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Abstract. Beluntas (*Pluchea indica* L) contains several active alkaloid compounds, essential oils and flavonoids. The flavonoid content in Beluntas leaves can improve the digestive tract so that it can function optimally. This study aims to determine the effect of adding Beluntas leaf meal to the rations on the length of the small intestine, the weight of the small intestine and the rate of quail digestion. The study used a completely randomized design which consisted of 4 treatments, and 4 replications. The treatment consisted of P0 (rations without Beluntas leaf flour as control), P1 (rations + Beluntas leaf flour 1%), P2 (rations + Beluntas leaf flour 2%), and P3 (rations + Beluntas leaf flour 3%). The results showed that the treatment had a significant effect ($P < 0.05$) on the length of the duodenum and ileum, jejunum and ileum weight digest, as well as the digest rate but there, was no significant effect ($P > 0.05$) on the length of the jejunum and duodenal weight. Based on the results it can be concluded that the addition of beluntas leaf flour with level 2% improved duodenum and ileum, the weight of jejunum and ileum and made longer digest rate compared to other treatments.

1. Introduction

Beluntas leaves (*Pluchea indica* L), medicinal plants commonly used as natural feed additives (non-nutritive additives), contain compounds that are useful for the body [1]. This local plant, apart from functioning as a feed additive because it contains several active alkaloid compounds, essential oils and flavonoids, also has several biological activities, namely as anti-inflammatory, antipyretic, hypoglycemic, diuretic and various pharmacological activities [2].

Beluntas leaves have been widely used in poultry, including as a feed additive for duck productivity. and on duck performance [3,4]. The results of the study stated that the addition of beluntas leaf extract in broilers can increase ration consumption because the essential oil content in beluntas leaves can increase ration consumption and better absorption of food substances [5]. The flavonoid content in beluntas leaves can improve the digestive tract so that it can function optimally, maximizing the digestion process and absorption of nutrients, especially protein [6].

Japanese quail (*Coturnix coturnix japonica*) is a quail known as egg-producing quail. As quails get older, their continuous digestive activity will decrease the function of body tissues and digestion, causing tissue damage. Decreasing efficiency of feed use is related to disruption of digestive tract growth which can interfere with nutrient absorption [7].

The active flavonoids in beluntas leave function as antioxidants that can destroy and damage oxidants. This cell damage can be overcome by active substances from beluntas leaves including stabilizing the growth of the digestive tract which can be seen from the length and weight of the digestive tract organs [8].

The given rations affected the performance of the small intestine in absorbing nutrients. The use of flavonoids and essential oils found in beluntas leaves has been widely used to improve the performance of broilers, besides that beluntas leaves also contain antimicrobial substances that can stimulate the development of the digestive tract during the process of nutrient absorption, thereby increasing the weight and length of the small intestine and reducing the number of pathogenic microbes to support optimal physiological conditions in the digestive tract, so that the digestion process and the rate of digestion take place properly.

This study aims to determine the effect of adding beluntas leaf meal to the rations on the length of the small intestine, the weight of the small intestine and the rate of quail digestion. The usefulness of research is expected to be a source of information for the public, especially breeders in the use of beluntas leaf flour in rations as an effort to improve the absorption process of food substances in quails.

2. Materials and method

The study was conducted from December 2019 - February 2020. The manufacture of beluntas leaf flour and the preparation was conducted in Non-Ruminant Poultry Ration Laboratory, mixing feed and raising quail in Djion Quail Farm, Gowa Regency.

2.1.Material

The materials used were 64 unsexed quails, beluntas leaf flour, rations, Fe_2O_3, label, plastic samples and yarn. The tools used were the experimental cage, place feed and drink, analytical balances, sanitary kits, scales and rulers.

2.2. Method

This study used 64 Day Old Quail (DOQ) which were divided into 16 experimental units. Each experimental unit consisted of 4 unsexed quail reared for 35 days. The rations were given twice a day ad-libitum according to the treatment. The composition and nutritional content of quail rations aged 1-35 days can be seen in table 1. The experimental cages used were battery cages totalling 16 experimental units with a size of 25 x 12.5 x 50 cm made of wood and equipped with a place to feed and drink. Each experimental unit consisted of 4 quail. The cage was equipped with a 40-watt lamp and was placed in the middle which functions as a heating and lighting device.

