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The level of market waste use of mustard greens (*Brassica pekinensis*) as duck feed

T D Nova* and R Zein

Department of Technology Animal Production, Animal Science Faculty, Universitas Andalas, Kampus Limau Manis, Unand, Padang, Indonesia Republic-23163.

E-mail: *tertial6unand@gmail.com

Abstract. Research to Determine the Effect of the level of vegetable waste in feed on duck production performance has been carried out in the experimental cages of Poultry Production, Faculty of Animal Science, Andalas University, West Sumatra Province. This study used 80 heads day-old ducks for ten weeks of class. The research design was a randomized block design (RBD) with five treatments and four replications. The treatments used were: treatment A: feed without chicory waste flour (control), B: feed + 10% chicory waste flour, C: feed + 15% chicory waste flour, D: feed + chicory waste flour 20%, E: feed + 25% chicory waste flour. The variables observed were energy intake, percentage of the carcass, and percentage of abdominal fat. Based on the research, the results showed that the addition of chicory waste flour had a very significant effect ($P < 0.01$) on energy intake and the percentage of abdominal fat for local male ducks but had no significant effect ($P > 0.05$) on the portion of local male duck carcass. It can be concluded that in this study, giving white mustard dregs flour in a ration of up to 25% can be used to reduce the percentage of local ducks

1. Introduction

The poultry industry has an excellent opportunity to become a resource-based industry because of the availability of feed raw materials, technology, and available support services. One of the poultry that is developing in Indonesia is the duck farming business. When compared with other poultry, ducks have advantages, including having good adaptability and resistance to disease. Besides, ducks have better efficiency in changing feed into meat [1]. Therefore, duck farming has a relatively smaller risk. Ducks in Indonesia usually produce eggs and meat. About 19% more of the need for eggs comes from duck eggs, however as a meat-producing poultry it is still low, namely 0.94% of the required [2]. Duck meat production in Indonesia increases every year, this is based on data recorded in 2015 that meat production reached 34,854 tons, in 2016 it was recorded at 41,866 tons, in 2017 meat production was recorded at 42,319 tons, in 2018 meat production reached 44,059 tons [3].

Feed ingredients are one of the production components in a poultry farming business, but feed improvement is a problem related to ration costs, which reach around 60% - 70% of production costs [4]. Therefore, it is necessary to make a new breakthrough in the world of animal husbandry, especially poultry, the use of expensive feed ingredients must be reduced by using alternative feed ingredients that are cheaper, easy to obtain, of good quality, and available continuously where their use does not compete with humans, however. has a good nutritional content. One of them is by utilizing market vegetable waste and those in the garden that have been harvest. Vegetable waste is part of vegetables that cannot



be sold and disposed of. One of the vegetable wastes is chicory. Chicory waste in Indonesia has not been widely used, such as cabbage which is sold in the market and not sold, is thrown away, even though the waste still contains nutrients needed by livestock. According to the results of the analysis of the IPB feed science and technology laboratory (2016) in [5], chicory waste contains 24.51% crude protein, 3.02% crude fat, 17.89% natural fibre, 39.0% BETN, and 22.48% ash, 1.11% Ca, 0.39% P, and energy 3339.37 Kcal/kg. The utilization of vegetable waste can be given in the fresh or processed form, as stated by [6]

Energy intake is assessed by the ration metabolic energy content in the ration multiplied by the amount of feed consumed. The energy needed by ducks for body tissue growth, egg production, carrying out physical activity, and maintaining average body temperature, comes from carbohydrates, fats and proteins in the feed. [7] state that energy requirements are above basic needs and growth will be stored as fat. Duck carcass is a part of the duck's body that is slaughtered and then separated from the stomach, head, neck, legs, hair, blood, and abdominal fat. [8] explains that carcass weight achievement is closely related to living weight and body weight gain. The availability of tissue-forming amino acids so that feed consumption is directly related to the growth process, therefore special attention is needed regarding the management of the use of feed ingredients containing sufficient protein in with the needs of poultry to meet the amino acid requirements of the poultry [9]. Chicory waste contains high enough protein to help increase duck carcass weight.

