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The effect of soybean meal substitution with *Indigofera zollingeriana* leaves and turmeric as phytobiotics in digestibility of crude protein and crude fiber of native chickens

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Abstract. Consumer demand for native chicken meat is increasing every year. The availability of protein feed ingredients for poultry is still a major problem, especially for soybean meal which is currently still filled with imports, so that the price of soybean meal is expensive which indirectly increases production costs. One of the feed ingredients that have the potential as a source of protein feed ingredients is the shoot leaves of *Indigofera* sp, namely *Indigofera zollingeriana*. This plant is very good as a source of forage for poultry. Apart from paying attention to the nutritional content of the feed given, one of the factors that must be considered is the use of herbal ingredients such as turmeric (*Curcuma domestica* Val.). The active substance content possessed by turmeric is curcumin and essential oils which function as colagoga (can increase bile secretion) to increase appetite which in turn will increase life weight. The design used in this study was a completely randomized design (CRD) with 4 treatments and 4 replications. The research treatment arrangement was as follows 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 parameters observed were digestibility of crude protein and digestibility of crude fiber. The results showed that the substitution of soybean meal protein with indigofera zollingeriana shoot flour at different levels and the addition of turmeric had no significant effect on crude protein digestibility and crude fiber digestibility ($P > 0.05$). The average value of protein digestibility was 45.75% -63.25% and the fiber digestibility was 31.37% -51.08%. This study concluded that 10% *Indigofera zollineriana* shoot flour substituted soybean meal and 2.5% turmeric phytobiotics provided the effective digestibility of crude protein and crude fiber in native chickens.

1. Introduction

The availability of protein feed ingredients for poultry is still a major problem, especially for soybean meal which is currently still filled with imports, so that the price of soybean meal is expensive which indirectly increases production costs. Therefore, it is necessary to look for alternative feed ingredients that are sourced from local feed ingredients but have adequate nutrient content, do not compete with human needs, are safe and easily available. One of the feed ingredients that has the potential as a source



of protein feed ingredients is the shoot leaves of *Indigofera* sp, namely *Indigofera zollingeriana*. *Indigofera zollingeriana* is a legume that has a high protein content of 28.41% [1].

Giving additive feeds is very important to improve the health and productivity of poultry. Feed additives commonly used as growth boosters are antibiotics. However, the use of antibiotics to spur the growth of poultry is increasingly being abandoned since the EU's ban on the use of antibiotics in livestock. Giving antibiotics as an additive feed which in principle reduces the bacterial population in the digestive tract, but its use provides a problem with the discovery of antibiotic residues in livestock carcasses which are consumed by humans and increase the resistance of pathogenic bacteria [2].

The active substance content possessed by turmeric is curcumin and essential oils which function as colagoga (can increase bile secretion) to increase appetite which in turn will increase life weight [3]. The addition of turmeric flour in poultry rations can improve the working system of digestive organs that can help the absorption of food in the body. It also serves to increase the body's resistance to livestock. *Indigofera zollingeriana* shoot flour and turmeric are the solutions to the problems that occur. Giving *Indigofera zollingeriana* at the level of 10% and turmeric 2.5% was able to improve dry matter digestibility of 84.96% and protein digestibility of 35.99% [4].

This study aims to determine the effect of substitution of soybean meal with *Indigofera zollingeriana* leaf flour and turmeric as a phytobiotic on the digestibility of crude protein and crude fiber of native chicken.

2. Materials and methods

The study was conducted in June – August 2020 at the Poultry Production Laboratory for raising native chickens and the Feed Chemistry Laboratory for excreta analysis, Faculty of Animal Husbandry, Hasanuddin University, Makassar.

2.1. Material

The tools in this research are oven, digital scale, blender, feed container, drinking container, analytical balance, 600 mL beaker, electric bath, 50 cc closed test tube, sintered glass, vacuum pump, funnel, furnace, oven, desiccator, holder, porcelain cup, 100 mL kjedhal flask, 100 mL volumetric flask, spray flask, nitrogen distiller and its accessories (Destilator), electric bath, fume hood, acid burette, suction pump, and erlenmeyer.

