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Effect of Tea Waste Supplementation in Feed on the Weight and Proportion of Liver and Pancreas in Male Quails

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Abstract: The purpose of this study is to ascertain how adding fermented tea waste utilizing EM4 to male quail meals affects the weight and proportion of the pancreas and liver. One hundred four-week-old male quails (Coturnix coturnix japonica) make up the material. In vivo experimental techniques and a completely randomized design (RAL) were used in the study. Basal feed (T0), basal feed + 2% fermented tea powder waste (T1), basal feed + 2% fermented tea granule waste (T2), and basal + plus 2% fermented tea leaf waste (T3) are the treatments that were put to the test. The weight and proportion of the pancreas and liver are the variables that are being observed. The variance analysis's findings demonstrated that the liver percentage of male quails was not significantly impacted by the addition of fermented tea waste with EM4 to the meal. On the other hand, it significantly affected the male quail's liver weight. T0 is substantially different from T2 and T3, and T1 is significantly different from T2 and T3, according to the results of the Honest Significant Difference (HSD) test on the weight of male quail liver. The variance analysis's findings indicate that the weight and proportion of the pancreas are not significantly impacted by the addition of fermented tea waste in any manner. This study concludes that the supplementation of fermented tea waste (both granules and leaves) in the feed of male quails increases liver weight in male quails.

Keywords: *Tea Waste; Fermentation; Male Quail; Liver Weight Percentage; Pancreatic Weight Percentage*

Introduction

Poultry productivity, including quail, is greatly influenced by the quality and composition of the feed given. Quail, or what is called "gemak" in Javanese, are considered wild birds, but quail are poultry that play an important role in producing eggs and meat (Krismiyanto et al., 2021). One effort to increase feed efficiency and physiological performance of poultry is through supplementation of alternative feed ingredients that are highly nutritious and environmentally friendly. Tea waste is a byproduct of tea beverage production.Kusmayadi et al., (2020), tea is divided into three forms: powder, granules, and leaves. The solid tea residue still contains various important compounds that are good for health, namely natural antioxidants. , state that the content of tea waste includes polyphenol compounds (gallocatechin gallate, epicatechin gallate, epigallocatechin, and epicatechin) as well as flavonoids myricetin, quercetin, and kaempferol, which provide strong antioxidants. Tea waste has the potential to be used as supplementary feed for poultry, with a dry matter content of 93.59%, organic matter of 88.08%, and crude protein of 19.63%, along with relatively high levels of tannins and crude fiber at 7.91% and 17.40%, respectively. Tea waste, which is a by-product of the tea processing industry, has great potential as a feed ingredient because its content has benefits in improving livestock health. However, the direct use of tea waste in feed has limitations due to the high crude fiber content and the potential for anti-nutritional compounds. The high crude fiber content in tea dregs can be reduced by fermentation. The fermentation used uses EM4.

Fermentation is an effective method to improve nutritional quality and reduce anti-nutritional compounds in tea waste. EM4 is a collection of cultures of various types of microorganisms such as photosynthetic bacteria, lactic acid bacteria (Lactobacillus sp), yeast (Saccharomyce sp) and Actinomycetes. These microorganisms play an important role in increasing the diversity and

population of microorganisms that support livestock health, growth and productivity. The application of fermented livestock medicine using EM4 has been shown to significantly increase poultry immunity, feed efficiency, productivity, carcass quality, meat aroma, and egg quality Mohamad et al., (2023). The fermentation aims to minimize anti-nutritional substances and crude fiber so that it can increase digestibility. This is due to the presence of microbes that break down complex components into simpler components, so that tea dregs become easier for livestock to digest.

The fermentation process can increase feed digestibility and provide secondary metabolite compounds that play a role in maintaining the physiological balance of animals, including vital organs such as the liver and pancreas. The digestive system is one of the internal organ systems that consists of a tract extending from the mouth to the cloaca, functioning as a place for intake, grinding, digesting, and absorbing nutrients, as well as expelling metabolic waste in the form of excreta. If the digestive organs develop well, it is hoped that livestock productivity will also be good. The provision of fermented tea waste feed with EM4 is expected to stimulate the development of internal organs, such as the liver and pancreas, so that nutrient absorption from the feed can occur optimally. The liver and pancreas have a connection to the digestive system through a duct that serves as a channel for excreting material from accessory organs into the digestive tract, which is essential for the smooth process of digestion. Pradikdo et al (2016),state that the liver has several functions, including the exchange of substances from proteins, fats, bile secretion, detoxification of toxic compounds, and excretion of metabolites that are no longer useful for the body. The function of the pancreas is to produce lipolytic, amylolytic and proteolytic enzymes. These enzymes play a role in breaking down fat, starch, protein and acidic substances in the digestive system. The presence of a healthy liver and pancreas will optimize quail productivity. Therefore, this study aims to evaluate the effect of fermented tea waste supplementation in feed on body weight and the percentage of liver and pancreas of male quail. The results of this study are expected to contribute to optimizing the use of tea waste as a sustainable feed additive in the livestock industry.

