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Effects Of Dietary Rucah Fish Meal On The Digestive Organ Weight Of Native Chickens

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ABSTRACT

BACKGROUND AND OBJECTIVES

Native chickens are local poultry with high economic value; however, their productivity remains relatively low, making nutritional improvement particularly from protein sources essential. Trash fish or discarded fish or rucah fish meal has potential as an alternative feed ingredient due to its abundant availability, lower cost, and high protein content. Its utilization may reduce production costs without compromising feed nutritional quality. This study aimed to evaluate the effect of rucah fish meal inclusion in the diet on the digestive organ weights of native chickens.

METHODS

The experiment was conducted at the Livestock and Forage Cultivation Laboratory, Faculty of Animal Science, Universitas Jambi, using 200 native chickens. A completely randomized design with five dietary treatments and four replications was applied. The treatments consisted of different inclusion levels of rucah fish meal: P0 = 12%, P1 = 14%, P2 = 16%, P3 = 18%, and P4 = 20%, with four replications per treatment. The observed parameters included feed intake, slaughter weight, relative weight of the gizzard, relative weight of the pancreas, and relative weight of the liver. Data were analyzed using analysis of variance (ANOVA), and parameters showing significant effects were further analyzed using Duncan's multiple range test.

FINDINGS

The results indicated that the inclusion of rucah fish meal up to 20% in the diet had no significant effect on feed intake, slaughter weight, relative gizzard weight, relative pancreas weight, or relative liver weight of native chickens.

CONCLUSION

Rucah fish meal can be included in native chicken diets at levels of up to 20% without adversely affecting the performance of digestive organs as reflected by organ weights.

Keywords: Diet; Digestion; Native Chicken; Rucah Fish Meal; Weight

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INTRODUCTION

The native chicken industry plays a strategic role in providing animal protein while also serving as a source of income for small-scale farmers. However, high feed costs, which account for approximately 70–80% of total production expenses, remain a major constraint in improving the efficiency of smallholder poultry farming (1). One of the primary challenges in feed formulation is the increasing price of conventional feed ingredients such as corn and commercial fish meal, resulting from price fluctuations and limited supply. Consequently, production cost reduction can be achieved by utilizing alternative feed ingredients that do not compete with human food, possess adequate nutritional value, are readily available, and are more economical (2). One alternative feed ingredient with high potential for inclusion in native chicken diets is rucah fish meal, which originates from fisheries by-products and contains high protein levels, making it a promising alternative protein source to reduce feed costs without compromising dietary nutritional quality.

Rucah fish refers to small marine fish commonly caught as incidental or low-value catches, which are not intended for human consumption and have limited market demand (3). These fish are by-products of fishing activities and are often underutilized economically during certain seasons, with a considerable portion being discarded back into the sea. From a nutritional perspective, rucah fish still contain high protein levels, ranging from 54.80 - 70.60% on a whole-body basis, and fat contents between 0.96 - 6.31% (3). The utilization of rucah fish as an alternative feed ingredient may serve as an effective strategy to reduce production costs while optimizing the use of underutilized resources (4). A study by (5) reported that the inclusion of 12% rucah fish meal in local chicken diets significantly improved body weight gain and feed efficiency. The development of the digestive system is closely related to the type and quality of feed provided. According to (6), feed intake can have a significant impact on digestive organ health and function. Digestive organs play a crucial role in nutrient absorption in poultry; improved digestive organ function enhances nutrient absorption efficiency, thereby contributing to increased body weight gain. This finding is consistent with the report of (7), who stated that body weight gain is influenced by the development of digestive organs, digestive system function, and nutrient absorption capacity.