The materials used in this study were 80 native chickens aged 8 weeks (grower), *indigofera* leaf shoots (ILS), turmeric flour, corn, rice bran, premix, fish meal, DCP (Dicalcium Phosphate), CaCO₃ (Kalsium Carbonate), L-Lysine, DL-Methionine, newspaper, plastics, H₂SO₄ 0.3 N, NaOH 1.5 N, technical alcohol, distilled water, filter paper, concentrated H₂SO₄, Selenium mixture, 2% H₃BO₃, 0.0229 N H₂SO₄ solution, and 30% NaOH.

2.2. Methods

The experimental design used in this study was a completely randomized design (CRD) with 4 treatments and 5 replications. So that there are 20 units / units of observation. Each observation unit contains 4 chickens. The treatment in this study consisted of R0: Control feed (without the addition of *indigofera* leaf shoots and turmeric), R1: 10% ILS substitutes soybean meal (protein = 2.82%) + 2.5% phytobiotics turmeric, R2: 15% ILS substituted soybean meal (protein = 4.23%) + 2.5% phytobiotics turmeric and R3: 20% ILS substitutes soybean meal (protein = 5.64%) + 2.5% phytobiotics turmeric.

2.2.1. *Indigofera zollingeriana* leaf flour production. The research was started by pruning the *indigofera*, then separating the shoots and old leaves, then the shoots were wilted for a while under the sun after that the *indigofera* leaves were in the oven at 60° C until they were completely dry and then mashed using a blender to turn into flour.

2.2.2. Making turmeric flour. The making of turmeric flour is done by cleaning the turmeric rhizome from the dirt that sticks to the skin of the turmeric using running water, after the turmeric is clean,

dissolve it by slicing the turmeric thinly and then drying it under the sun or using an oven at $\pm 60^{\circ}\text{C}$ for 2 days. After drying, it is mashed with a grinding machine and sieved using a sieve to make flour then mixed into the feed.

2.2.3. Cages and Equipment. In this study, 20 units of plot cages were used. Each cage unit is equipped with a 5 watt incandescent lamp (as a heater), 500 g of feed and 500 ml of drinking water. A week before the research was carried out cleaning, each unit of the cage and its equipment (the place for feeding and drinking) was cleaned and disinfected in each unit of the cage to be used. The lights are turned on at night with a house temperature of $31^{\circ}\text{C} - 32^{\circ}\text{C}$ to keep the cages temperature stable.

2.2.4. Feed preparation. The feed used in this study was grower feed in the form of corn, bran, fish meal, turmeric flour, *Indigofera zollingeriana* leaf flour, soybean meal, premix, DCP, CaCO_3 , lysine, methionine and water. The composition of the ration nutrients used during the study can be seen in table 1.

Table 1. Composition of the nutritional substances of the ration.

Feed ingredients	EM Kkal/Kg	CP (%)	CFT (%)	CF (%)	LY (%)	METH (%)	P (%)	Ca (%)
Corn	3291.27	9.88	1.79	5.70	0.06	0.18	0.60	0.02
Rise bran	2730.00	13.40	5.10	11.50	0.42	0.30	2.50	0.2
<i>Indigofera zollingeriana</i> flour	2617.41	27.18	6.26	10.00	2.05	0.67	0.58	0.13
Soybean meal	2191.31	41.24	3.30	3.55	2.95	0.80	1.21	0.27
Permixon					0.3	0.3		
Fish meal	3233.88	36.32	0.52	0.16	2.11	0.66	2.88	7.19
DCP	0.00	0.00	0.00	0.00	0.00	0.00	21.00	16.00
CaCO_3	0.00	0.00	0.00	0.00	0.00	0.00	0.04	39.00
L-Lysin	0.00	62.00	0.00	0.00	99.00	0.00	0.00	0.00
DL-Metionin	0.00	58.78	0.00	0.00	0.00	99.00	0.00	0.00

The addition of turmeric was 2.50% as a feed additive [4].

