, indicating that live weight, carcass weight, and eviscerated weight differed significantly.

Effects of conventional and organic husbandry in sensory evaluation

The sensory evaluation of colour, taste, flavour, texture, and overall acceptability revealed statistically significant differences between the two treatments, as shown in Table 5.

DISCUSSION

The chemical composition of broiler meat was influenced by the rearing strategy. The organic chickens exhibited higher moisture and protein levels, and lower fat and energy content, suggesting that differences may be associated with increased physical activity in organic systems; however, this was not directly measured in the present study. Graat et al. (2022) found minimal differences in protein but significant differences in fat content (P = 0.022) across muscle groups when comparing conventional and organic rearing systems. Differences in carcass composition and the chemical profile of breast and thigh meat further support the impact of organic systems, particularly the provision of free-range space, on meat quality (Castellini et al., 2002; Dal Bosco et al., 2021).

Table 3. Effects of conventional and organic broiler production on meat nutrient content

Treatments	Moisture	Ash	Protein	Fat	pH	Energy
Organic (%)	72.7±0.1	1.6±0.0	22.8±0.1	1.6±0.1	5.5±0.1	5797±19.4
Conventional (%)	71.7±0.2	0.9±0.0	21.6±0.1	4.8±0.1	5.7±0.1	5868±88.9
P-value	0.003	0.032	0.028	0.025	0.001	0.045

For each group n=30,

Table 5. Effects of conventional and organic broiler chicken in sensory evaluation

Treatments	Mean ± SD				
	Properties				
	Colour	Taste	Flavour	Texture	Overall acceptability
Organic	5.97±0.49[a]	6.40±0.56[a]	6.30±0.65[a]	5.57±0.50[a]	6.50±0.51[a]
Conventional	5.47±0.51[b]	5.67±0.48[b]	5.60±0.67[b]	6.47±0.51[b]	5.63±0.49[b]

For each group n=30, [a, b] is superscript, similar superscript significantly no difference in column-wise ($P < 0.05$)

In this study, organic broiler meat showed significantly higher moisture content than moisture in organic and 74.85% in conventional Cobb 500 meat. Similarly, Küçükyilmaz et al. (2012) observed higher moisture in organically reared thigh meat. Çapan and Bağdatli (2021) reported a moisture range of 72.62–76.42 % in Cobb 500 broilers across systems. While Lakshani et al. (2016) and Islam & Mustari (2017) confirmed significant differences in tropical climates, some studies noted higher moisture in conventional meat under such conditions. In this study, the higher moisture in organic meat may be attributed to the earlier slaughter age (65+ days), compared to the standard 81 days for organic broilers (Poltowicz, 2012).

Protein content was significantly higher in organic broiler meat, which is consistent with earlier studies by Zerehdaran et al. (2004) and Küçükyilmaz et al. (2012), who reported greater protein levels in organic and free-range broilers. Similar observations were made by Castellini et al. (2002) and Lakshani et al. (2016). The variations in protein, fat, and moisture content are influenced by factors such as diet and physical activity (Rizzi et al., 2007; Abdullah & Buchtova, 2016; Çapan & Bağdatli, 2021). The increased physical activity in organically reared chickens may contribute to the elevated protein concentrations, particularly in muscle tissues (Graat et al., 2022).

Abdullah and Buchtova (2016) found that increased physical activity in organically reared Cobb 500 broilers under tropical conditions may lead to higher total and net protein levels in wing meat. Our findings similarly revealed that organic chickens (OC) had higher carcass weights and protein-rich giblets (heart, liver, gizzard) and necks, enhancing the value of these by-products. According to Küçükyilmaz et al. (2012), differences in slaughter age, nutrient intake, and bird genotype may explain the inconsistencies across studies on meat composition. The Conventional broiler meat exhibited higher fat content than organic meat. Zerehdaran et al. (2004) reported significantly lower fat in the thigh muscles of free-range birds compared to conventional ones ($P < 0.05$). Similarly, Castellini et al. (2002) found higher fat levels in conventional thigh and breast meat (4.46%) than in organic meat (2.47 %, $P < 0.01$). However, Çapan and Bağdatli (2021) observed instances where organic meat was fattier than conventional, highlighting variability across studies. Variations in fat content are likely due to differences in dietary fatty acid intake, as the type of fat consumed influences carcass fat composition. Ahmad et al. (2018) noted that the high fat and fatty acid content in commercial chicken meat may contribute to obesity. Castellini et al. (2002) reported lower pH levels in organic chicken meat due to diet differences, with higher pH observed in conventional meat. pH influences myofibril structure, affecting meat color and water-holding capacity (WHC). Wang et al. (2009) found that conventional diets with synthetic additives promote faster growth and higher muscle glycogen at slaughter, causing rapid postmortem pH decline and resulting in pale, soft, exudative (PSE) meat with reduced WHC and tenderness compared to organic meat. In this study, organic chicken meat had a lower pH, consistent with Castellini et al. (2002), who reported significantly lower pH in organic broilers. However, Çapan and Bağdatli (2021) found higher pH in organic meat, attributing differences to growth promoters in commercial feed affecting muscle pH. Higher pH correlates with darker meat color, while lower pH results in lighter color (Zerehdaran et al., 2004). Castellini et al. (2002) also linked organic rearing to lower fat and energy content due to increased bird activity, leading to healthier meat without antibiotics or hormones. Commercial chickens' high fat and fatty acid content may contribute to obesity (Ahmad et al., 2018). Küçükyilmaz et al. (2012) reported higher ash content in organic breast meat (1.20%) than

