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Meat chemical and phytochemical quality of broiler chickens fed butterfly pea (*Clitoria ternatea*) flour

Iis Yuanita[1*], Lisnawaty Silitonga[1], Hastin E.N.C. Chotimah[2], Ellen C. Tambunan[3], Siti Ma'rifah[1], Asri Pudjirahaju[1], Heri Sujoko[1], Satrio Wibowo[1]

[1]*Animal Science Study Program, Faculty of Agriculture University of Palangka Raya, Palangka Raya 73111, Central Kalimantan, Indonesia.*
[2]*Agrotechnology Study Program, Faculty of Agriculture University of Palangka Raya, Palangka Raya 73111, Central Kalimantan, Indonesia.*
[3]*Agricultural Industrial Technology Study Program, Faculty of Agriculture University of Palangka Raya, Palangka Raya 73111, Central Kalimantan, Indonesia.*

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*Correspondence:

Corresponding author: Iis Yuanita
E-mail address: iis.yuanita@pet.upr.ac.id

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ABSTRACT

Butterfly pea (*Clitoria ternatea*) flour contains antioxidant compounds, particularly phenolic anthocyanins and triterpenoids, which are expected to enhance both the chemical and phytochemical quality of broiler chicken meat. The study aimed to evaluate the effect of butterfly pea flour on the chemical and phytochemical quality of broiler chicken meat. The experiment was assigned in a completely randomized with five treatments and five replications. The treatments included BPF0 = basal ration (BR), BPF1 = BR + 1% butterfly pea flour (BPF), BPF2 = BR + 2% BPF, BPF3 = BR + 3% BPF, and BPF4 = BR + 4% BPF. ANOVA was applied to the chemical data, and subsequently, Duncan's multiple range test (DMRT) for significant effect. Descriptive analysis was done for the phytochemical content data. Observed variables were nutrient quality, and phytochemical quality of broiler chicken meat. The findings were that addition of butterfly pea flour resulted in tremendous improvement in chemical quality of broiler chicken meat by raising protein level ($P<0.05$), and reducing fat, moisture and carbohydrate level ($P<0.01$). But no effect on the ash content of broiler meat ($P>0.05$). Furthermore, the addition of butterfly pea flour to the broiler feed enhances the phytochemical content in the broiler chicken meat, including triterpenoids, phenolics, anthocyanins, and DPPH antioxidant activity.

Introduction

Poultry farming, particularly the production of broiler chickens, has significant advancements. The demand for broiler chicken meat has increased every year. The US Department of Agriculture (USDA) in its Livestock and Poultry report estimates that global chicken meat production in 2024 could reach 102.3 million tons, representing an approximate increase of 1% compared to 2023. In Indonesia, the production of broiler chicken meat from 2020 to 2024 is projected to grow at an average rate of 4.51% annually. The Agriculture Ministry in 2024 recorded that national production of broiler chicken meat was 3.84 million tons, with demand at 3.72 million tons, representing a monthly surplus of 116.19 thousand tons (https://ditjenpkh.pertanian.go.id/). To fulfil the need of the growing population, the quantity and quality of broiler chicken carcass production must be enhanced.

The increase in broiler chicken carcass productivity is closely related to the quality of feed provided. One approach is the use of additive feed derived from plants that contain phytobiotic compounds beneficial for quantity and quality of chickens' carcass. This agrees with the statement of Liu *et al.* (2015), that negative effects of oxidative stress can be reduced by providing chickens with adequate antioxidant supplementation. Several synthetic antioxidants, including ethoxyquin, BHA (butylated hydroxyanisole), and BHT (butylated hydroxytoluene), are frequently applied as effective feed additives to preserve poultry feed stability (Farahat *et al.*, 2017).

