



PERCENTAGE OF CARCASS AND INNARDS OF QUAIL (*coturnix-coturnix japonica*) WITH THE ADDITION OF *Lumbricus rubellus* FLOUR TO FEED

*Sri Suryaningsih Djunu, Ellen J Saleh, Arlan Igrisa

Animal Science Department, Agriculture Faculty, Gorontalo State University

*Correspondence Author: sdjunu@ung.ac.id

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Abstract: The study aimed to determine the percentage of Quail carcasses and giblets fed with earthworm meal in the feed ration. The research was carried out at the Quail livestock experimental enclosure, Jendral Sudirman Street, Gorontalo City, which was carried out from November 2023 to January 2024. Using the material as many as 125 Quail head aged 47 days. The feed Formula consists of yellow corn, bran, coconut cake, soy flour, fish meal, earthworm flour, coconut oil, calcium (Ca) and phosphorus (P) supplements and premixes. The experimental method used is a complete randomized design (RAL) 5 implementations, 5 replications. The feed consists of (P0) 0%, (P1) 2%, (P2) 4%, (P3) 6% and (P4) 8% earthworm flour. Research variables include the percentage of Carcass and giblets (heart, liver, gizzard and spleen) Quail livestock. The results showed that the use of earthworm meal 2-8% in Quail feed resulted in the percentage of carcass 68.23 - 70.01%, heart 1.02 - 1.25%, liver 1.95 - 2.65%, gizzard 2.93 - 3.13% and spleen 0.03 - 0.58%. The highest percentage of Quail carcass in the use of earthworm feed is 6%: 70.01%, the best percentage of giblets is in the heart organ 4 and 6%: 1.25%, liver 8%: 2.65%, gizzard 6%: 3.13% and spleen 4%: 0.58%.

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INTRODUCTION

Quail (*Coturnix-coturnix japonica*) is one type of poultry that has great potential for development because it provides a source of animal protein. Quail are very efficient in their maintenance because they require relatively little feed compared to other poultry and do not require a large area (Nusi et al., 2021). Growth is fast and short so less capital is required. In order for quail to grow and produce high production, they need to pay attention to nutrition in their ration. Quail farming in the starter phase requires higher protein, i.e. 22-24% and in the grower phase requires 20-22% protein.

The main food source needed is fish meal. Fish meal has high economic value because it contains 40-45% crude protein and is easily digested by quail. The price of fish meal is currently felt by quail farmers to be very expensive because most of it is still imported from abroad, and in addition local fish production cannot meet the large demand. To overcome this problem, it is necessary to look for alternative feed ingredients to replace protein sources that are easy to obtain and have not been utilized optimally, one of which is using earthworm flour (*Lumbricus rubellus*).

Earthworm meal is a source of animal protein that can be used as a replacement for some or all of conventional feed ingredients, because it contains better amino acids than fish meal. Earthworms contain 64-76% protein, apart from having high nutrition, earthworms are easy to obtain because many people cultivate them. The use of earthworm meal as feed for poultry has been reported, such as research by Hasyim, et al., (2023), that the effect of using earthworms in egg feed for laying hens can increase the best omega 3 content in the 10% addition treatment, namely 51.024 mg/l compared to without the addition of earthworm meal, namely 7.107 mg/l (control feed). Zulendra et al., (2010) reported that the use of earthworm flour as a feed additive to promote growth in broiler chickens resulted in improving performance, optimally increasing protein digestibility, improving livestock health and increasing the absorption of food substances. Some research on the use of earthworm meal in chickens has been reported, but not much has been reported for quail. Based on the description above, there is a need for research on the use of earthworms in quail feed to determine the carcass percentage and giblet percentage of quail.

MATERIALS AND METHODS

The research was carried out in a quail experimental pen, on Jendral Sudirman street, Gorontalo City from November 2023 to January 2024. The research used 100 quail animals aged 47 days, male and female (unsexed). The equipment used includes an analytical balance with a capacity of 5 kg with a scale of 0.01 g, a thermometer, a lamp and a wire ram. Battery model quail cage with length: 40 cm, width 30 cm with height 20 cm, totaling 25 plots, each plot occupied by 5 quail, each unit equipped with a place to feed and drink.