The treatment arrangement consisted of 4 types of rations, namely: P0 = rations without beluntas leaf flour; P1 = rations with 1% beluntas leaf flour; P2 = rations with 2% beluntas leaf flour and P3 = rations with 3% beluntas leaf flour.

2.3. Parameter

The length of the duodenum is measured from the base of the gizzard to the bile duct, the jejunum is measured from the bile duct junction to Meckel's diverticulum, and the ileum is measured from Meckel's diverticulum to the bifurcated cecum. The percentage of the length of the small intestine segment can be obtained as follows. The weight of the small intestine (g) was intact and the weight of each segment (duodenum, jejunum, and ileum) was washed and its contents cleaned first, then weighed using analytical scales. Then the weight of the duodenum, jejunum, and ileum was expressed as a percentage (%) of the total weight of the small intestine, the percentage of small intestine weight can be obtained using as follows. Digestion rate measurements were carried out when the chicken was 35 days old, using the Fe_2O_3 indicator. One quail was taken per experimental unit, then put in a battery cage and given a treatment ration mixed with 0.5% Fe_2O_3 indicator. The indicator served to mark the start of the excreta collection as well as to measure the rate of the digest. Observing the digest rate was by seeing the red excreta first appeared according to the indicator color and recording the time. The digest rate value was

the time difference when the indicated ration was given when the indicated excreta first comes out then the average was calculated.

Table 1. Composition and nutritional content of quail rations at age 1-35 days.

Ingredient (%)	Feed treatment (%)			
	P0	P1	P2	P3
Bran	10	10	10	10
Soybean meal	22	22	22	22
Corn	50	50	50	50
Fish flour	8	8	8	8
Coconut cake	8	8	8	8
Coconut oil	1	1	1	1
Mineral	1	1	1	1
Total	**100**	**100**	**100**	**100**
Beluntas leaf flour (%)	0	1	2	3
The nutritional content of feed based on a calculation				
Metabolism energy (kcal/kg)	3,019	3,019	3,019	3,019
Crude protein (%)	20.25	20.25	20.25	20.25
Crude fiber (%)	4.12	4.12	4.12	4.12
Extract ether (%)	6.04	6.04	6.04	6.04

2.4. Statistical Analysis

The data obtained were analyzed for variance (ANOVA). Data that significant was followed by the Duncan test (Gasperzs, 1991) [9]

3. Results and discussion

The results of the research giving different levels of beluntas leaf flour to the length of the small intestine, the weight of the small intestine and the rate of digestion can be seen in table 2.

Table 2. Percentage of small intestine length, small intestine weight and quail digestive rate at 35 days.

Parameter	Treatment			
	P0	P1	P2	P3
Percentage of length				
Duodenum	10.56±0.19^{ab}	10.71±0.28^{b}	10.93±0.22^{b}	10.26±0.28^{a}
Jejunum	23.74±0.49	23.74±0.31	23.95±0.36	23.33±0.50
Ileum	20.64±0.62^{ab}	20.58±0.45^{ab}	21.19±0.37^{b}	20.14±0.42^{a}
Weight percentage				
Duodenum	1.45±0.19	1.53±0.10	1.62±0.11	1.44±0.06
Jejunum	1.55±0.12^{ab}	1.53±0.11^{ab}	1.71±0.12^{b}	1.44±0.07^{a}
Ileum	1.35±0.13^{a}	1.44±0.08^{ab}	1.44±0.05^{b}	1.52±0.08^{ab}
Digesta rate (minutes)	83.38±6.50^{ab}	85.22±5.31^{ab}	92.64 ± 7.82^{b}	79.75±0.63^{a}

^{abc}Different superscripts on the same row show significant differences (P<0.05), P0: rations without beluntas leaf flour (control), P1: rations + 1% beluntas leaf flour, P2: rations + beluntas leaf flour 2 %, P3: rations + 3% beluntas leaf flour

3.1 The small intestine length percentage

The results of variance showed that the treatment had a significant effect (P<0.05) on the percentage of duodenal and ileal length but had no significant effect (P>0.05) on the percentage of jejunum length. Table 3 showed that the percentage of duodenal and ileal lengths in treatment P0, P1 and P2 were not significantly different, but there was an increase in duodenal length with the addition of beluntas leaf flour to a level of 2% as well as the percentage of ileal length. This increase was likely due to the

flavonoids and essential oils contained in beluntas flour which were able to stimulate the development of the digestive tract and respond to growth and improve the microflora of the digestive organs.