conventional thigh meat (0.94%), consistent with our findings. Fanatico et al. (2005) attributed elevated ash in organic chickens to ingestion of organic and inorganic materials while foraging outdoors. Lakshani et al. (2016) found similar ash levels in conventional meat (0.83%). Increased ash may also result from mineral-rich soil ingestion. While some studies (Castellini et al., 2006; Fanatico et al., 2007) found genotype and outdoor access did not affect ash content, Castellini et al. (2002) supported the present results, noting higher ash in organically raised birds. The live weight and carcass weight of broiler chickens mostly depend on the age and production. Organic broiler birds at 65^{+} days and conventional birds at 42-45 days reached the commercial weight with acceptable carcass traits and also organic broilers are expected to show lower growth performance (Graat et al., 2022). In the carcass characteristics assessment, conventional broiler chickens showed significantly higher live weight and carcass weight compared to the organic broiler chickens. The findings correlated with Sirri et al. (2010), that conventional birds' average live weight was higher than organically reared chicken meat. Similarly, Castellini et al. (2002) also found that, live and carcass weight of conventionally reared chicken meat was higher than organically reared chicken meat.

Sirri et al. (2010) reported slaughter weights of 2,381 g (organic) and 2,588 g (conventional), with organic pasture groups showing higher carcass weights. Gunasena et al. (2015) recorded average body weights of 1,085 g, 1,576 g, and 2,088 g at weeks 4, 5, and 6, respectively. Fanatico et al (2005) found organic indoor-reared birds had carcasses weighing 2,630 g with a 76.3% dressing percentage, while the dress carcass percentage has always been established to range from 75-76% and above. Cömert et al. (2016) noted that genotype and feed system significantly influenced breast and thigh yields ($P < 0.05$). Cobanoglu et al. (2014) found that organic groups had greater carcass and slaughter weights than conventional. Cobanoglu et al. (2014) reported higher carcass (2,045 g and 1,735 g) and slaughter weights (2,778 g vs. 2,250 g) in organic compared to conventional groups. However, Gunasena et al. (2015) found conventional broilers had greater live and carcass weights, likely due to higher physical activity and energy utilization (Rembiałkowska & Badowski, 2012). Consistently, the eviscerated weight of conventional broiler chickens was significantly higher ($t = -11.29$, $df = 58$, $P < 0.05$) in comparison to the other group.

This study found organically raised chicken meat to be more flavoured than conventionally raised meat, aligning with Gornowicz et al (2017), who reported higher acceptance and better taste for organic chicken. Meat tenderness is influenced by several factors, such as diet, age, and handling (Zerehdaran et al., 2004; Fletcher, 2002; Baracho et al., 2006; Owens and Meullenet, 2010), and varies across production systems, making definitive conclusions difficult. Jahan et al. (2005) noted higher texture quality in organic chicken. Overall, this study suggests organic systems enhance flavor and quality due to natural rearing conditions, increased physical activity promotes, and reduced stress, leading to higher protein and lower fat content. It is hypothesized that differences in physical activity associated with outdoor access may contribute to variations in meat composition; however, direct measurements of activity were not undertaken in this study. According to these results, the nutritional content of moisture ($p = 0.003$), protein ($p = 0.028$), and ash ($p = 0.032$) of organic broiler meat had higher values, and it had a significant difference. The carcass characteristics of conventional broiler meat had higher values with significant differences. Sensory characteristics of taste and overall acceptability of organic broiler meat had higher evaluated values. While several studies report favorable nutritional or sensory attributes in organic poultry meat, other investigations have found minimal or inconsistent differences between organic and conventional systems (Çapan & Bağdatli, 2021; Fanatico et al., 2007). Such variability may be attributed to differences in genotype, feed composition, climate, and slaughter age, underscoring the need for cautious interpretation. Under the conditions of this study, organic production systems were associated with differences in selected meat quality attributes; however, broader recommendations regarding production system transitions require comprehensive evaluations including economic, productivity, and sustainability analyses. Future studies can consider other breeds, and their performances would help to get better sustainable approaches.

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CONFLICT OF INTEREST

The authors declare that they have no competing interests.

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