The presence of flavonoids, anthocyanins, and polyphenols in butterfly pea (*Clitoria ternatea*) can enhance broiler performance, promote the immune system, or prevent free radical damage to body cells (Prado *et al.*, 2019). Anthocyanin compounds are present in butterfly pea, with concentrations ranging from 0.31 to 1.81 mg/g (Shen *et al.*, 2016). Neda *et al.* (2013) identified that the nutrient composition of butterfly pea includes fat (2.5%), carbohydrates (2.2%), fiber (2.1%) and protein (0.32%), as well as calcium (3.09 mg/g), magnesium (2.00 M) in each serving (580 milligrams), potassium (1.05.25 min/kg), zinc (0.59 mg/1.14 mg/21). Iron is 0.14mmol/3.8%). Butterfly pea's ethanol extract contains 63.09 mgEQ/g and an antioxidant activity of 3.08 ppm, which is higher than the recommended amount per unit volume. (Rahayu *et al.*, 2021). Antioxidants may also 52 play a role in improving the quality of meat by inhibiting the peroxidation of lipids, which can affect 53 flavor and freshness. Natural sources of antioxidants, such as butterfly pea, can therefore be utilized as a 54 safe and effective way of enhancing the quality of broiler chicken meat.

Recent studies have utilized additive materials such as dayak onion (*Eleutherine palmifolia*) and dragon fruit peel flour (*Hylocereus polyrhizus*), which contain flavonoid antioxidants, to enhance meat carcass size and protein content, while reducing fat content (Yuanita *et al.*, 2019; 2023). The quality of the carcass was improved by a new herbal plant extract with phenolic and flavonoid components (Park *et al.*, 2014). Butterfly pea flour (*Clitoria ternatea*) is a promising additive feed for broilers. Utilization of butterfly pea flour will be capable of boosting the productivity and overall health of broilers, as well as the quality of broiler chicken carcasses, thereby producing safe and high-quality animal protein sources. Therefore, this study aimed to asses the effect of butterfly pea flour enhances the quality of broilers' meat.

Materials and methods

The Ethics Committee of the Faculty of Medicine, University of Palangka Raya, approved this study with protocol number 108/UN24.9/LL/2024.

Preparation of butterfly pea flour (Clitoria ternatea)

In accordance to the observations made by Yuanita *et al.* (2023), the procedure to produce butterfly pea flour (*Clitoria ternatea*) started with the dehydration of blooming flowers using the insolation method, stopping the process, with the flowers having a moisture content of around 5%. After that, the withered flowers were dried and blended to micron size. The butterfly pea flour was then classified to remove larger unground particles to produce a higher quality and technologically acceptable butterfly pea flour. Yield analysis has estimated the flour yield to roughly be 6 to 7 percent, based on the weight of fresh dried flower's yield.

Experimental feed administration

Butterfly pea flour was incorporated into the basal ration at various levels. The ration was administered to broiler chickens aged 35 days. The assignment was randomized. The cohort, consisting of 100, day-old broiler chickens, was split into 5 distinct treatment groups. Thereafter, each treatment was replicated 5 times, each replicate consisting of 4 chickens. The initial body weight was 42.78±3.50 grams. Feed was provided *ad libitum* as well as drinking water. The treatments with butterfly pea flour (BPF) in the basal ration included BPF0 (without BPF), BPF1 (1% BPF), BPF2 (2% BPF), BPF3 (3% BPF), and BPF4 (4% BPF). The basal ration nutrient contents were designed in accordance with PT. Wonokoyo Jaya Corp. and the Indonesian National Standard 8173:2015. The compositions and nutrient content for the starter and finisher rations used for the research are included in Table 1 and Table 2 respectively.

Sample collection and parameter measurement

At the conclusion of the experiment, one chicken from each replication was slaughtered to collect breast meat samples. Proximate chemical composition analysis of chicken meat was done at the Laboratory of Animal Nutrition and Feed Science, Lambung Mangkurat University, by the method of AOAC (2012). Analysis of other phytochemicals as well as antioxidant activity of broiler chicken meat was conducted at the Biochemistry and Biomolecular Laboratory, Faculty of Medicine, Lambung Mangkurat University.

Analysis of moisture content in meat

The analysis of moisture content was conducted to determine the water content or the amount of water present in a given material. The initial step in moisture content determination involved placing a porcelain dish in an oven and heating it to a temperature of 105c for one hour. The porcelain dish was then placed in a completely dry glass container for 15 minutes to cool down to temperature before weighing. A sample of 1 gram was taken and was subsequently ground. The dishes which contained the sample were placed in an oven and dried at a temperature of 102-105°C for 5-6 hours. After the 5-6 hours period was up, the dish and the sample were taken out of the oven and placed in the dry glass container for 30 minutes to cool down before weighing it (AOAC, 2012).