Phenolic compounds found in beluntas flour such as flavonoids were some of the compounds that have antioxidant properties that increased the growth of the digestive tract organs so that the length and weight of the digestive organs increased optimally [8]. These antioxidants inhibited oxidation which destroyed oxidants [10]. The increase in digestion length showed the expansion of the field of nutrient absorption and the effectiveness of the absorption of food juices. The longer the jejunum, the greater the surface area of the villi for nutrient absorption [11]. Rations with the addition of beluntas leaf flour which contain antioxidants were thought to prevent pathogenic microorganisms in the quail's body so that the digestive organs were not disturbed.

The presence of microflora in the small intestine will affect the health and development of the small intestine and can increase nutrient absorption [12]. The flavonoid content in beluntas leaves can improve performance and be able to maximize the digestion process and nutrient absorption. The absorption of nutrients took place optimally if the intestines were healthy. The population of microbes and bacteria that live in the gut affected the health of the gut itself [6].

3.2 The small intestine weight percentage

The results of variance showed that the treatment had a significant effect ($P < 0.05$) on the percentage of jejunum and ileum weight but had no significant effect ($P > 0.05$) on the percentage of duodenal weight. The results of this study indicated that giving beluntas leaf flour to a level of 2% in quail rations increased the weight of the duodenum, jejunum, and ileum. The possibility of this was due to the flavonoids and essential oils contained in the ration up to a level of 2% which stimulated the development of the digestive tract. This was following the opinion of Sudarman *et al.,* (2011) that the flavonoid content in beluntas leaves improved the digestive tract and maximize the digestion process and nutrient absorption [6]. Besides that, Beluntas leaves have antimicrobial substances that stimulated the development of the digestive tract during the absorption of nutrients, thereby increasing the length of the intestine. This was in line with the opinion of Sulianti (2012) which stated that giving antimicrobial substances was expected to suppress the development of pathogenic microbes and increased beneficial microbes in the intestine [13].

In this study, it appeared that the weight of the duodenum and jejunum decreased with the addition of 3% beluntas leaf flour. This was probably due to an increase in crude fiber content which affected rations consumption that results in a decrease in protein consumption. The protein content of beluntas leaves will be used in the metabolic process to support the growth and development of the digestive tract [14]. Besides that, the essential oil in beluntas leaves increased the absorption of food substances [15].

3.3 Quail digest rate

The results of variance showed that giving Beluntas leaf flour (*Pluchea indica* L) had a significant effect ($P<0.05$) on the digest rate of quails. The rate of quail digest in this study has a positive correlation with the length of the digestive tract of the quail. The results showed that the longer the digestive tract (which consists of the duodenum, jejunum and ileum), the longer the digest flow through the digestive tract and vice versa.

The results showed that treatment with up to 2% of beluntas leaf flour in the ration was able to slow down the rate of digestion which would have an impact on the absorption of nutrients. Kusmayadi et al [16] stated that the slow digestion rate caused many nutrients to be digested and absorbed by the body so that the availability of nutrients for body tissue synthesis increases. Reference Agus (2007) added that the slow digestion rate allowed the enzyme to hydrolyze food for longer so that the absorption of food substances will be effective and the digestibility of the feed will increase [17].

The average rate of quail digest in this study ranged from 79.75–92.64 minutes or 1–1.5 hours, the duration of this digest rate was lower than that reported by Agus (2007) who stated that the rate of digestion in the digestive tract of poultry ranged from 2-4 hours [17]. Digestion rate in poultry was influenced by the type of livestock age, physical form, feed and consumption. Besides, the higher the

crude fiber content will slow down the digestion rate, the faster the digestion rate, the shorter the digestive process in the digestive tract [18]. The slow digestion rate allowed enzymes to hydrolyze food substances longer so that the absorption of food substances will be effective and the digestibility of the feed will increase. Increased digestibility can be caused by an increase in the capacity of the digestive organs. Therefore, the higher the crude fiber, the longer the intestine and the percentage of intestinal weight along with the relative length of the intestine. Utilization of crude fiber in digestion required a fermentation process whereas in poultry the process was limited so that feed ingredients containing high crude fiber, in general, will be difficult to use.

4. Conclusion

Based on the results of the research, it can be concluded that the addition of beluntas leaf flour up to 2% improved the condition of the small intestine and the rate of digestion was longer than other treatments.

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