The digestive tract plays a vital role in the digestion and absorption of nutrients, particularly protein, which is essential for tissue formation. Other nutrients also influence digestive organ performance, which can be evaluated through digestive organ weights. According to (8), abnormalities in digestive organs are usually characterized by unusual changes in organ shape and color. The main organs involved in digestion and metabolism in poultry include the liver, gizzard (ventriculus), and pancreas. The liver functions in the metabolism of fats, carbohydrates, proteins, vitamins, and minerals, as well as in detoxification and the excretion of metabolic waste products (9). The gizzard is a muscular organ that plays a key role in the mechanical grinding of feed by reducing particle size to facilitate digestion (10). The pancreas contributes to digestion by secreting various enzymes, including amylase, lipase, protease, and other proteolytic enzymes, as well as sodium bicarbonate, which aid in the digestion of carbohydrates, proteins, and fats (11).

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The inclusion of rucah fish meal in native chicken diets has been reported to support growth performance and feed efficiency. However, most previous studies have primarily focused on production parameters such as body weight gain, feed conversion, and carcass characteristics, while information regarding the effects of high inclusion levels of rucah fish meal on the physiological condition of digestive organs remains limited. Evaluation of digestive organs, such as the gizzard, pancreas, and liver, is essential as an indicator of safety and physiological adaptation of chickens to changes in dietary protein sources. Therefore, this study offers novelty by evaluating the effects of rucah fish meal inclusion up to 20% In the diet on the relative weights of digestive organs in native chickens. This study aimed to determine whether the use of rucah fish meal at these levels can be safely applied without causing disturbances to digestive organs, thereby providing a scientific basis for the sustainable utilization of rucah fish meal as an alternative feed ingredient for small-scale native chicken farmers.

RESEARCH METHOD

Research Time and Materials

This study was conducted at the experimental poultry facility of the Faculty of Animal Science, Universitas Jambi. The experiment lasted for eight weeks, starting from day-old chicks (DOC) until the end of the rearing period. The experimental animals consisted of 200 native chickens at one day of age, unsexed, with an average initial body weight of 42.4 g and a coefficient of variation of 7.48%. The chickens were reared in a floor pen system under standardized management practices, sanitation, and controlled environmental conditions. The main feed ingredient used in this study was rucah fish meal, obtained from local fishermen in Tanjung Jabung Timur Regency, Jambi Province, Indonesia. The rucah fish consisted of various by-product fish species commonly found in coastal fisheries, including *Selar crumenophthalmus, Spratelloides gracilis, Ilisha elongata, Trichiurus lepturus, Anodontostoma chacunda, Parastromateus niger, Leiognathus equulus, and Chirocentrus dorab* (Figures 1–10).

Figures 1. *Selar crumenophthalmus*

Figures 2. *Spratelloides gracilis*

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Figures 3. *Ilisha elongata*

Figures 4. *Trichiurus lepturus*

Figures 5. *Ilisha elongata*

Figures 6. *Anodontostoma chacunda*

Figures 7. *Parastromateus niger*

Figures 8. *Ilisha elongata*

Figures 9. *Leiognathus e*

Figures 10. *Chirocentrus d.*

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Feed Ingredients and Nutrient Composition

The standard nutritional requirements of native chickens used as a reference for diet formulation are presented in Table 1 (12), as follows:

Table 1. Nutritional requirements of native chickens

No	Age (weeks)	Crude Protein (min) (%)	Crude Fat (min) (%)	Crude Fiber (max) (%)	Ash (max) (%)	Metabolizable Energy (min) (kcal/kg)
1.	0-4	19	3	7	8	2,900
2.	4-20	14	3	8	8	2,500

source: (12)

The composition of the experimental diets used for each treatment during the study is presented in Table 2, as follows:

Table 2. Composition of Experimental Diets (%)

No	Feed Ingredients	P0	P1	P2	P3	P4
1.	Yellow Corn Flour	43.5	43.5	43.5	43.5	43.5
2.	Coconut Meal	12	12	11	11	11
3.	Rucah Fish Meal	12	14	16	18	20
4.	Soybean Meal	13	11	10	8	6
5.	Rice Bran	15	15	15	15	15
6.	Vegetable Oil	2	2	2	2	2
7.	Lysine	0.5	0.5	0.5	0.5	0.5
8.	Methionine	0.5	0.5	0.5	0.5	0.5
9.	Herbal Premix*	1	1	1	1	1
10.	Calcium Carbonate ($CaCO_3$)	0.5	0.5	0.5	0.5	0.5
	Total	**100**	**100**	**100**	**100**	**100**

