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Amino acid composition and protein quality of native chicken meat fed green feed

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Abstract. Amino acid composition can be used to determine protein quality, by comparing with reference amino acid values. This research was conducted with the aim to evaluate and study the composition of amino acids and protein quality of native chicken meat by giving *Indigofera zollingeriana* powder (IP) and turmeric phytobiotics (TP) as green feed. Treatment ration study: R0 = control ration (research ration without green feed; Treatment R1 = substitution of 10% protein of soybean meal with IP + 2.5% TP; Treatment R2 = substitution 15% of soybean meal protein with IP + 2.5% TP, treatment R3 = substitution of 20% protein of soybean meal with IP + 2.5% TP. The variables observed were amino acids composition and protein quality of native chicken meat. The raw material for rations was prepared according to the needs of native chicken with iso-protein and iso-energy. The study used 160 native chickens which were divided into 4 treatments and 5 replications using a completely randomized design (CRD). Chemical scores were 78.91%, 76.39%, 82.66% and 82.66% for the treatment of R0, R1, R2 and R3 respectively, and amino acid scores increased along with the increase in substitution of soybean meal with indigofera powder protein be respectively 98.29%; 97.78%; 102.59% and 107.85%. It concluded that substituting 20% soybean meal protein with indigofera powder protein and added 2.5% turmeric phytobiotic gives a better chemical score and amino acid score.

1. Introduction

Increasing the productivity of native chicken meat must be accompanied by the provision of feed that contains sufficient nutrition and efforts to maintain the health of the native chicken. The challenge for native chicken breeders is the high cost of protein feed. One of the protein sources used in poultry feed is soybean meal. Soybean meal has a high price and still depends on imports from other countries. In addition, the prohibition of the use of antibiotics as growth promoters, commonly known as Antibiotic Growth Promoters (AGPs). So, that an alternative feed additive from natural ingredients is needed that does not cause harm. The productivity of native chicken meat must be accompanied by providing feed that contains sufficient nutrition and efforts to maintain the health of the native chicken. The challenge for native chicken breeders is the high cost of protein feed. One of the protein sources used in poultry feed is soybean meal. Soybean meal has a high price and still depends on imports from other countries. In addition, the prohibition of the use of antibiotics as growth promoters, commonly known as Antibiotic Growth Promoters (AGPs). So, we need alternative feed additives from natural ingredients that do not cause harm.



One of the feed ingredients that has the potential as a source of protein feed ingredients is the leaves of *Indigofera* sp. *Indigofera* sp. has high productivity and a fairly good nutrient content, especially high protein content. Tarigan et al., (2010) stated that the dry matter production of *Indigofera* sp. cutting at the age of 60 days with a cut height of 1.0 m is 31.2 tonnes/ha/year, which is the highest production when compared to the older or younger cutting age [1]. The feed ingredients needed by poultry are feed ingredients that have high protein and low crude fiber content. The shoot part of a plant usually has a better nutrient content when compared to other parts. The addition of turmeric flour with bioactive substances is that curcumin has many biological activities, such as anticancer, anti-inflammatory, antimicrobial and antioxidant properties [2].

Indigofera zollingeriana shoot flour can be used as a protein source feed ingredient as a substitute for soybean meal because it has a high crude protein content of 28.98% and a crude fiber content of 8.49% [3]. Several studies have been conducted regarding the addition of *indigofera* leaves to poultry feed [4,5] and turmeric as a natural antibiotic for poultry [6-8].

The chemical method is a method that is fast, easy and can provide the necessary information about the quality of a protein. This method is based on the amino acid content contained in native chicken meat. Meat with protein that contains amino acids in a ratio that equals human amino acid requirements will have high protein quality. Chemical score, amino acid score can be determined based on the amino acid content of a substance. Protein quality is important to ensure that the protein can play a role in the synthesis process in the body. The quality of protein in food is determined by the type and proportion of amino acids it contains. Complete protein or protein with high biological value or high quality is a protein containing all types of essential amino acids in proportions suitable for growth purposes, namely all animal protein except gelatin is complete protein. Based on the description above, a study on the potential of *Indigofera* sp. shoot flour was conducted as an alternative feed ingredient source of protein to reduce the use of soybean meal and its use in native chicken rations by looking at the amino acid composition and amino acid scores of native chicken meat.