Analysis of protein content (kjeldahl method)

A sample of breast meat weighing 0.5 g was taken and placed in a Kjeldahl flask. To it was added 7.5 g of potassium sulphate, 0.35 g of mercuric oxide and 15 ml of sulfuric acid. While placed in the Kjeldahl acid cabinet, the flask was heated until it stopped smoking. After that, the heating continued until the liquid started to boil and the layer of liquid atop it became clear. The flask was allowed to cool after that. After the Kjeldahl flask cooled, 100 ml of distilled water was added to it, and then 15 ml of 4% potassium sulphate was added. Next, 50 ml of 50% sodium hydroxide was added, but it was added in a controlled fashion. The mixture was then heated until both liquids were well integrated. Distillate collection occurred in an Erlenmeyer flask which was also filled with 50 ml of 0.1N hydrochloric acid and 5 drops of 0.1% b/v methyl red solution. The indicator used to signal the endpoint of the titration was a solution with a reddish color which turned yellow after the addition of a titrant. After that the blank titration was performed (AOAC, 2012).

Analysis of fat content

Sample of breast meat was taken, wrapped in filter paper, and put in a fat extraction thimble, which was then placed in a pre-weighed fat flask. The flask was then attached to a Soxhlet extraction tube containing a fat solvent. With the help of Soxhlet distillation, the boiling flask was heated to a temperature of 40°C for 6 hours while the entire assembly was maintained under a Soxhlet distillation apparatus. The flask containing the fat solvent was boiled for as long as required to evaporate/eliminate all trace of the solvent. Except for the solvent, all other matters were held in the extractor chamber. It was the case when the Phantom (=the fat flask) was drained and then placed in the oven maintained at 105°C for its intended purpose of an arbitrary time in order to remove all moisture. The Phantom was kept as long as required in order to achieve constant

Table 1. Composition and Nutritional Content of the Ration at Starter Phase.

Material	Treatment				
	BPF0	BPF1	BPF2	BPF3	BPF4
BR 1	100	100	100	100	100
Butterfly Pea Flour	0	1	2	3	4
Amount (Kg)	100	101	102	103	104
Nutritional Content (%)					
Crude Protein*	23	23.23	23.46	23.69	23.96
Crude Fiber*	6	6.09	6.17	6.26	6.34
Crude Fat*	4	4.03	4.06	4.09	4.12
Ash*	8	8.06	8.12	8.19	8.25
Calcium	1.2	1.2	1.2	1.2	1.2
Phosphorus	1	1	1	1	1
Anthocyanin (mg/100g)**	-	0.01	0.02	0.03	0.04
Phenolic (mg/ml)**	-	0.88	1.75	2.63	3.5
Triterpenoid mg/ml**	-	10.97	21.94	32.9	43.87
Antioxidant Activity (ppm)***	15.28	26.1	27.18	34.26	36.6

*: Laboratory of Animal Nutrition and Feed Science, Universitas Lambung Mangkurat, Banjarbaru (2024); **: Laboratory of Biochemistry and Biomolecular Department, Universitas Lambung Mangkurat, Banjarbaru (2025); ***: Laboratory of Nutrition and Feed Science, Universitas Diponegoro, Semarang (2025)

Table 2. Composition and Nutritional Content of the Ration at Finisher Phase.

Material	Treatment				
	BPF0	BPF1	BPF2	BPF3	BPF4
BR 2	100	100	100	100	100
Butterfly Pea Flour	0	1	2	3	4
Amount (kg)	100	101	102	103	104
Nutritional Content (%)					
Crude Protein*	19	19.23%	19.46	19.69	19.96
Crude Fiber*	5	5.09%	5.17	5.26	5.34
Crude Fat*	5	5.03%	5.06	5.09	5.12
Ash*	7	7.06%	7.12	7.19	7.25
Calcium	1.1	1.10%	1.1	1.1	1.1
Phosphorus	0.45	0.45%	0.45	0.45	0.45
Anthocyanin (mg/100g)**	-	0.01	0.02	0.03	0.04
Phenolic (mg/ml)**	-	0.88	1.75	2.63	3.5
Triterpenoid mg/ml**	-	10.97	21.94	32.9	43.87
Antioxidant Activity (ppm)***	15.28	26.1	27.18	34.26	36.6

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weight after which the Phantom was placed in the desiccator for cooling (AOAC, 2012).

