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The effect of soybean meal substitution with *Indigofera zollingeriana* and addition of turmeric as phythobiotic on performance of native chicken

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Abstract. The feed well is that protein content is high enough to meet the needs and improve endurance of chickens. This research aims to determine the effect of giving *Indigofera zollingeriana* with a combination of turmeric flour at different treatment levels in substituting soybean meal usage on performance, protein and fiber consumption of chicken grower phase. This research was conducted from July to September 2020 at the Poultry Production Laboratory, Faculty of Animal Science, Hasanuddin University, Makassar. Using 80 grower phase native chickens. The research design used was a completely randomized design (CRD) with 4 treatments and 5 replications R0 (control feed), R1 (basal feed + 10% flour *Indigofera zollingeriana* + 2.5% turmeric flour), R2 (basal feed + 15% flour *Indigofera zollingeriana* + 2.5% turmeric flour), R3 (basal feed + 20% flour *Indigofera zollingeriana* + 2.5% turmeric flour). Data using *analysis analysis of variant* (ANOVA) with Response Test. The results of this research showed a significant effect ($P < 0.05$) on feed consumption, body weight gain, crude fiber consumption and crude protein consumption and showed not significant differences ($P > 0.05$) in feed conversion ratio. The mean of feed consumption was 297.89-421.13 g/day. The mean of body weight gain was 88.43-187.18 g/ bird. The mean of feed conversion is 2.65-4.46. The mean of consumption of crude protein was 15.26-23.70 g/bird/day. The mean of consumption of crude fiber is 2.30-4.21 g/bird/day. This research concluded that the R1 treatment (basal feed + 10% flour *Indigofera zollingeriana* + 2.5% turmeric flour) was the most efficient in optimizing performance, consumption of crude protein and crude fiber in the treated feed.

1. Introduction

Feed is an important component in the livestock production system, because it directly contributes up to 60-70% of the total production cost [1]. The high cost of feed is due to the fact that most of the potential raw materials for animal feed cannot be produced entirely domestically, such as soybean meal, fish meal and corn.



Good feed for native chickens is feed that has a high enough protein content to meet the needs of livestock. Soybean meal is a high protein feed ingredient, but the price is relatively expensive compared to other types of feed ingredients.

Indigofera zollingeriana is a source of protein around 22.3 - 31.10% [2-4], besides that the dry matter content is 89.47%, energy 3788 kcal / kg, crude fiber 15.13%, with a low anti-nutritional content of tannins. *Indigofera zollingeriana* has advantages that soybean meal does not have, namely the content of β -carotene and xanthophyl.

Antibiotics play a role in maintaining the balance of microbes in the digestive tract so that absorption of food substances is more effective, however, their use can cause residuals on danging. Turmeric (*Curcuma longa*) as a more natural phytobiotic in increasing absorption of nutrients.

As an antibiotic ingredient, turmeric has curcumin compounds and essential oils as anti-bacterial which can increase livestock resistance to pathogenic bacteria [5-7]. Turmeric has phenolic compounds (curcuminoids) which act as antioxidant and anti-inflammatory agents [8].

This study aims to determine how much influence the application of *Indigofera zollingeriana* leaf shoot flour with a combination of turmeric flour at different treatment levels in substituting soybean meal usage on performance, fiber consumption and protein consumption of native chicken grower phase.

2. Materials and Methods

This research was conducted from July to September 2020 at the Poultry Production Laboratory, Faculty of Animal Husbandry, Hasanuddin University, Makassar.

2.1 Material

The tools used in this study were an oven, analytical scales, blender, experimental unit cage, feed container, drinking area, 5 watt incandescent lamp, curtain, cleaning tools, plastic containers.

Materials used are 80 native chickens aged 9 weeks (grower), corn, bran, fish meal, turmeric (*Curcuma longa*), *Indigofera zollingeriana* leaf shoot flour, soybean meal, premix, DCP (Dicalcium Phospat), CaCO₃, Lysine, Methionine and water.

2.2 Methode

This study used an experimental research method with 4 treatments and 4 replications. The treatment rations given were as follows where TI (*Indigofera* Flour) and TK (Turmeric Flour): RO: control ration (research ration without use (TI) and (TK), R1: TI 10% (PK soybean meal substitute = 2.82%) + 2.5% TK, R2: TI 15% (PK soybean meal substitute = 4.23%) + 2.5% TK, R3: TI 20% (PK soybean meal substitute = 5.64%) + 2.5% TK

2.2.1. The leaves of *Indigofera zollingeriana* are separated from the stems and then dried in an oven at 60°C for 3 days to obtain 10-12% moisture content, the dried leaves are mashed in a blender to obtain *Indigofera* leaf flour.