Note:*The herbal premix was produced by PT Cipta Ternak Sehat Indonesia, Kediri, Indonesia, and contains amino acids, multivitamins, Languatis rhizome, Curcuma rhizome, Andrographidis herba, Alstoniae cortex, Zingiberis rhizome, and garlic.P0 = diet containing 12% rucah fish meal; P1 = diet containing 14% rucah fish meal; P2 = diet containing 16% rucah fish meal; P3 = diet containing 18% rucah fish meal; P4 = diet containing 20% rucah fish meal.*

The nutrient composition of each feed ingredient used in the experimental diets is presented in Table 3, as follows:

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Table 3. Nutrient Composition of Feed Ingredients

No.	Feed Ingredients	DM (%)	Ash (%)	CP (%)	CF (%)	Fat (%)	NFE	ME (kcal/kg)
1.	Yellow Corn Flour	87.83	1.44	15.77	5.31	2.59	62.73	4,858
2.	Coconut Meal	92.69	4.54	16.67	7.62	7.80	56.07	5,482
3.	Rucah Fish Meal	91.36	28.28	56.15	3.00	3.40	0.54	3,722
4.	Soybean Meal	87.45	7.62	49.08	0.31	2.22	28.22	5,001
5.	Rice Bran	90.89	16.20	12.27	17.91	0.70	43.82	4,318
6.	Vegetable Oil	-	-	-	-	-	-	8,600

***Note**: Laboratory analysis results of the Faculty of Animal Science, Universitas Jambi, 2025.*

The calculated nutrient content of the experimental diets based on diet composition and the nutrient values of each ingredient is presented in detail in Table 4, as follows:

Table 4. Nutrient Composition of Experimental Diets

No.	Nutrient Component	P0	P1	P2	P3	P4
1.	Dry Matter (%)	85.29	85.37	85.48	85.48	85.56
2.	Ash (%)	7.98	8.40	8.84	9.25	9.67
3.	Crude Protein (%)	23.82	23.96	24.43	24.57	24.71
4.	Crude Fiber (%)	6.31	6.36	6.34	6.40	6.45
5.	Crude Fat (%)	2.86	2.89	2.85	2.88	2.90
6.	Nitrogen-Free Extract	44.32	43.77	43.01	42.38	41.83
7.	Metabolizable Energy(kcal/kg)	3,398.4	3,379.9	3,357.8	3,339.3	3,320.8

***Note**: Calculated based on the multiplication of the values presented in Tables 2 and 3.*

Research Design

A completely randomized design (CRD) was applied in this study, consisting of five dietary treatments with four replications. Each replication included ten birds, resulting in a total of 20 experimental units. The treatments were defined by different inclusion levels of rucah fish meal in the diets, as follows:

- P0: Diet containing 12% rucah fish meal
- P1: Diet containing 14% rucah fish meal
- P2: Diet containing 16% rucah fish meal
- P3: Diet containing 18% rucah fish meal

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- P4: Diet containing 20% rucah fish meal

Data Collection

The observed parameters included feed intake, slaughter weight, relative gizzard weight, pancreas weight, and relative liver weight. Feed intake (g/bird) was recorded weekly by calculating the difference between the total amount of feed offered at the beginning of the week and the remaining feed at the end of the week. The resulting value was then divided by the number of birds in that week to obtain the average feed intake per bird. Slaughter weight was determined by weighing the chickens prior to slaughter after approximately 8 hours of fasting and was expressed in g/bird. Relative gizzard weight was calculated as the ratio of gizzard weight to slaughter weight and expressed as a percentage. Relative pancreas weight was obtained by dividing the absolute pancreas weight by slaughter weight and expressing the result as a percentage. Relative liver weight was calculated as the ratio of absolute liver weight to slaughter weight and expressed as a percentage.