Analysis of ash content

Analysis of ash content was carried out to find out 'the amount of ash derived from an analyzed substance and it's explainable by the content of minerals present in the analyzed substance. For 30 min, a porcelain ash dish was washed and subsequently dried in an oven to maintain a temperature of about 105°C and adhered to the dish was in the desiccator for 30 min. After that the porcelain ash dish in the weighing balance was put with 5 grams sample of breast flesh. There was subsequently burned on an electric stove till no more smoke came out and afterwards transferred to a muffle furnace that was kept on and maintained to a temperature of 600 for a period of 6 hours. After 6 hours, the dish was then transferred to the desiccator. The dish was then placed in the desiccator and allowed to cool before being weighed (AOAC, 2012).

Carbohydrate content

With the formula below, it is easy to find out the content of the amount of carbohydrates: Carbohydrate content (%wb) = [100% - (moisture + protein + lipid + ash) % wb] Carbohydrate content (% db) = [100% - (protein + lipid + ash) % db]. With the components, "calculated by difference the content of carbohydrates" is the total amount because it does not differentiate from indigestible and digestible carbohydrates.

Phytochemical content of meat

To determine the presence of triterpenoid compounds the Lieberman–Burchard method was utilized. 2 mg of the dry sample was dissolved in a mixture of acetic anhydride where it was boiled and cooled and afterwards one molecule of concentrated H_2SO_4 was added. The presence of reddish-violet liquid indicates that the sample could possibly contain triterpenoids (Sahaa *et al*., 2011).

Quantification of phenolic compounds was done by utilizing the Folin-Ciocalteu method (Sam *et al*., 2016). The sample was dissolved and added to 10 mg in 10 ml of absolute 96% ethanol. 0.5 ml of that solution was mixed with 0.4 ml of Folin-Ciocalteu reagent, which consists of phosphomolybdic and phosphotungstic acids, and shaken and left for a period of 4-8 minutes. Next, 4.0 ml of Na_2CO_3 solution of a 7% concentration was added and shaken until it was uniform. Sterile distilled water was used to make the final volume 10 ml. The mixture was left at room temperature for 2 hours and then measured for absorbance at 750 nm, where the resulting solution turned blue.

Shimamura *et al*. (2014) testing total antioxidant capacity against DPPH in 2014, so we will take a similar approach and see how it applies to our antioxidant testing. 0.2 DPPH solution was prepared by dissolving 0.0078 g of DPPH powder in ethanol to a volume of 100 mL. An aliquot was withdrawn from the solution and placed in a test tube, to which 3 mL of ethanol was added, and mixed in a vortex machine for 60 seconds until homogenized. The sample was allowed to incubate in the dark at room temperature for 30 minutes. This was done in order for the DPPH and the sample to react. After incubating the samples, spectrophotometer and cuvette were employed to determine the absorbance value at 517 nm.

Data Analysis

Chemical quality values of meat were compared through analysis of variance (ANOVA). When differences between treatments were significant (P<0.05), analysis was conducted using Duncan's multiple range test (DMRT). Phytochemical content and antioxidant activity values were analyzed descriptively.

Results

Chemical Quality of Broiler Chicken Meat

The nutritional aspect of broiler chicken meat and its chemical quality characteristics are closely interrelated. Given its nutritional value, meat adds especially high value to the economy, which makes it a particularly highly sought after product. The livestock and animal's meat and other unused parts also consist of chemical constituents which differ in amount and type due to the species, genetic makeup, age, sex, feeding and care, carcass, storage and the animal's handling processes. The chemical quality of the meat derived from broiler chicken in this research is determined by content of moisture, ash, protein, fat, and carbohydrates. Averages of chemical quality of broiler chicken meat with supplementation of butterfly pea flour is illustrated in Table 3.

The treatment means for moisture, protein, fat and carbohydrate content were different (P<0.05) among the treatment (Table 3). The protein content of the meat improved corresponding to increasing levels of butterfly pea flour (BPF) inclusion at the expense of its moisture, fat, and carbohydrate content.