2.2.2. The turmeric rhizome is washed and thinly sliced and then dried in an oven at 60% for two days, after the water content has dropped, the turmeric is then mashed in a blender to get turmeric flour.

2.2.3. The number of cages used is 20 units with the type of mapped cages, each unit is equipped with a 5 watt incandescent lamp as a heater, 500 g of feed pot and 500 ml of drinking water. Before the cage and equipment are used, cleaning and spraying disinfectants are carried out.

2.2.4. The feed used is feed for domestic chickens in the grower phase and is a mixture of several feed ingredients in the form of corn, bran, soybean meal, *Indigofera zollingeriana* leaf shoot flour, fish

meal, turmeric flour, premix, DCP, CaCO₃, lysine, methionine and drinking water given ad libitum. The nutritional composition of feed ingredients can be seen in Table 1.

Table 1. Composition of Feed Ingredients Nutrients

Feed ingredients	EM (Kkal/Kg)	Nutrient Content						
		PK (%)	SK (%)	LK (%)	METH (%)	LY (%)	Ca (%)	P (%)
Corn	3291.27	9.88	5.70	1.79	0.18	0.06	0.02	0.60
Rice Bran	2730.00	13.40	11.50	5.10	0.30	0.42	0.2	2.50
Soybean Meal	2191.31	41.24	3.55	3.30	0.80	2.95	0.27	1.21
Indigofera Meal	2617.41	27.18	10.00	6.26	0.67	2.05	0.13	0.58
Fish Meal	3233.88	36.32	0.16	0.52	0.66	2.11	7.19	2.88
Premix	-	-	-	-	0.3	0.3	-	-
DCP	0.00	0.00	0.00	0.00	0.00	0.00	16	21.00
CaCO ₃	0.00	0.00	0.00	0.00	0.00	0.00	39	0.04
L-Lysin	0.00	62.00	0.00	0.00	0.00	99.00	0.00	0.00
DL-Metionin	0.00	58.78	0.00	0.00	99.00	0.00	0.00	0.00

Turmeric flour as much as 2.50% as a feed additive [6]

Source: Near Infra Red (NIR) Test Results of Feed Chemistry Laboratory. 2020

2.2.5. This study used 80 domestic chickens with a uniform body weight and placed directly randomly in a prepared cage by dividing into 4 treatments and 4 replications. Each replication consisted of 4 native chickens. Maintenance of native chickens in the grower phase from 9 weeks to 13 weeks of age.

2.2.6. Data were collected every week during the study for 4 weeks. Every week the amount and remaining rations are weighed to calculate the ration consumption. Weighing the body weight of the chickens is done every week starting at 9 weeks to 13 weeks of age to determine body weight gain. The feed conversion ration calculation is done by comparing ration consumption with body weight gain.

2.3. 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

3. Results and Discussion

The average results of performance and consumption of crude protein and consumption of crude fiber in grower phase chickens by substituting soybean meal with *Indigofera zollingeriana* topping flour and the use of turmeric flour as a phytobiotic can be seen in Table 2 and the results of the response test can be seen in Table 3.

3.1. Feed Intake

Table 3 shows that the substitution of soybean meal with *Indigofera zollingeriana* flour in the feed has a significant effect ($P < 0.05$) on the consumption of native chicken feed in the grower phase. The highest feed consumption was found in treatment R1 (basal feed + 10% *Indigofera* flour + 2.5% turmeric flour) with a value of 421.13 ± 36.94 g/bird/week compared to other treatments. Based on research conducted by [9] the average value of domestic chicken feed consumption ranges from 42-43 g/bird/day or equivalent to 294 g/bird/week. This value is in line with research [10] which showed that domestic chicken feed consumption ranged from 42.49 to 44.31 g/bird/ day.