The ration used was a formulated ration, using feed ingredients consisting of ground yellow corn, rice bran, ground soybeans, coconut meal, fish meal, earthworm meal (*Lumbricus rubellus*), calcium and phosphorus supplements, coconut oil and premix. The ration was prepared according to the nutrient requirements for quail, using a ration with a metabolic energy content of 2800 kkl/kg, with a protein content of 24% (Table 1). Feeding was adapted first for 7 days.

Table 1. Composition of Feed Formulation

Feed Material	Treatments				
	P0	P1	P2	P3	P4
Yellow corn	47,5	47,6	46,2	48,1	48,0
Rice bran	2,0	2,0	1,0	1,0	1,8
Coconut kernel meal	4,0	4,0	5,0	5,0	5,0
Soy flour	36,3	36,0	35,7	34,1	33,5
Fish meal	8,0	6,0	4,0	2,0	0,0
Earthworm flour	0,0	2,0	4,0	6,0	8,0
Coconut oil	0,4	0,4	0,9	0,6	0,6
Ca & P supplements	0,8	1,1	1,4	1,8	2,1
Premix	1,0	0,9	1,8	1,4	1,0
Total %	100	100	100	100	100

Tabel. 2. Feed Nutrition Component

Feed Nutrition Component	Treatments				
	P0	P1	P2	P3	P4
Dry matter %	86,29	86,32	86,05	86,26	86,28
Protein %	24,22	24,33	24,39	24,12	24,19
Crude fiber %	4,74	4,75	4,75	4,70	4,77
Fat %	8,71	8,89	8,95	8,97	8,99
Ca %	0,91	0,90	0,91	0,96	0,98
P %	0,86	0,84	0,81	0,80	0,80
Metabolic energy Kkal/kg	2800,25	2800,33	2800,31	2800,44	2800,34

This research was an experimental study, using a completely randomized design, consisting of five treatments and five replications, namely: (P0) 0% earthworm flour, (P1) 2% earthworm flour (P2) 4% earthworm flour, (P3) 6% earthworm meal and (P4) 8% earthworm meal. The observed variables were: 1). Carcass percentage, calculated by carcass weight divided by live weight (weight at the time of slaughter) multiplied by 100% (Soeparno, 1998; Mastika, et al., 2016; Rupu, et al., 2022) and 2). Giblet percentage (heart, liver, gizzard and spleen), percentage of internal organs by weighing the weight of the heart, liver, gizzard and spleen then dividing by the slaughter weight multiplied by 100% (Halim et al., 2018).

RESULT AND DISCUSSIONS

The average carcass percentage and giblet percentage (heart, liver, gizzard and spleen of quail can be seen in Table 3.

Table 3. Average carcass percentage and giblet percentage (heart, liver, gizzard and spleen of quail (%))

Treatments	Average %				
	Carcasses	Heart	Liver	Gizzard	Spleen
P0	66,35	1,45	2,35 ^{ab}	3,05	0,04
P1	69,85	1,02	1,95 ^c	2,93	0,25
P2	68,95	1,25	2,18 ^{bc}	3,05	0,58
P3	70,01	1,25	2,25 ^{abc}	3,13	0,38
P4	68,23	1,15	2,65 ^{a4}	3,03	0,03

^{a,b,c} Different superscripts in the same column indicate a significant difference ($P < 0.05$)

Percentage of quail carcasses

The results showed that the percentage of quail carcasses yielded the highest results in a row, namely: 70.01 (P3), 69.85 (P1), 68.95 (P4) and 66.35% (P0). Based on the results of analysis of variance between feed treatments which were not significantly different ($P > 0.05$), the data showed that the addition of 2 to 8% earthworm meal in the ration did not significantly increase quail carcasses, this was due to the poor feed treatment (P0-P4). provided has balanced or almost the same nutritional content. Various factors influence quail carcass weight including age, sex, nutritional ration, growth rate and live weight (Ariqoh et al., 2019).