Phytochemical Content of Meat

Butterfly pea flour is identified as a bioactive antioxidant activity source. Phytochemical content of broiler chicken meat is in the form of triterpenoids, phenolics, anthocyanins, and antioxidants DPPH, as indicated in Table 4.

Discussion

According to Table 3, the moisture content of broiler chicken meat exhibited significant differences (P<0.05). Increasing the level of butterfly pea flour (BPF) in the broiler diet led to a reduction in the moisture content of broiler chicken meat. The lowest average moisture content was observed in treatment BPF4, which involved the addition of 4% butterfly pea flour, yielding a result of 71.69%. The moisture content of the broiler chicken meat in this study was within the normal range. This finding aligns with the statements of Bostami *et al*. (2017), which indicate that 72-73% of the chemical composition of meat consists of water. The normal moisture content of chicken meat typically ranges from 70% to 75%.

Table 3. Meat Chemical Quality of Broiler Chickens Fed with Butterfly Pea Flour.

Content	Treatment					
	BPF0	BPF1	BPF2	BPF3	BPF4	P Value
Moisture Content (%)	72.74±0.56^{c}	72.33±0.35^{bc}	72.22±0.52^{abc}	72.06±0.35^{ab}	71.69±0.50^{a}	0.02
Ash Content (%)	1.48±0.05	1.41±0.06	1.42±0.11	1.39±0.03	1.37±0.06	0.12
Protein Content (%)	23.39±0.53^{a}	23.51±0.34^{b}	23.92±0.48^{bc}	24.32±0.42^{c}	24.69±0.53^{c}	0
Fat Content (%)	2.22±0.22^{b}	1.97±0.08^{a}	1.94±0.03^{b}	1.96±0.07^{b}	1.88±0.06^{b}	0
Carbohydrate Content (%)	0.79±0.1^{c}	0.77±0.1^{c}	0.50±0.03^{b}	0.32±0.16^{a}	0.37±0.06^{ab}	0

Different superscripts indicate significantly different results (P<0.05); BPF0 (basal diet without the addition of butterfly pea flour); BPF1 (basal diet + 1% butterfly pea flour); BPF2 (basal diet + 2% butterfly pea flour); BPF3 (basal diet + 3% butterfly pea flour); BPF4 (basal diet + 4% butterfly pea flour).

Table 4. Phytochemical Content of Broiler Chicken Meat Fed with Butterfly Pea Flour.

Phytochemical Content	BPF Treatment	
	Without BPF	BPF 4%
Triterpenoid (mg/ml)	52.8	230.8
Phenolic (mg/ml)	3.07	13.2
Anthocyanin (mg/100 g)	0.49	0.73
DPPH antioxidant (% inhibition)	6.51±0.04	34.60±0.06

The low moisture content in the BPF treatment shows the increasing nutritional content of broiler meat, which indicates better digestibility and absorption of nutrients. Treatment diets containing BPF have phenolic, anthocyanin, and triterpenoid content, as well as its antioxidant activity which increases with increasing BPF level (Table 2). These bioactive compounds can act as powerful antioxidants, as well as antibacterials, so that the broiler's digestive tract becomes healthy as proven in previous studies. Yuanita *et al*. (2025) stated that total coliform bacteria significantly decreased by the addition of BPF. It can enhance the absorption of nutrients deposited into broiler meat. Another research that produces similar results is the provision of Dayak onions that are rich in phenolic and flavonoid, can improve broiler meat quality, especially protein (Yuanita *et al*., 2019).

A decreasing moisture content also indicates a higher level of freshness in broiler chicken meat, which can enhance the shelf life of the meat. Higher moisture levels in food products can provide a conducive environment for microbial growth (Zambrano *et al*., 2019). The moisture content of broiler chicken meat is also affected by factors including age, water consumption, nutrient intake, and the type of poultry (Estancia, 2012).

Ash content represents the mineral composition of food materials. The ash content of broiler chicken meat showed no significant difference ($P > 0.05$) and the addition of butterfly pea flour in up to 4% levels did not affect significantly the mineral content of broiler chicken meat. From this research, the ash content of broiler chicken meat ranged from 1.37% to 1.48%. Qiao *et al*. (2002) document that the ash content of fresh chicken meat is 1.26%. Ash content is a determinant of nutritional value as it relates to mineral content in chicken meat. The amount of ashes also relate to the amount of feed consumption, higher feed consumption results in higher ash content. Moreover, the quantity of ash content varies according to species, age, and sex of animals.