Abdominal fat is body fat stored in the abdominal cavity, including fat that protects the gall (Essay and Dawson, 1965) in [10]. Reduced feed energy or an increase in the percentage of protein will increase the growth rate and, therefore, will increase abdominal fat and the amount of fat density [11]. Abdominal fat is an unfavourable result because higher abdominal fat will affect the quality of the carcass, according to the opinion of [12] that the accumulation of abdominal fat is a waste of energy and is detrimental to carcass. After al carcass fat is removed during processing and is not liked by consumers. The accumulation of abdominal fat is influenced by several factors, namely the level of energy in the ration, age and gender [13]. In addition, another factor that also affects the weight of abdominal fat is crude fibre. Based on research by [14], The higher the crude fiber in the ration, the lower the belly fat in broiler chickens. Feeding using chicory waste flour in the ration can increase the crude fiber content. The results of [15] research that using chicory waste flour up to 20% showed promising results on the percentage of carcass and abdominal fat of broiler chickens. Compared to chickens, ducks have a higher tolerance for crude fibre or vegetable waste

2. Materials and methods

This research has been carried out experimentally in the UPT poultry production cage, Faculty of Animal Husbandry, Andalas University. The livestock used in this study were 80 male local ducks, the method used was a randomized block design with 5 treatments of 4 groups. The class of each block based on body weight, the treatment in this research was the administration of chicory waste (*Brassica pekinensia* L) with doses, namely: A feed (without chicory waste), B feed + 10% chicory waste, C feed + 15% chicory waste, D feed + 20% chicory waste and E feed + 25% chicory waste. The mathematical model and design used are according to [16] $Y_{ij} = \mu + \tau_i + \beta_j + \epsilon_{ij}$ Each cage unit is equipped with a place for feeding and drinking water. The feed used were laying ducks with a metabolic energy content of 2970,20 -3073,17 Kcal/Kg and crude protein 20,26 – 20,57 %

2.1. Making chicory waste flour

The chicory waste used is obtained from traditional markets around the city of Padang, separated from the rubbish that has stuck to it and is washed clean. Then the chicory waste is dried in the sun, after that it is autoclaved until the water content is gone. Then the chicory waste is ground into a fine like flour. the composition of the feed ingredients used consisted of corn, bran, soybean meal, fish meal, coconut oil, top mix, and mustard waste. The feed used in the first week was commercial feed mixed with the addition of chicory waste flour based on a predetermined composition

Table 1. Nutritional content and energy metabolism of feed ingredients in research.

Nutrition content	CP	Fibre	CL	Ca	P	ME
Corn ^a	9.55	3.80	2.18	0.38	0.33	3370
Rice bran ^a	10.60	10.84	4.09	0.70	0.09	1630
Fish flour ^a	51.00	2.80	1.52	5.55	2.60	2580
Soybean meal ^a	45.00	7.50	2.49	0.63	0.32	2240
Top Mix ^c	0.00	0.00	0.00	5.38	1.14	0.00
Palm oil ^a	0.00	0.00	100	0.00	0.00	8600
Mustard waste ^d	24.51	17.89	3.02	1.11	0.39	3339.37

Source: a) [17]; b) Analysis of laboratory analysis of non-ruminant livestock 2015; c) [18]; d) Analysis Results of the Laboratory of Feed Science and Technology, IPB 2016 in [5]

The nutritional composition and metabolic energy of feed in this study can be seen in Table 2. The feed given is in accordance with the standards at the growth stage. [19]

Table 2. The nutrient content and metabolic energy of the material making up the research ration (%).

Feed	Feed A	Feed B	Feed C	Feed D	Feed E
Corn	52.00	46.00	44.50	42.50	40.00
Rice bran	10.50	11.50	10.00	9.00	8.50
Fish flour	15.00	14.00	13.0	12,00	11.00
Soybean meal	20.00	16.00	15.00	14,00	13.00
Top Mix	0.50	0.50	0.50	0.50	0.50
Palm oil	2.00	2.00	2.00	2.00	2.00
Mustard waste	0.00	10.00	15.00	20.00	25.00
Total	100.00	100.00	100.00	100.00	100.00
CP	20.36	20.26	20.34	20.44	20.57
CL	4.66	4.72	4.72	4.74	4.75
Fibre	5.00	6.46	6.97	7.55	8.19
Ca	1.24	1.26	1.24	1.22	1.20
P	0.63	0.62	0.60	0.58	0.56
Metabolic Energy (ME) (Kcal/Kg)	2970.20	3002.14	3041.81	3073.17	

Note: The above results are calculated based on Table 1 and Table 2.

2.2. Providing feed and drinking water

Feeding ducks were done two times a day, namely in the morning (08.00 WIB) and evening (16.00 WIB). The remaining rations are collected and weighed every day. Gave provision of drinking water was given ad libitum. Cleaned cages, drinking places, and manure every day during the study, reared ducks for ten weeks.

2.3. Statistical analysis

According to the Randomized Block Design (RBD) pattern, analysis of variance if the results were significant, then continued with ANOVA analysis of variance according to procedures, according to [16].