Table 2. Average Performance, Consumption of Protein and Fiber in Grower Phase

treatment	Parameters				
	Feed intake (%)	Body weight gain (%)	Feed conversion ratio (%)	Protein consumption (%)	Fiber consumption (%)
R0	300.51 ± 31.03	88.43 ± 25.15	4.46 ± 0.73	15.26 ± 1.57	2.30 ± 0.23
R1	421.13 ± 36.94	187.18 ± 35.27	2.65 ± 1.18	23.70 ± 2.77	2.86 ± 0.33
R2	315.12 ± 28.47	133.12 ± 38.58	2.92 ± 1.20	18.79 ± 1.69	3.92 ± 0.35
R3	297.89 ± 51.01	128.43 ± 22.15	3.28 ± 1.14	18.92 ± 3.23	4.21 ± 0.72

Information : R0 (control feed). R1 (basal feed + 10% flour *Indigofera zollingeriana* + 2.5% turmeric flour). R2 (basal feed + 15% flour *Indigofera zollingeriana* + 2.5% turmeric flour). R3 (basal feed + 20% flour *Indigofera zollingeriana* + 2.5% turmeric flour)

Table 3. Response Test Performance. Protein and Fiber Consumption

Source of Diversity	Sum of square	Df	Mean square	F	Sig.
Feed Intake					
Linear	2.594.414	1	2.594.414	1.525	.240
Kuadratik	19.002.622	1	19.002.622	11.173	.006
Kubik	19.896.694	1	19.896.694	11.698	.005
Body Weight Gain					
Linear	869.551	1	869.551	.902	.361
Kuadratik	10.699.316	1	10.699.316	11.096	.006
Kubik	8.175.957	1	8.175.957	8.479	.013
Protein Consumption					
Linear	66.430	1	66.430	1.254	.285
Kuadratik	622.253	1	622.253	11.743	.005
Kubik	607.753	1	607.753	11.470	.005
Fiber Consumption					
Linear	82.540	1	82.540	45.102	.000
Kuadratik	.640	1	.640	.350	.565
Kubik	2.843	1	2.843	1.553	.236

Based on the results obtained, the value of feed consumption in this study is higher than some previous studies. The high consumption of feed is caused by the level of palatability of native chickens to the given treatment feed. According to [11] the amount of feed consumption is influenced by the palatability of the feed (taste, smell and shape), the way of feeding and the condition of the chicken. This is made clear by [12] that feed consumption can be influenced by the quality and quantity of feed, age, livestock activity, feed palatability, production levels and management.

The lowest feed consumption was found in treatment R3 (basal feed + 20% *Indigofera* flour + 2.5% turmeric flour) with a value of 297.89 ± 51.01 g/bird/week. The low feed intake in treatment R3 was caused by the high crude fiber content and the low level of palatability in the treated feed. In accordance with the opinion of [13] which states that the crude fiber content will reduce the availability of energy and food substances and will affect the speed of flow of food ingredients in the digestive tract which results in reduced efficiency of nutrient use.

Feed that contains high crude fiber cannot be fully digested and will cause a full fast cache which results in limited feed consumption. This is in accordance with the opinion of [14] who states that the high crude fiber content in the ration will make the chicken feel full quickly because crude fiber is bulky and will expand when exposed to water.

Based on the results of the response test for feed consumption in Figure 1. the relationship between the cubic equation $Y = 0.197x^3 - 7.2091x^2 + 64.187x + 300.52$ is obtained, $R^2 = 1$ from the equation.

10% *Indigofera zollingeriana* flour and the addition of 2.5% turmeric flour are able to produce feed intake of 421.13 g/bird/week. The R2 value indicates that 100% of body weight gain is influenced by *Indigofera zollingeriana* flour and the addition of turmeric flour.

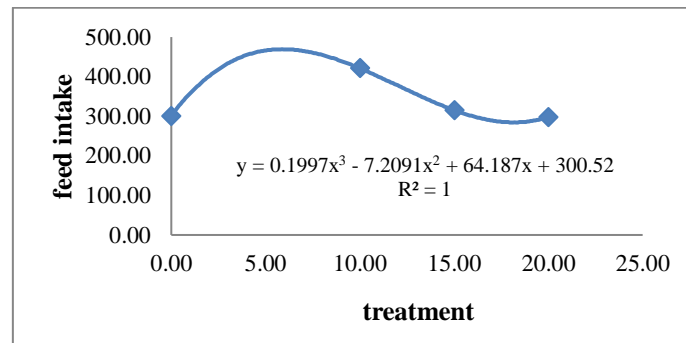


Figure 1. Graph of Feed Intake

3.2. Body Weight Gain

Table 5 shows that the substitution of soybean meal with *Indigofera zollingeriana* flour in the feed had a significant effect ($P < 0.05$) on the body weight gain of native chickens in the grower phase. The increase in body weight of native chickens in treatment R1 (basal feed + 10% *Indigofera* flour + 2.5% turmeric flour) obtained the highest yield, namely 187.18 ± 35.27 g/bird/week. This is in accordance with research conducted by [15] which states that the average weight gain of chickens ranges from 128.40-512.85 grams. The high body weight gain in treatment R1 was caused by the high value of domestic chicken ration consumption in the same treatment.