2. Material and methods

2.1. Materials

The materials used in this research are native chicken from maintenance in the Poultry Production Laboratory of the Faculty of Animal Science, Universitas Hasanuddin. The ingredients of the ration consist of ground maize, bran, soybean meal, coconut cake, fish meal, meat and bone meal (MBM), vegetable oil, dicalcium phosphate (DCP), lysine, methionine, turmeric flour, and shoot flour of *Indigofera zollingeriana*.

2.2. Methods

2.2.1. Making the *Indigofera* leaf powder. The study began with the manufacture of *Indigofera* leaf shoots by picking the leaf buds. The intended shoots of the plants are the topmost parts of the plant with a diameter of stems less than 5 mm or which have 4 - 5 leaf stalks at the top. Then dry in the sun for 6 hours with a moisture content of 10-20%. After drying the *Indigofera* leaf buds are crushed with a grinding machine and sieved using a sieve to make flour to be mixed into the feed.

2.2.2. Making the turmeric powder. Turmeric rhizomes are washed and sliced into small pieces, then dried using an oven at $\pm 60^{\circ}\text{C}$ for 2 days. Having been dried, the sliced rhizomes was grinded to produce the turmeric flour.

2.3. Research Implementation

The rations are given as follows R0: Control feed (without the addition of *indigofera* powder (IP) and turmeric phytobiotics (TP)), R1: 10% IP substituted soybean meal (protein = 2.82%) + 2.5% phytobiotic turmeric, R2: 15% IP substitute soybean meal (protein = 4.23%) + 2.5% TP, R3: 20% IP substitutes

soybean meal (protein = 5.64%) + 2.5% TP. The design used was a completely randomized design (CRD) with 5 treatments and 4 replications so that there were 20 experimental units [9]. The added turmeric to the ration was 2.5% [6].

Amino acid composition of meat was measured using High Pressure Liquid Chromatography (HPLC) [10]: Waters Acquity UPLC H Class and H Class amino Acid Analysis System Guide, 2012). The determination of the chemical score is done by comparing each essential amino acid in the sample with the essential amino acid content in chicken eggs. Amino acid score is determined by comparing the composition of the essential amino acids in the sample with the provisional amino acid scoring pattern, which is the type and number of amino acids needed by humans to grow normally [11].

3. Results and discussion

The composition of amino acids contained in chicken meat can be seen in table 1. Table 1 showed that by giving green feed, chicken meat has a complete essential amino acid composition, which is needed by the human body.

Table 1. Amino acid composition of native chicken meat with green feed.

Amino acids	Treatments			
	P1	P2	P3	P4
L-Serine	33.43	31.96	36.02	33.84
L-Glutamic acid	75.57	73.01	73.94	120.32
L-Phenylalanine	39.56	35.88	42.81	39.45
L-Isoleucine	38.94	38.49	41.29	41.12
L-Valine	39.58	38.74	42.08	41.44
L-Alanine	41.24	38.26	40.35	48.42
L-Arginine	59.66	53.96	60.89	56.54
Glycine	48.05	38.80	44.30	48.50
L-Lysine	73.84	76.17	72.76	86.52
L-Aspartic acid	61.34	57.23	59.26	78.05
L-Leucine	64.21	63.25	67.67	68.19
L-Tyrosine	31.88	28.66	33.85	31.46
L-Proline	35.71	29.93	32.01	36.76
L-Threonine	35.60	34.53	38.64	39.54
L-Histidine	26.76	25.97	28.45	26.70

PT Saraswanti Indo Genetech Laboratory, 2020

Note: R0: Control feed (without the addition of indigofera leaf shoots and turmeric), R1: 10% ILS substituted soybean meal (protein = 2.82%) + 2.5% phytobiotic turmeric, R2: 15% ILS substitute soybean meal (protein = 4.23%) + 2.5% phytobiotics of turmeric, R3: 20% ILS substitutes soybean meal (protein = 5.64%) + 2.5% phytobiotics of turmeric.