Source: Result analysis Feed Chemistry Laboratory, 2020

2.2.5. Maintenance of Chicken Grower Phase. Native chicken maintenance is carried out from the age of 8 weeks to the age of 16 weeks. Chickens were placed in 20 plots of cages with 4 chickens / plot. During the maintenance of chickens are given feed and drinking water ad libitum. The feed used is a mixed feed based on table 1.

2.2.6. Data collection. Data were collected in the last 5 days using the total collection method. The first day, the total collection of native chickens was fasted for 24 hours but they were still given drinking water and the excretions had not been collected. After 24 hours of fasting, feed the chicken and the excretions are collected. The collected excreta is then weighed and dried in the sun, after drying, the excreta is weighed again. homogenized the dry total collection of excreta. Then take the sample of excreta for analysis of crude protein (CP) and crude fiber (CF). The measurement of the digestibility of crude protein and crude fiber was carried out using the total collection method. The total collection period is the period of excreta collection until the end of the experiment which is then dried and analyzed [5].

2.2.7. Statistical analysis. The data obtained were processed using variance with a Completely Randomized Design (CRD) with 4 treatments and 5 replications, analysis of the data used Analysis of Variance (ANOVA) following the linear additive of the Complete Randomized Design with the according to model [6].

3. Results and discussions

Based on the results of the research that has been carried out, it is obtained that the average digestibility of crude protein and crude fiber of native chickens which were given soybean meal substitution treatment with *Indigofera zollingeriana* and turmeric as phytobiotics is presented in table 2.

Table 2. Average digestibility of crude protein and crude fiber of domestic chicken given substitute feed of soybean meal with *Indigofera zollingeriana* and turmeric as a phytobiotic.

Treatment	Parameters	
	Crude Protein Digestibility (%)	Crude Fiber Digestibility (%)
R0	49.64± 14.76	41.95±25.01
R1	61.98±16.51	51.08±19.27
R2	63.19±8.72	31.37±14.73
R3	45.72±16.91	33.50±3.34

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 results of statistical analysis showed that the substitution treatment of soybean meal protein with *Indigofera zollingeriana* leaf shoots at different levels and the addition of turmeric showed no significant effect ($P > 0.05$) on digestibility of crude protein and crude fiber.

3.1. Crude protein digestibility

The results (table 3) showed that the average protein digestibility of native chickens treated with soybean meal protein substitution treatment with *Indigofera zollingeriana* leaf shoots at different levels and the addition of turmeric as a phytobiotic was 45.75% -63.25%. Numerically, the protein digestibility value of R2 treatment was higher than other treatments by 63.25%. This is presumably because the protein content of the ration increased along with the increase in the percentage of *Indigofera zollingeriana* leaf shoot flour on the ration. The results of laboratory analysis of Animal Feed Chemistry (2020) show crude protein content at the level of 15%, namely 17.89%. Prawitasari, et al. [5] stated that one of the factors affecting the digestibility of crude protein is the protein content in the rations consumed by livestock. Rations with low protein content generally have low digestibility, and vice versa.

Protein digestibility by giving *Indigofera zollingeriana* with a level of 20% decreased, presumably because the R3 treatment ration had the highest crude fiber content among all treatments, namely 4.24%. Rosyadi, et al. [7] which states that high crude fiber in the ration can reduce the availability of energy and other food substances and affect the speed of flow of food ingredients in the digestive tract thereby reducing the efficiency of using other nutrients. If the ration contains high crude fiber, the ration cannot be digested completely and causes a full cache, limiting the ration consumption. The high crude fiber content in the ration will cause the chicken to feel full quickly because crude fiber is bulky and will expand when exposed to water.