The value of body weight gain in the grower phase in Table 5 is the lowest in treatment R0 (control feed), namely 88.43 ± 25.15 g/bird/week. According to [16] that one of the factors affecting the height and weight of chicken body weight gain is the consumption of feed and the fulfillment of nutritional needs in chickens, so body weight gain should have a positive correlation with feed consumption.

One of the factors that influence body weight gain is feed consumption. This is in accordance with the opinion of [17] that the factors that affect body weight gain are gender differences, feed consumption, environment, seeds and feed quality. This was also stated by [18] stated that body weight gain is closely related to feed. in terms of quantity related to feed consumption, if feed consumption is disturbed, it will interfere with chicken growth.

Based on the results of the response test for body weight gain in Figure 1, the relationship between the cubic equation $Y = 0.1183x^3 - 4.3375x^2 + 41.417x + 88.437$, $R^2 = 1$ shows that 10% *Indigofera zollingeriana* flour and 2.5% addition of turmeric flour are able resulted in a body weight gain of 187.18 g/bird/week. The R2 value shows that 100% of body weight gain is influenced by *Indigofera zollingeriana* flour and the addition of turmeric flour.

3.3. Feed Conversion Ratio

Table 5 shows that the substitution of soybean meal with *Indigofera zollingeriana* flour in the feed has a significant effect ($P > 0.05$) on the feed conversion of native chickens in the grower phase. Conversion of native chicken feed grower phase in treatment R0 (control feed) obtained a higher yield, namely 4.46 ± 0.73 compared to other treatments. The high rate of feed conversion in treatment R0 was influenced by low weight gain but relatively high consumption. This is in accordance with the opinion of [19] which states that feed conversion is a reflection of the amount of feed consumed and the increase in body weight of an animal.

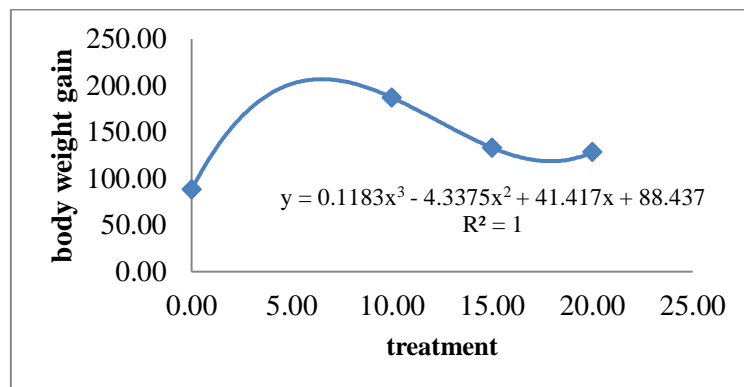


Figure 2. Graph of Body Weight Gain

The lowest feed conversion was found in the R1 treatment (basal feed + 10% *Indigofera zollingeriana* flour + 2.5% turmeric flour) with a value of 2.65 ± 1.18 , the lower the feed conversion, the more efficient livestock maintenance. [20] added that the level of feed conversion is largely determined by the content of food substances, especially protein and amino acids contained in the feed. In addition, [21] stated that the factor of feeding, lighting also plays a role in influencing feed conversion. the rate of feed travel in the digestive tract, the physical form of the feed and the nutritional composition of the feed. A part from that stated by [22], factors that influence feed conversion are feed quality, age and strain.

[23] states that feed conversion is the ratio of the amount of feed consumption in one week with the body weight gain achieved that week. if the ratio is small it means that the chicken body weight gain is satisfactory or the chicken eats efficiently. A high feed conversion value indicates the amount of feed needed to increase body weight and a lower feed efficiency.

4. Conclusion

Based on the results of the research that has been carried out. it can be concluded that the substitution of soybean meal with *Indigofera zollingeriana* flour and the addition of turmeric is the most efficient in optimizing performance, consumption of crude protein and crude fiber is the treatment R1 (basal feed + 10% *Indigofera zollingeriana* flour + 2.5 % turmeric flour).

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