Protein is an organic compound composed of C, N, H, O, as well as S and P (Pinto and Gantner, 2020). The primary components of protein are amino acids that form long chains consisting of both essential and non-essential amino acids. The protein content of broiler chicken in this study exhibited highly significant differences ($P<0.01$). An increase in the addition of butterfly pea flour to the broiler chicken ration resulted in a significant enhancement in the protein content of the chicken meat. The highest average protein content in broiler chicken meat was observed in treatment BPF4, which involved the addition of 4% butterfly pea flour, yielding a result of 24.69%. Butterfly pea flowers contain phenolic compounds and anthocyanins, which act as antioxidants and antibacterials, which can suppress the growth of pathogenic bacteria, thereby increasing nutrient absorption (Sapsuha *et al*., 2023; Yuanita *et al*., 2025). Protein absorption increases protein intake, providing substrates for deposition in meat. Antioxidants play a crucial role in reducing oxidative stress in animals, which can positively impact meat protein content and quality. By reducting oxidative stress, atioxidants help protect proteins from damage, preserving their structure and function (Serdaroglu, 2023). These outcomes support the findings of earlier work on the provision of dragon fruit peel (Yuanita *et al*., 2023), Dayak onion (Yuanita *et al*., 2019) which contains antioxidant compound may increase broiler meat protein mass.

Soeparno (2011) explained that meat protein content tends to range from 19% to 22%. The result indicates that the protein content of broiler chicken meat that was provided with butterfly pea flour supplement in the ration is higher than the average protein content of broiler chicken meat in general. Protein content of chicken meat is also influenced by feed they consume. According to Liu *et al*. (2015), the amount of protein depends on the quantity of feed consumed by the animals. Furthermore, higher protein levels are associated with the weight of the livestock; greater body weight indicates higher protein consumption. The body weight of chickens is related to protein consumption, which determines the deposition of protein in chicken meat (Rotiah *et al*., 2019).

Chicken meat contains various nutritional components in various amounts, including fat content. Fat plays a crucial role in maintaining health and metabolism; however, certain types of fat, such as saturated and trans fats, should be avoided due to their potential health risks. The fat content of broiler chicken in this study exhibited highly significant differences ($P<0.01$). An increase in of butterfly pea flour to the broiler chicken ration resulted in a significant reduction in the fat content of the chicken meat. The lowest average fat content in broiler chicken meat was observed in treatment BPF4, which involved the addition of 4% butterfly pea flour, yielding a result of 1.88%. This result is lower compared to the statement by Soeparno (2011), which indicates that the fat content of broiler chicken meat is approximately 2.5%. Study by Yuanita *et al*. (2019) of Dayak onion (*Eleutherine palmifolia*) extract with antioxidant can decrease lipid meat (cholesterol), since according to Sohaib *et al*. (2015) stated that retardation of meat lipid by dietary antioxidant from plant source. Study by Sudheesh *et al*. (1997) of *Solanum melongena* extract with flavonoids can decrease triglyceride by the action of increasing lipase enzyme. By the elevation of the enzyme, very low density lipoprotein will be hydrolyzed into glycerol and fatty acid. Free fatty acids are used by muscles and other tissues as energy stores. Flavonoids also possess the ability to suppress the enzyme fatty acid synthase, which plays a key role in the metabolism process of fat. Inhibition of fatty acid synthase reduces fatty acid synthesis inversely (Tian *et al*., 2011).

The differences in fat content are suspected to be due to the varying digestibility of certain amino acids in the meat protein. According to Gregory (2010), the chemical quality of meat is influenced by the digestion of nutrients and the metabolism of livestock. Additionally, as the age of livestock increases, the fat content also tends to rise. Fat content also shows a positive correlation with livestock weight; as the body weight of the chicken increases, so does the fat content. Furthermore, fat content has a negative correlation with protein and moisture content in the meat. Meat with lower fat content generally contains higher levels of protein and moisture, and the opposite also applies (Aberle *et al*., 2001).