Feed that contains relatively the same nutrients means consumption is also relatively the same. If the consumption is the same, the live weight of quail will be relatively the same. Law et al., (2023) stated that the level of feed consumption affects the rate of growth and development of live weight of livestock because live weight is the result of the amount of feed consumed which is absorbed by the body. Herlinae et al., (2019) stated that there is a positive correlation between live weight and carcass weight, where the higher the live weight, the higher the carcass weight.

Providing 2 - 8% earthworm meal in the ration gave average results that were not much different from the results of research conducted by Ahdanisa et al., (2015), namely using male quail that were given different levels of protein in the feed ration, producing a carcass percentage of 68.25 - 72.07%. The level of protein in the feed will have a different effect on quail growth. A good ration for quail must contain balanced nutrition and meet needs. A deficiency of one of these nutrients can result in health problems and decreased productivity. Wahyu (1997) stated that protein is vital for poultry, its function is to repair damaged tissue, grow new tissue, supply amino acids and for feather growth. Research by Julendra et al., (2010) reported that the use of earthworm flour up to 1.5% in broiler chickens can improve performance, protein digestibility and animal health.

Percentage of giblet (heart) of quail

The highest percentage of giblet (heart) of quail was found in successive treatments: (P0) 1.45, (P2) and (P3) 1.25, (P4) 1.15 and (P1) 1.02%. Based on the results of analysis of variance, it showed that between treatments there was no significant difference ($P > 0.05$) in the percentage of heart weight. There was no significant difference between treatments. It is assumed that giving earthworm flour up to 8% did not have a negative effect on the body's digestibility and metabolism, especially affecting the working capacity of the heart. The percentage of quail heart weight from the research results was compared with research by Rahayu et al., (2020) that the percentage of quail heart weight given bitter melon fruit extract produced a lower value, namely 0.8 - 1%.

Energy for the heart's work is obtained from food substances that are eaten and circulated by blood cells that are pumped throughout the body by the heart. Heart size in this study was still within normal limits, i.e. 1.02 - 1.45%, both without treatment with the addition of earthworm

meal and with earthworm meal in the ration. According to Bintang et al., (2020) the heart weight of male quail can reach around 1.12% and female 1.15%. The research results show that the average heart percentage value was not much different from several research results that have been reported. The size of the heart weight is influenced by different body sizes. Heart weight depends on the type, age, size and work of the animal itself. Providing good quality rations does not result in metabolism which can affect the size of the heart, however, feed containing anti-nutrients can affect the size of the heart due to greater contraction of the heart's work.

Percentage of giblets (liver) of quail

The highest to lowest average percentages of quail liver were respectively P4 (2.65), P0 (2.35), P3 (2.25), P2 (2.18) and P1 (1.93%). Based on the results of analysis of variance, between treatments there was a significant difference ($P < 0.05$) in liver percentage, and the Duncans test results showed that treatment P0 was not significantly different ($P > 0.05$) from P3 and P4, but significantly different from P1, P2 and P3. Furthermore, P1 is not significantly different ($P > 0.05$) from P2 and P3, but is significantly different ($P < 0.05$) from P0 and P4.

In the P0 treatment ration without the use of earthworm meal, there was a percentage of fish meal of 8%, the composition of the ration did not have a significant effect on P4, it is suspected that earthworm meal has a fairly high protein content reaching 64-78% (Suhartina et al., 2018) higher than fish meal, namely 58%, contains complete amino acids and low fat content.

Between P1, P2 and P3 there is no significant difference ($P > 0.05$) in the percentage of quail liver, it is suspected that the presence of earthworm meal in quail rations does not contain toxic substances that harm liver function. When surgery was carried out and the internal organs were removed for observation, the condition of the liver from all feed treatments (P0 -P4) was normal, both in color, size and surface, smooth and undamaged. McLelland, (1990) stated that the factors that influence liver color, size, consistency are the nation, age and status of the same individual, if liver poisoning occurs, it will turn yellow. The color of the liver under normal conditions is reddish brown or brown.