Data Analysis

Data analysis was conducted in accordance with the research objectives, which aimed to evaluate the effects of rucah fish meal inclusion in the diet on feed intake, slaughter weight, and the relative weights of digestive organs (gizzard, pancreas, and liver) of native chickens. The data were analyzed using analysis of variance (ANOVA) based on a completely randomized design. When the analysis of variance indicated significant differences among treatments ($P < 0.05$), Duncan's multiple range test (DMRT) was applied to determine differences among treatment means.

RESULTS AND DISCUSSION

Feed Intake

The results of feed intake observations of native chickens under different dietary treatments are presented in Table 5, as follows:

Table 5. Average Feed Intake (Mean ± SD)

No	Treatment	Feed Intake
1.	P0	266.95 ±54.45
2.	P1	258.32±47.63
3.	P2	266.83±41.57
4.	P3	266.52±36.39
5.	P4	270.78±58.37

The results showed that the inclusion of rucah fish meal in native chicken diets at levels of up to 20% did not significantly affect feed intake ($P > 0.05$), as presented in Table 5. The average feed intake of native chickens during the rearing period ranged from 258.32 to 270.78

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g/bird/week. The absence of differences in feed intake among treatments indicates that native chickens were able to adapt well to diets containing rucah fish meal at various inclusion levels. This finding suggests that diet palatability among treatments was relatively similar, despite the increased inclusion level of rucah fish meal in the diets.

These results are consistent with the findings of (5), who reported that the use of rucah fish meal as a protein source in native chicken diets did not significantly affect feed intake as long as dietary energy and protein balance was maintained. Similar results were also reported by (6) and (7), who stated that changes in dietary protein sources do not necessarily influence feed intake when the nutrient composition of the diets remains relatively uniform. Furthermore, (13) reported that feed intake in native chickens is more strongly influenced by energy balance, feed form, and feeding management than by the type of feed ingredients used in the diet.

However, feed intake observed in the present study tended to be lower than that reported by (14),who documented feed intake of 8-week-old native chickens ranging from 301.60 to 339.13 g/bird/week. This discrepancy may be attributed to differences in chicken age, diet composition, and physical form of the feed used. In addition, (2) reported higher feed intake in native super chickens fed diets containing fermented rice bran, indicating that fermentation of feed ingredients can enhance diet palatability. Therefore, the absence of differences in feed intake in the present study indicates that the inclusion of rucah fish meal up to 20% did not reduce the palatability of native chicken diets. With stable feed intake, farmers do not need to adjust feeding management or face the risk of reduced performance due to inadequate nutrient intake. This finding is particularly beneficial for small-scale farmers, as it allows the use of lower-cost alternative feed ingredients without disrupting normal feeding patterns of native chickens.

Slaughter Weight

The average slaughter weight of native chickens fed diets containing different levels of rucah fish meal is presented in Table 6, as follows:

Table 6. Average Slaughter Weight (Mean ± SD)

No.	Treatment	Slaughter Weight
1.	P0	810.63±197.31
2.	P1	783.13±209.92
3.	P2	696.88±191.39
4.	P3	792.50±129.31
5.	P4	839.38±222.25

The analysis of variance indicated that the inclusion of rucah fish meal in native chicken diets at various levels had no significant effect ($P > 0.05$) on slaughter weight (Table 6). Although no statistically significant differences were observed, a tendency toward higher slaughter weight was noted in treatment P4 (20% rucah fish meal). This trend suggests that rucah fish meal provides protein of sufficient quality to support tissue growth in native chickens. These results are

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consistent with the findings of (5), who reported that substituting commercial fish meal with rucah fish meal did not reduce the growth performance of native chickens. Other studies by (15) and (16) also reported that slaughter weight in native chickens is influenced by dietary protein quality; however, differences in protein sources do not always result in significant differences in slaughter weight when nutritional requirements are adequately met. This finding indicates that the protein contained in rucah fish meal is capable of fulfilling the essential amino acid requirements of native chickens.