Generally, chicken meat is not a source of carbohydrates, as it typically contains an average carbohydrate content of only 1%. However, carbohydrates play a role in the characteristics of meat, such as texture and flavor. The carbohydrate content of broiler chicken in this study exhibited highly significant differences ($P<0.01$). The addition of butterfly pea flour to the diet of broiler chicken resulted in a very low percentage of carbohydrates in the broiler chicken meat.

The lowest carbohydrate average content was achieved in treatment BPF3 using the addition of 3% butterfly pea flour with a value of 0.32%. This is lower than the percentage of carbohydrates as stated by Soeparno (2011), which is 1.2%. This difference is most probably due to differences in digestibility, thereby resulting in variations in chemical content among various livestock species (Gregory, 2010). From the above results presented, it is evident that the inclusion of butterfly pea flour in broiler chicken diet can enhance the chemical composition of broiler chicken meat, as indicated by the increased protein and decreased fat and carbohydrate content. Therefore, it can be anticipated that butterfly pea flour can serve as an alternative natural feed additive for broiler chicken diets.

According to the contents in Table 4, the phytochemicals in broiler chicken meat, such as triterpenoid, phenolic, anthocyanin, and DPPH antioxidant, rose in the treatment with 4% butterfly pea flour (BFP 4%) than in the treatment without BPF (BPF 0%). Triterpenoid content in the broiler chicken meat under the research improved to 230.80 mg/ml, and phenolic content improved to 13.20 mg/ml. By comparison, the anthocyanin content of the broiler chicken meat was 0.73 mg/100g and DPPH antioxidant activity was 34.60%. These outcomes show that the triterpenoid content, being an antioxidant, in the chicken meat supplemented with the added butterfly pea flour was 77.12% higher compared to the control group without BPF. Similarly, the levels of phenolic compounds, anthocyanins, and antioxidant activity were raised by 76.74%, 32.88%, and 81.18%, respectively, compared to the control.

The functional value bioactive constituents in butterfly pea flowers are from various phytochemical compound classes, i.e., phenols (flavonoids, phenolic acids, tannins, and anthraquinones), terpenoids (triterpenoids, tocopherol saponins, phytosterols), and alkaloids (Chayaratanasin *et al*., 2019). The phenolic compounds consist of flavonoids, phenolic acids, and tannins. Non-phenolic bioactive components identified in butterfly pea flowers include phytosterols, terpenes, sugar alcohols, alkyl aldehydes, and peptides. The presence of these bioactive compounds can reduce abdominal fat content in broiler chickens, as reported in previous publication (Yuanita *et al*., 2025).

The flavonoid components in butterfly pea flowers include flavonols, anthocyanidins, flavanols, and flavones. Similar to flavonols, anthocyanidins in butterfly pea are found in their glycosylated form, known as anthocyanins. The most prominent visual characteristic of butterfly pea flowers is their deep blue color, attributed to the anthocyanins they contain. The terpenoid compounds identified in butterfly pea include triterpenoids (identified as taraxerol), phytosterols, and tocopherols (Suganya *et al*., 2014). Flavonoid, triterpenoid, anthocyanin exhibit antioxidant activity. A potent antioxidant that can enhance meat quality and protect against oxidative damage. Furthermore, butterfly pea extract is recognized as one of the flowers with the highest antioxidant activity (Vankar & Srivastava, 2010). Suganya *et al*. (2014) also noted that the ability of butterfly pea extract to reduce radical compounds is greater than that of vitamin C. In current study, triterpenoid, phenolic, and antocianin deposition in broiler meat have contributed to the better meat quality with higher antioxidant content. It is known that certain active components from plants can be quickly absorbed into the body after being taken by mouth and metabolized.

The increase in the phytochemical compounds present in broiler chicken meat indicates that the resulting meat product possesses added value as a functional food ingredient. In addition to having a high protein content and low fat, it also exhibits relatively high antioxidant content compared to conventional broiler chicken meat.

Conclusion

The addition of butterfly pea flour to the broiler chicken ration can enhance the protein content while reducing the moisture, carbohydrate, and fat contents of broiler chicken meat. Furthermore, broiler chicken meat also contains a significant amount of phytochemical compounds, such as triterpenoids, phenolics, anthocyanins, and DPPH antioxidants.

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Conflict of interest

The authors have no conflict of interest to declare.

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