Materials and Methods

This research used 100 male quails aged 4 weeks, with 20 units each of cages, feeding stations, and drinking stations, as well as supporting equipment such as scales, thermometers, and tools for dissecting the quails. The research method uses an experimental approach with a Completely Randomized Design (CRD), which consists of four treatments: T0 (basal feed), T1 (basal feed + 2% fermented tea powder residue), T2 (basal feed + 2% fermented tea granule residue), and T3 (basal feed + 2% fermented tea leaf residue). Each treatment is repeated five times with randomization of pens and livestock, with each repetition consisting of 5 quails. The research was carried out in four stages. The first stage is the preparation of EM4 fermented tea residue, the second stage is the preparation of the cage, the third stage is maintenance, and the fourth stage is data collection.

The stage of producing fermented tea residue is carried out with tea residue in the form of powder, granules, and leaves that undergo the fermentation process. Tea ampers are the form of leaves before fermentation, which are cut into small pieces. The fermentation of tea waste is carried out with the formulation of 700 g of tea waste + 1 ml of EM 4 + 1 ml of molasses dissolved in 50 ml of water. Fermentation is carried out anaerobically at room temperature for 7 x 24 hours.

The preparation of the cage is carried out by sanitizing the cage and the equipment. Sanitation using formalin for the cages and disinfectants for the feeding and drinking areas, with the aim of maintaining cage cleanliness and breaking the development of microbes. The next step is to weigh the 4-week-old male quails before placing them in the cage to obtain their initial body weight. The quails were randomly placed in the cage, a preliminary assessment was conducted in the first week, and then the quails were raised and treated for 35 days. Feeding is done twice a day at a rate of 18 grams per animal per day at 6:00 AM and 4:00 PM. Drinking water is provided adlibitum.

Data was taken after the maintenance was completed. One unit of the repeat is sampled with one animal. The male quails used as samples were then slaughtered to obtain internal organs such as the liver and pancreas, which were subsequently weighed and their percentages calculated to determine the differences in weight and percentage of the liver and pancreas in the male quails under each treatment. The data obtained from all treatments were analyzed using variance analysis. (Anava). Further testing using the Honest Significant Difference Test (HSD) at 5%.

Results and Discussion

Weight of Liver

The average liver weight obtained during the study ranged from 1.854 ± 0.135 g to 2.361 ± 0.13 g, as shown in Table 1. This result differs from the opinion of Saraswati et al. (2015), which reported an average liver weight of quail at six weeks of age to be 3.5 ± 0.26. The age of quails has a significant impact on liver weight, as shown in the research conducted by Saraswati et al. (2015), which found that the highest liver weight in quails occurs at the age of three to four weeks.

Table 1. Liver Weight of Male Quail Given Fermented Tea Waste EM4 in Feed (g/bird)

Variable	Treatment			
	T_0	T_1	T_2	T_3
Liver Weight	2,022 ±0,257^{a}	1,854 ± 0,135^{ab}	2,361 ± 0,130^{c}	2,357 ± 0,454^{c}

Description: T0 = basal feed; T1 = basal feed + 2% fermented powdered tea waste with EM4; T2= basal feed + 2% fermented granulated tea waste with EM4; T3 = basal feed + 2% fermented tea leaf waste with EM4. Different superscripts indicate significantly different treatments (P<0.05).

The results of the variance analysis show that the use of EM4-fermented tea waste in feed has a significant effect (P<0.05) on the liver weight of male quails. One of the factors that affects liver weight is the varying consumption of tannins. Tannins, which are anti-nutritional substances, can be harmful to livestock if present in significant amounts. According to Kusmayadi et al., (2020), the high levels of tannins and crude fiber in tea waste can inhibit nutrient digestibility. The results of the Honest Significant Difference (HSD) test indicate that T0 is significantly different from T2 and T3, while T1 is significantly different from T2 and T3. These results show that the use of fermented tea waste with EM4 in granular and leaf forms in the feed significantly increases the liver weight of male quails compared to the control and powder forms. The treatment T1 is significantly different from T2 and T3, likely due to the higher feed consumption in quails given the fermented tea waste in granular and leaf forms, which increases their tannin intake compared to the powder form. The high tannin content in the feed will enhance liver performance. This is due to the nature of tannins, which protect proteins, making it difficult for them to be digested into amino acids. The impact on livestock due to excessively high tannin levels is the disruption of protein metabolism.

The weight of quail liver with the treatment of adding granular tea waste and leaves resulted in relatively similar and higher weights compared to powder. The increase in the weight of quail livers is due to the hard work of the liver. According to Mesah et al., (2024), the weight of the liver is influenced by the heavy workload of the liver and the amount of nutrient absorption. The increased liver weight due to the presence of tannins that inhibit protease enzymes causes the digestion of proteins into amino acids to be hindered, resulting in a low formation of amino acids. This is in accordance with , which states that in poultry, the provision of feed containing tannins at a level of 0.33% is not harmful. However, when the tannin levels in the feed reach 0.5% or more, it will start to have an impact, namely stunted growth, because tannins inhibit nitrogen retention and reduce the digestibility of amino acids that should be absorbed by the intestinal villi. Amino acids are then absorbed by the walls of the small intestine and enter the liver. One of the functions of the liver is to regulate the concentration of amino acids in the blood. Therefore, when the availability of amino acids from the absorption of the small intestine is low, the liver's performance increases in regulating

the formation and utilization of amino acids. The liver has several functions, including protein metabolism, fat metabolism, bile secretion, detoxification of toxic compounds, and excretion of metabolites that are no longer useful for the body.