3. Results and discussion

3.1. The Effect of the level of use of mustard waste on the energy intake of male local ducks.

In (Table 3) can see that the lowest average energy intake is four in treatment A (0% mustard greens), and the highest is in treatment E (25% mustard greens)

Table 3. Average energy intake / day, percentage of carcass and abdominal fat of local male ducks with the addition of chicory flour in the feed.

Treatment	Energy Intake (kcal/g)/day	Carcass (%)	Abdomen Fat (%)
A	265.23 ^D	62.83	1.51 ^A
B	268.1 ^C	63.76	0.65 ^B
C	271.4 ^B	65.78	1.68 ^A
D	276.1 ^A	65.46	0.72 ^B
E	275.5 ^A	62.42	0.64 ^B
SE	15.21	0.50	0.17

Note: Different superscripts show very significant differences ($P < 0.01$); SE = Standard error

Based on the analysis of variance, it shows that the treatment with different percentages of chicory flour showed a very significant result of energy intake in local male ducks. Continued with the DMRT test, found that treatment A (0% mustard greens) was very significantly different lower than treatment B (10% chicory flour), C (15% chicory flour), D (20% chicory flour), and E (25% chicory flour). Treatment B (10% chicory flour) was significantly different higher than treatment A (0% chicory flour), but very treatment C (15% chicory flour), D (20% chicory flour), and E (25% chicory flour). Treatment C (15% mustard greens) was very significantly different ($P < 0.01$) higher than treatment A (0% mustard greens) and B (10% mustard greens), but the difference was significantly lower than treatment. D (20% chicory flour) and E (25% chicory flour). Treatment D (20% chicory flour) was significantly different (higher than treatment A (0% chicory flour), B (10% chicory flour), and C (15% chicory flour). However, it was not significantly different from treatment E (25% Chinese mustard flour).

The low energy intake in treatment A (0% chicory flour), this is due to the lower metabolic energy content in treatment A (0% chicory flour) while the ration consumption is the same when compared to treatment B (10% chicory flour), C (15% chicory flour), D (15% chicory flour) and E (25% chicory flour). According to the opinion of [19], chickens will fulfil their energy as needed. If there is less energy in the ration, the chickens will eat more to meet their energy needs; conversely, if the ration energy is high, the ration consumption will be less

The high energy intake in treatment E (25% chicory flour), this is because the metabolic energy content in treatment E (25% mustard greens) is higher while the ration consumption is the same when compared to treatment A (0% chicory flour), B (10% mustard greens), C (15% mustard greens) and D (20% mustard greens). This is in accordance with the opinion of [20], that the taste of the ration does no effect on ration consumption. However, the most significant influence on feed consumption is the energy of feed metabolism. Metabolic point life in feed -in treatment A, B, C, and E is 2970.20 Kcal / Kg, 3002.14 Kcal / Kg, 3041.81 Kcal / Kg, 3073.17 Kcal / Kg, and 3096.24 Kcal / Kg. Thus, different metabolic energy in feed results in extra energy intake in meals so that energy intake is very different.

The amount of feed consumed depends on the type of livestock, gender, body weight, activity, environment, and the purpose of its maintenance [21]. If poultry were feed with good nutritional content during the growing period, it would only consume to meet their daily energy needs. The unique characteristic of poultry is that the feed is consumed so that its energy needs are met, if the feed has metabolic energy, the poultry body will provide less protein due to the low amount of feed consumed [22]. According to [23], low energy feeding ducks can increase feed consumption. This is supported by [23], that feeding with insufficient energy to local ducks compared to ducks fed high energy feed will consume the higher meal.

According to [20], the ideal ambient temperature for raising ducks is 18.3-5.5°C. Environmental temperature incompatible with livestock will affect adaptability, physiological activity, resistance to disease, and behaviour. Ducks, as warm-blooded (homoeothermic) need a comfortable temperature to maintain their body temperature (homeostasis). Ducks will be more comfortable at low temperatures according to the temperature of their place of origin. So that the ducks will consume more feed. The

following peer under the opinion of [24], livestock use at lower temperatures is very efficient because none of the energy consumed were wasted

3.2. The level of chicory waste to the percentage of male local duck carcasses

In the research that has been carried out, the average percentage of male local duck carcasses with 5 different treatments is presented in table 3. In the analysis of the diversity of the percentage of male local duck carcasses fed with chicory waste flour in the feed, there was no significant effect on male local duck carcasses. The rate of carcasses that were not significantly different was due to the live weight that was not significantly different. This is by following under the opinion of [25], that carcass weight and percentage are not significantly different because live weight results are not significantly different

The average percentage of a carcass in the study ranged from 62.83% - 65.78% (Table 39, which was insignificant). The presence of chicory dregs flour in the ration did not significantly affect the percentage of duck carcasses. This can indicate that chicory waste flour can be used in duck rations up to 25% without affecting carcasses. This percentage of a carcass in this study was lower than [13] in broiler chickens, ranging from 69.99% - 77.79%, but higher than [26], which ranged from 59.70% - 61.10%. According to [27], stated that the percentage of carcass is influenced by the growth rate, feed quality, and the percentage of non-carcass that can affect carcass weight. Various factors can affect the percentage of carcass such as genetics, physiology, sex, age, and body weight of ducks.