Essential amino acids are amino acids that cannot be synthesized by the human body and must be obtained through food. The amino acid in question is histidine, lysine, methionine, threonine, isoleucine, leucine, valine, phenylalanine and tryptophan [12]. Non-essential amino acids can be synthesized by the human body through ketone acid reductive aminases or through simple transaminases of other amino acids. For example, the amino acid proline can be synthesized from the amino acid glutamic acid.

Indigofera sp. shoot flour has a complete amino acid content. Assessment of protein quality is not only determined by the total amino acid content of the feed ingredients. but also determined by the balance of essential amino acids that are arranged in these proteins. After knowing the amino acid composition, a protein quality calculation was carried out which included the chemical score and the amino acid score. The results of the chemical score calculation is presented in table 2. Amino acid score calculation is proposed to find out how far the contribution of essential amino acids in a protein source to human needs. The results of the calculation of the amino acid score can be seen in table 3.

Table 2. Chemical Score Value (%) of native chicken meat with green feed.

Amino acids	Treatments			
	P1	P2	P3	P4
L- Phenylalanine	62.79	56.96	67.95	62.62
L-Isoleucine	48.67	48.11	51.62	51.39
L-Valine	54.22	53.07	57.64	56.77
L-Arginine	93.22	84.31	95.14	88.35
L-Lysine	102.55	105.76	101.05	120.17
L-Leucine	69.79	68.75	73.56	74.12
L-Threonine	72.65	70.48	78.86	80.70
L-Histidine	127.41	123.67	135.48	127.13
Chemical score	78.91	76.39	82.66	82.66

Note: R0: Control feed (without the addition of indigofera leaf shoots and turmeric), R1: 10% ILS substituted soybean meal (protein = 2.82%) + 2.5% phytobiotic turmeric, R2: 15% ILS substitute soybean meal (protein = 4.23%) + 2.5% phytobiotics of turmeric, R3: 20% ILS substitutes soybean meal (protein = 5.64%) + 2.5% phytobiotics of turmeric.

Table 3. Amino Acid score (%) native chicken meat with green feed.

Amino Acids	Treatments			
	P1	P2	P3	P4
L-Isoleucine	97.34	96.22	103.23	102.80
L-Valine	79.16	77.48	84.15	82.88
L-Lysine	134.25	138.50	132.29	157.31
L-Leucine	91.73	90.36	96.68	97.42
L-Threonine	88.99	86.33	96.60	98.86
Amino Acid score	98.29	97.78	102.59	107.85

Note: R0: Control feed (without the addition of indigofera leaf shoots and turmeric), R1: 10% ILS substituted soybean meal (protein = 2.82%) + 2.5% phytobiotic turmeric, R2: 15% ILS substitute soybean meal (protein = 4.23%) + 2.5% phytobiotics of turmeric, R3: 20% ILS substitutes soybean meal (protein = 5.64%) + 2.5% phytobiotics of turmeric.

The method of assessing protein quality with an amino acid score gave equivalent results with a biological assessment [13]. From the table 3 it is known that native chicken meat protein has the highest average amino acid score in the addition of 20% TDI (P4) or equivalent to 12% soybean meal substitution based on protein content. Amino acid score in treatment P1, P2 and P3 show that the lowest amino acid score is L-Valine, so it is a limiting amino acid.

4. Conclusion

The conclusion was that the substitution of Indigofera leaf meal with 20% (equivalent to 12% substitution of soybean meal) added with 2.5% turmeric flour gave a better chemical score and amino acid score in native chicken meat.

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