Percentage of Liver

The average percentage of quail liver during the study was 1.441 ± 0.082 to 1.798 ± 0.172, as shown in Table 2. The percentage of male quail liver obtained during the study is not significantly different from the results of the research conducted by Pradikdo et al., (2016), where the percentage of quail liver ranged from 1.7% to 2.8% of body weight. The percentage of liver fed with fermented tea waste supplemented with EM4 increased compared to the control treatment.

Table 2. Percentage of Quail Liver Weight Given Fermented Tea Waste EM4 in Feed

Variable	Treatment			
	T_0	T_1	T_2	T_3
Percentage of Liver	1,618±0,173^{ns}	1,441±0,082^{ns}	1,798±0,172^{ns}	1,778±0,342^{ns}

Description: T0 = basal feed; T1 = basal feed + 2% fermented powdered tea waste with EM4; T2= basal feed + 2% fermented granulated tea waste with EM4; T3 = basal feed + 2% fermented tea leaf waste with EM4. ns = non-significant / has no significant effect.

The results of the variance analysis indicate that the use of EM4 fermented tea waste in male quail feed has no significant effect on liver percentage (P>0.05). One of the influencing factors is that the type of quail used is the same, so their growth is also relatively similar, resulting in their body weight being relatively the same. Therefore, the resulting percentages of the liver are not significantly different. The percentage of fat always corresponds with the body weight of livestock. Research by Sitorus & Telambanua (2021), indicates that the percentage of liver is influenced by live weight, with the same live weight in broiler chickens resulting in relatively similar liver percentages. The weight of the liver increases with age, but its percentage remains constant in relation to body weight. Therefore, in the results of the research conducted, the percentage of the liver obtained does not have a significant effect because the age of the male quails used is the same.

Weight and Percentage of Pancreas

The results of the study on the use of fermented tea waste in feed on the weight and percentage of male quail pancreas are presented in Table 3. The average weight of the quail pancreas during the study ranged from 0.259 ± 0.057 g to 0.329 ± 0.052 g. The results regarding the percentage of male quail pancreas fed with EM4 fermented tea waste are found in Table 3, with the percentage of pancreas ranging from 0.202 ± 0.047% to 0.249 ± 0.036%. The lowest percentage result can be seen from treatment T1, which involved feed supplemented with 2% fermented tea waste in powder form.

Table 3. Weight and Percentage of Quail Pancreas Given Fermented Tea Waste EM4 in Feed

Variable	Treatment			
	T_0	T_1	T_2	T_3
Pancreas Weight	0,274± 0,060^{ns}	0,259± 0,057^{ns}	0,329 ± 0,052^{ns}	0,311± 0,051 ^{ns}
Pancreas Percentage	0,219 ± 0,046^{ns}	0,202±0,047^{ns}	0,249±0,036^{ns}	0,234±0,035^{ns}

Description: T0 = basal feed; T1 = basal feed + 2% fermented powdered tea waste with EM4; T2= basal feed + 2% fermented granulated tea waste with EM4; T3 = basal feed + 2% fermented tea leaf waste with EM4.

The results of the variance analysis indicate that the use of powdered, granular, and fermented tea waste with EM4 in male quail feed has no significant effect on weight and pancreas percentage. One of the factors that influences this is the nutrient content of the feed materials that meets the needs of the quail. This is in accordance with Kuswandi et al., (2022), the fact that what influences the

weight of the pancreas is the increase in the performance of digestive enzyme excretion, and is also influenced by the nutritional content of the feed.

The nutrient content of the feed used is not much different from SNI (2006) on quail feed, namely the nutrient content of the feed is a maximum water content of 14%, a maximum ash of 8%, a minimum crude protein of 17%, a maximum crude fat of 7%, a maximum crude fiber of 7% and a minimum metabolizable energy of 2600 Kcal/kg. Providing feed that is in accordance with the nutrient needs in quail feed does not affect the secretion of enzymes by the pancreas so that the weight and percentage are within the normal range. Enzymes released by the pancreas are used to digest protein, fat and carbohydrates. Increased secretion of digestive enzymes produced by the pancreas can cause the weight of the pancreas to increase.

Conclusion

Supplementation of fermented tea waste in the form of granules and leaves can increase the liver weight of male quails, with the smallest liver weight observed in quails fed with fermented tea waste in powder form. However, the results for liver percentage, weight, and pancreas percentage using powdered, granulated, and leaf forms of fermented tea waste supplementation are relatively similar.

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