The average slaughter weight observed in this study ranged from 696.88 to 839.38 g/bird, which was relatively lower than that reported by (15), who recorded slaughter weights of up to 875.85 g/bird. This difference may be attributed to the use of unsexed chickens in the present study, as male chickens generally exhibit faster growth rates than females. In addition, differences in slaughter age, rearing systems, and feeding management may also influence slaughter weight. From a practical perspective, these results indicate that the inclusion of rucah fish meal does not reduce the slaughter weight of native chickens and therefore does not negatively affect their market value. Moreover, the tendency for increased slaughter weight at the highest inclusion level suggests that rucah fish meal has the potential to replace part of more expensive conventional protein sources without compromising production output. Consequently, farmers can reduce feed costs without sacrificing harvest weight.

Relative Gizzard Weight

The relative gizzard weight of native chickens under each dietary treatment is presented in Table 7, as follows:

Table 7. Average Relative Gizzard Weight (Mean ± SD)

No.	Treatment	Relative Gizzard Weight
1.	P0	2.58±0.33
2.	P1	2.75±0.31
3.	P2	2.73±0.24
4.	P3	2.93±0.47
5.	P4	2.35±0.42

The analysis of variance showed that the inclusion of rucah fish meal in the diet had no significant effect ($P > 0.05$) on the relative gizzard weight of native chickens (Table 7). The average relative gizzard weight ranged from 2.35 to 2.93%. This finding indicates that increasing levels of rucah fish meal in the diet did not increase the mechanical workload of the gizzard. From a practical standpoint, these results suggest that the inclusion of rucah fish meal at levels of up to 20% is safe for the digestive system of native chickens and does not induce digestive stress. Therefore, farmers do not need to be concerned about digestive disorders or reduced feed efficiency resulting from changes in digestive organ structure, allowing rucah fish meal to be applied over the long term.

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These results are in agreement with (6) and (10), who stated that gizzard weight is more strongly influenced by the physical form of the diet and crude fiber content than by the protein source. In addition, (17) reported that the relative gizzard weight of native super chickens ranged from 2.82 to 3.27%, which is comparable to the values obtained in the present study. Relatively stable gizzard weights indicate that the experimental diets had similar texture and coarseness. According to (18), increased crude fiber levels in the diet may increase gizzard weight due to higher mechanical activity. Therefore, the absence of differences in gizzard weight in this study indicates that the inclusion of rucah fish meal up to 20% does not impose additional mechanical burden on the gizzard of native chickens.

Relative Pancreas Weight

The average relative pancreas weight of native chickens during the study is presented in Table 8, as follows:

Table 8. Average Relative Pancreas Weight (Mean ± SD)

No.	Treatment	Relative Pancreas Weight
1.	P0	0.28±0.10
2.	P1	0.25±0.06
3.	P2	0.38±0.10
4.	P3	0.33±0.05
5.	P4	0.33±0.10

The analysis of variance demonstrated that the inclusion of rucah fish meal in the diet had no significant effect ($P > 0.05$) on the relative pancreas weight of native chickens (Table 8). The average relative pancreas weight ranged from 0.25 to 0.38%. This result indicates that the use of rucah fish meal did not disrupt the physiological function of the pancreas in producing digestive enzymes. These findings are consistent with reports by (19) and (20), who stated that changes in diet composition do not necessarily affect pancreas weight as long as nutrient levels remain within the chickens' requirements. Furthermore, (21) reported that increases in pancreas weight are generally associated with enhanced enzyme secretion in response to differences in dietary nutrient composition.

The average pancreas weight observed in this study was slightly higher than that reported by (20), who recorded pancreas weights ranging from 0.26 to 0.29%. This difference may be related to variations in dietary protein levels and pancreatic metabolic activity in response to different protein sources. Nevertheless, the pancreas weights obtained in this study remained within the normal range and did not indicate any impairment of organ function. These findings are important for farmers, as they demonstrate that the inclusion of rucah fish meal does not disrupt digestive enzyme function. With normal pancreatic function maintained, nutrient digestion efficiency remains optimal, allowing farmers to utilize rucah fish meal without the risk of reduced digestive performance or compromised bird health.