Protein digestibility in treatment R0 and R3 with an average digestibility value of 49.64% and 45.72%. Protein digestibility values were low compared to R1 and R2 treatments of 61.98% and 63.19% (moderate category). Suprpto [4] states that there are 3 categories of ration quality based on the digestibility level, namely: digestibility values in the range of 50-60% are of low quality, between 60-70% of medium quality and above 70% of high quality. The addition of 2.5% turmeric flour in chicken rations serves to increase the work of the digestive organs which can help the absorption of food in the body, besides that it also functions to increase the endurance of livestock. The function of turmeric to improve the work of the digestive organs of poultry is to stimulate the walls of the gallbladder to release bile and stimulate the release of pancreatic juices which contain amylase, lipase and protease enzymes.

which are useful for improving the digestion of ration materials such as carbohydrates, fats and proteins [4].

Crude protein digestibility in native chickens in this study did not have a significant effect even though there was an increase in the amount of protein from each treatment, this is presumably because the metabolic energy levels were almost the same in each treatment so that it did not affect the digestibility of crude proteins. This is in accordance with the opinion of Fitasari, et al. [8] who stated that the increase in the protein content of the ration caused an increase in the amount of protein consumed by chickens. However, increased protein retention must also be supported by the metabolic energy content of the ration, because the metabolic energy content of the ration can determine the protein consumption of native chickens which can affect the digestibility of chicken protein.

3.2. Crude fiber digestibility

Based on table 3, it is known that the highest numerical average digestibility of crude fiber was obtained in treatment R1, namely 51.08% with the highest average fiber consumption of 1054.32 grams / unit of cage and the lowest was in treatment R2 which was 31.37% with the average fiber consumption is 701.79 grams / cage unit. The high digestibility value of crude fiber causes a lack of digestibility of other nutrients which has an impact on the performance of native chickens. The decrease in crude fiber digestibility of R2 and R3 treatments was probably due to the increase in crude fiber content of the rations R2 = 3.37% and R3 = 4.24% which caused the low digestibility value of crude fiber. Pangestu, et al. [9] stated that the higher crude fiber content in the ration causes the digestibility of crude fiber to be lower and vice versa.

The value of crude fiber digestibility of native chickens fed with soybean meal substitution with *Indigofera zollingeriana* and turmeric as a phytobiotic is high, in contrast to Prawitasari et al. [5] stated that the digestibility value of crude fiber in poultry generally ranges from 20-30%. *Indigofera zollingeriana* crude fiber content of 10% can produce the highest digestibility of 51.08%, this indicates that the crude fiber content of feed ingredients can affect the fiber digestibility value in poultry. Sumiati and Nurhaya [10] showed that the use of forages such as kayambang in duck rations with a crude fiber content of 7.21% resulted in the highest crude fiber digestibility of 54.33%.

The use of *Indigofera zollingeriana* as a source of protein has several drawbacks because if given in large quantities it can reduce the digestibility of feed. Hadist et al. [11] stated that the weakness of *Indigofera zollingeriana* when used in poultry feed is its high crude fiber content, so the more use of *Indigofera zollingeriana* the higher the crude fiber in the ration. The high crude fiber content in the ration will shorten the retention (retention) of the ration particles in the digestive tract and then quickly the undigested particles are excreted along with the feces.

Crude fiber digestibility that is not significantly different is likely to cause digestibility of crude protein and organic matter is also not significantly different because other nutrients that should be digested bind to cellulose and then are wasted with excreta. The high crude fiber content will decrease the digestibility of feed ingredients, absorption of food substances will decrease so that the metabolic energy content will also decrease. The availability of metabolic energy in the ration will decrease if the polysaccharide content in crude fiber is difficult to digest and vice versa [9].

4. Conclusion

This study concluded that 10% *Indigofera zollingeriana* shoot flour substituted soybean meal and 2.5% turmeric phytobiotics provided the effective digestibility of crude protein and crude fiber in native chickens.

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