The research feed is structured based on balanced energy and protein. So that the ration did not significantly affect the growth and carcass weight, even though the crude fiber content in the ration was higher in the rations fed with chicory waste flour and was still tolerable by ducks. This is in accordance with the opinion of [26], a balanced diet of energy and protein has no effect on the conversion value and final body weight of ducks. Carcass weight is related to the live weight of the cut. The higher the cutting weight, the higher the carcass weights

3.3. The level of use of chicory waste to the percentage of abdominal fat in male local duck

The level of use of chicory waste of abdominal fat in local male duck in the study, the average rate of local male ducks' abdominal fat, which gave five treatments of different chicory waste flour, can be seen in Table 3.

Followed by the DMRT test resulted in treatment A (0% chicory waste flour) was not significantly different from treatment C (15% mustard greens flour) but was very significantly different from treatment B (10% chicory waste flour), Treatment D (20% mustard greens flour) and treatment E (25% mustard greens flour). Treatment B (10% chicory waste flour) was very significantly different from treatment A (0% mustard greens flour) and treatment C (15% chicory waste flour) but was not significantly different from treatment D (20% waste flour. chicory) and E (25% chicory waste flour). Treatment C (15% mustard greens flour) was not significantly different from treatment A (0% mustard greens flour) but was significantly higher than treatment B (10% mustard waste flour), D (20% mustard waste flour) and E (25% chicory waste flour). Treatment D (20% chicory waste flour) was significantly different from treatment A (0% mustard waste flour) and C (15% mustard waste flour) but was not significantly different from treatment B (10% mustard waste flour) and E (25% chicory waste flour)

The percentage of abdominal fat was not significantly different in treatment A and treatment C because the energy and protein content were almost the same even though the energy consumption was slightly different. The difference in energy consumption in this study was still influential in the growth of meat and bones. Abdominal fat will increase in birds that gave rations that have low protein [28]. Abdominal fat will increase if the crude fibre content in the feed is low [12]. The low percentage of abdominal fat in treatment B, D, and E was due to the high level of crude fibre in the ration to reduce abdominal fat abdominal in local male ducks. This study's result is consistent with [12], which states that the higher the crude fibre in the ration, the lower the abdominal fat in broiler chickens

The results of the analysis of diversity showed that the provision of chicory waste flour in the ration showed a very significant effect on the percentage of local male ducks' abdominal fat during the study. In this research, it shows that giving chicory waste flour in the ration can reduce the belly fat of local

male ducks. The results of the average belly fat content of local male ducks are presented in Table 3, there was a decrease from treatment A 1.51%, treatment B 0.65%, an increase in treatment C was 1.68% and decreased again in treatment D 0.72% and treatment, E 0.64%. I can see that chicory waste flour can reduce the percentage of male local ducks' abdominal fat

This percentage of abdominal fat is lower than the research of [15], which ranged from 1.29% - 1.79% conducted on broiler chickens and higher than the investigations by [29], which ranged from 0.59% - 0.66. %. The decrease in the percentage of ducks' abdominal fat was related to differences in crude fibre in the ration where the natural fibre content in this study ranged from 5% - 8%, [15] ranged from 4% - 6.70%, and [29] ranged between 8.67 - 10.45%. Rations that contain high crude fibre can reduce cholesterol and fat levels in the body of poultry. The high oil fibre in the ration is bulky and voluminous [30] and causes the rate of passage of feed in the digestive tract (quality, of course) to increase [31]. They were thus decreasing the absorption and digestibility of energy and dry matter. Decreased digestibility and energy retention will result in insufficient energy availability to convert into abdominal fat

Other factors that can affect the percentage of abdominal fat include energy content, age, sex, species, and environmental temperature. According to [32], excess energy can affect fat formation. Will store the extra point in the duck's body in fat, which generally collects in the abdominal cavity as abdominal fat. This accumulation of grease will cause a waste of life, which can harm the carcass. Besides that, twill is removed abdominal fat during processing

4. Conclusions

This study concluded that chicory waste flour could increase energy intake and reduce the percentage of abdominal fat in local male ducks and had can use up the chicory waste up to 25% in the local duck feed

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