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Relative Liver Weight

The results of observations on the relative liver weight of native chickens under different dietary treatments are presented in Table 9, as follows:

Table 9. Average Relative Liver Weight (Mean ± SD)

No.	Treatment	Relative Liver Weight
1.	P0	2.28±0.19
2.	P1	2.23±0.35
3.	P2	2.28±0.29
4.	P3	2.20±0.22
5.	P4	2.43±0.33

The analysis of variance showed that the inclusion of rucah fish meal in native chicken diets had no significant effect ($P > 0.05$) on relative liver weight (Table 9). The average relative liver weight ranged from 2.20 to 2.43%, which is within the normal range for native chickens. These results are consistent with reports by (22) and (23), who found that the relative liver weight of chickens ranged from 2.18 to 2.53%. In addition, (10) reported that increases in liver weight are generally associated with the presence of toxic substances or specific nutrients that stimulate increased metabolic activity in the liver. The absence of differences in relative liver weight in the present study indicates that rucah fish meal does not contain antinutritional or toxic compounds that could burden liver function.

Minor variations in liver weight among treatments may be related to differences in dietary protein and mineral content. According to (24), increased dietary protein and sodium chloride levels may elevate liver weight due to enhanced protein metabolic activity. However, in the present study, liver weights remained within the normal range, indicating that the inclusion of rucah fish meal up to 20% is safe for the liver health of native chickens. For farmers, these results provide assurance that the use of rucah fish meal does not compromise the health of metabolic organs. This is particularly important because liver health is directly associated with metabolic efficiency and disease resistance in poultry. Therefore, rucah fish meal can be utilized as an alternative feed ingredient without the risk of harmful substance accumulation that could reduce productivity.

CONCLUSION

The use of rucah fish meal as an alternative feed ingredient in native chicken diets can be applied at inclusion levels of up to 20% without reducing feed intake, growth performance, or the health of digestive and metabolic organs. These findings indicate that rucah fish meal possesses nutritional quality and acceptability comparable to conventional protein sources, making it a viable alternative feed ingredient in native chicken production systems. Scientifically, this study contributes to the advancement of animal nutrition knowledge, particularly in the utilization of non-conventional feed ingredients derived from fisheries by-products. The results reinforce the concept that substitution of animal protein sources does not necessarily exert negative effects on

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animal performance and physiological function, provided that dietary nutrient balance is maintained. Therefore, this study enriches the scientific literature related to more efficient and sustainable feed formulation strategies. From a practical perspective, the utilization of rucah fish meal has the potential to reduce feed costs and decrease the dependence of small-scale farmers on imported or high-priced commercial feed ingredients. This provides direct implications for improving production efficiency and supporting the sustainability of small-scale native chicken farming systems.

RECOMMENDATIONS

Based on the findings of this study, further research is recommended to evaluate the use of rucah fish meal at different growth phases of native chickens in order to determine optimal inclusion levels for each production stage. In addition, future studies should assess the effects of rucah fish meal on carcass quality and organoleptic characteristics of native chicken meat, so that its utilization can be evaluated not only in terms of production performance and organ health but also product quality.Further investigations are also recommended to explore the combination of rucah fish meal with feed processing technologies, such as fermentation or other physical treatments, to enhance nutrient digestibility and utilization efficiency. Moreover, economic analyses of rucah fish meal inclusion in native chicken diets should be conducted to determine cost efficiency and feasibility for application in smallholder farming systems. The use of rucah fish meal can be recommended as an alternative feed ingredient for small-scale native chicken farmers, particularly in regions with abundant fisheries by-products. This approach is expected to reduce feed costs and enhance the sustainability of poultry production, while maintaining balanced diet formulation in accordance with the nutritional requirements of native chickens.

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