Putnam, (1991) stated that the liver percentage ranges from 1.70 - 2.80% of live weight. From the research results, the percentage of quail liver ranged from 1.93 - 2.65% so it was still within normal limits. The average percentage of liver obtained was not much different from the research results of Arifin and Widiastuti (2016) who reported that quail fed commercial feed supplemented with protein and crude fiber from noni leaf flour obtained a liver percentage of 2.52 - 2.65%. The same thing was reported by Pradikdo et al., (2016) that the liver weight percentage of Bangkok quail was 2.31% and the liver weight of Bangkok-Local cross quail was 2.03%.

The function of the liver is to secrete bile to emulsify fat, neutralize toxins, store energy ready for use by glycogen and break down the remaining protein products which become uric acid which is excreted through the kidneys (Blakely and Bade, 1991).

Percentage of gizzard (Gizzard) quail

The average results of the percentage of quail gizzard with the highest to lowest values were P3 (3.13), P0 and P2 (3.05), P4 (3.03) and P1 (2.93%). Based on the results of analysis of variance, it was found that treatments P0 to P4 were not significantly different ($P > 0.05$). This is because the feed provided does not contain high levels of crude fiber. The treated feed contains crude fiber in the range of 4.70 to 4.77%, this is still within the Indonesian National Standard (SNI) range, the maximum standard for crude fiber for quail feed is 7%.

Halim et al., (2018) stated that the gizzard is an organ that functions to crush or grind incoming feed. In the case of grinding the process is assisted by grit, the size of the gizzard is influenced by the high or low levels of fiber in the feed. The increase in gizzard weight is not due to increased growth, but is caused by the heavy work of the gizzard organ in grinding the feed material into smaller particles, so that the increase in gizzard size is caused by the coarse fiber in the feed material.

The research results for the gizzard range were 2.93 - 3.13%, this result is higher than the research reported by Novita et al., (2016) which used katuk (*Sauropus androgynus*) leaf flour in quail feed resulting in a livestock gizzard weight of 1.52%. Similarly, in research by Halim et al., (2018), using a solution of Moringa leaves in quail feed for 35 days produced an average gizzard percentage of 2.54%.

Percentage of giblet (spleen) of quail

The results of the data on the addition of earthworm flour in feed on the spleen, the highest values were P2, namely (0.58), P3 (0.38), P1 (0.25), P0 (0.04) and P4 (0.03%) . The results of the analysis of variance test between treatments were not significantly different ($P>0.05$). It is assumed that the feed containing earthworms provided does not contain anti-nutrients or foreign objects that can cause swelling of the spleen. Ramdani et al., (2018) stated that the spleen can enlarge or shrink due to splenic activity or because the spleen is attacked by disease or a foreign object.

Bagus (2008) stated that the spleen has the function of filtering the blood, removing antigens that have been rejected. Factors that cause the spleen to enlarge or shrink include disease and the presence of foreign objects. If food substances contain toxic substances or contain anti-nutrients or disease, the spleen will form lymphocyte cells to form body antibodies (Pradikdo et al., 2016). It is further stated that the spleen is an organ that has a dark red color, which is found on the right side of the abdomen, where it connects the proventriculus and gizzard.

Quail spleen research results have a range of 0.03 - 0.38%. These results are not much different from the results of research by Pradikdo, et al (2016) using commercial feed on 2 types of quail resulting in a percentage of spleen in the Bangkok type quail of 0.08% and the Bangkok-Local cross type 0.07%.

CONCLUSION

The highest percentage of quail carcasses in the feed treatment using a mixture of earthworms was 6%: 70.01%, the best giblet percentage was in the heart 4 and 6%: 1.25%, liver 8%: 2.65%, gizzard 6%: 3.13% and spleen 4%: 0.58%.

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