

Effect of corn substitution with Enzymated apple pomace on broiler production performance and percentage internal organ of broiler chickens

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ABSTRACT: Corn is a feedstuff that use as a major component of energy sources and hard to be replaced other feedstuff in poultry ration, even its use is always above 45% in the composition of poultry feed. However, domestic maize availability is limited and the price is changes depend on season harvest time, and most of the availability for animal feed is still imported. Besides that, there is a ban on the use of Antibiotic Growth Promoter (AGP) in poultry feed and drinking water effectively since January 2018, so an effort is needed to replace AGP with natural feed additives or Natural growth promoters (NGP). Based on the above conditions, it is necessary to make efforts to replace corn with local feed ingredients, one of which is apple extraction pomace (apple pomaces). The pomace of apple extraction, if left unchecked, will quickly rot so that it will potentially as an environmental pollutant. The potential of apple pomace extract can be used as a feed ingredient with high sugar and energy content (2300 kcal/kg BK). This research was conducted in the Field Laboratory of Sumber Sekar, Laboratory of Animal Nutrition and Feed, Faculty of Animal Husbandry, Agricultural Technology Laboratory, Brawijaya University. The experiment used 192 DOC broilers and placed them in 8 postal cages per replication. Research on Enzymanted apple pomaces (EAP) as a substitute for corn used a completely randomized design (CRD) P0: basal feed, P1: substitution of EAP 5%, P2: substitution of EAP 10%, P3: substitution of EAP 15%. The variables observed were the production performances include (feed consumption, weight gain, feed conversion ration) and the % internal organs. Based on the research, the results were not significantly different on the production performances and the % of organs in broilers. The use of apple pomaces can be used as a substitute for broiler feed up to a level of 15%.

Keywords: Apple pomace; Broilers; Production performance; % of internal organs

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INTRODUCTION

East Java area is a center for poultry production of Indonesia, especially laying hen (Blitar and Malang) and broiler (Lamongan and Kediri), which requires the availability of feed, especially corn as an energy source. Many researchers have been trying to find alternatives to corn that have been carried out using conventional feed ingredients. Apple production in the Greater Malang area (Batu and Malang Regency) is not less than 600 thousand quintals. Apples are processed, besides being consumed directly, they are processed into chips and apple juice extraction. About 50% of the apple production is processed through apple extraction and produces around 100 thousand quintals of apple pomace (AP) per year. The AP is the extraction of apples with a polar solvent or water (Bhushan, 2008). The extraction results still contain active compounds that dissolve in non-polar solutions, including flavonoids.

Also, the potential for apple pomace extraction can be used as a feed ingredient with high sugar and energy content (2300 kcal/kg DM). The problem with the use of AP is the high content of fiber, especially glucans and pectin. Besides, the pomace of apple extraction, if left untreated, will quickly rot so that it will disturb the environment. Based on previous research, the use of AP in broiler chickens can only replace corn by 5%. Enzyme application is a rational alternative to increase the use of AP as a feed energy source substitute for corn. The use of AP as feed will have an impact on reducing the use of corn and feed costs as well as being an alternative for processing AP with economic value. Corn is a feed ingredient that cannot be replaced by poultry, even its use is always above 45% in the composition of poultry feed and as a major component of energy sources. However, domestic maize availability is still limited and the price is inflated, causing corn to date, most of the availability for animal feed is still imported, resulting in quite a large foreign exchange expenditure. Besides

that, there is a ban on the use of Antibiotic Growth Promoter (AGP) in poultry feed and drinking water effectively since January 1, 2018, so an effort is needed to replace AGP with natural feed additives or Natural growth promoter (NGP) (Nuningtyas et.al, 2021). For the above conditions, it is necessary to make efforts to replace corn with local feed ingredients, one of which is apple extraction pomace. Based on previous research on apple extract pomace, it shows that fermentation using *Aspergillus niger* as much as 0.8% can increase the crude protein content by 4.22% (Dhillon, 2013). This study aims to determine the effectiveness of the enzyme as a fermenting agent for apple pomace on the broiler production performance.

MATERIALS AND METHODS

The research was conducted and carried out at the Sekar Sumber Field Laboratory, the Laboratory of Animal Nutrition and Feed, the Faculty of Animal Husbandry, the Laboratory of Agricultural Technology Technology, and Faculty of Medicine, Brawijaya University.

The material used in this research were 192 DOC of MB 202 broiler produced by PT. Japfa Comfeed Indonesia, Tbk. unsexed, Enzymated apple pomaces (EAP), yellow corn, rice bran, and broiler concentrates. The 192 DOC experimental chicken placed in 8 postal cages per replication. Research on enzymatic apple pomaces as a substitute for corn used a completely randomized design (CRD) as follows:

- P0 = basal feed
- P1 = treatment feed substitution of 5% yellow corn with EAP
- P2 = treatment feed substitution of 10% yellow corn with EAP
- P3 = treatment feed substitution of 15% yellow corn with EAP

It consisted of 4 treatments and each treatment was repeated 6 times so that the total treatment unit was 24 replications and

each replication used 8 chickens. Feed and drinking water were given ad libitum. The feed given to the starter and finisher phase

chickens can be seen in table 1. The content of nutrition and amino acids of the basal feed to be used can be seen in table 2

Table 1. The composition of Basal and Treatment Feed *starter and Finisher* (%)

Feed stuffs	<i>Starter Phase</i>			
	P0	P1	P2	P3
Yellow corn	60	55	50	45
Consentrate	40	40	40	40
Rice bran	0	0	0	0
EAP	0	5	10	15
	<i>Finisher Phase</i>			
Yellow corn	60	55	50	45
Consentrate	30	30	30	30
Rice bran	10	10	10	10
EAP	0	5	10	15

The research procedure was done by following steps as follows:

1. Preparation for making Enzymated apple Pomace (EAP): Drying the apple pomace in the sun to reduce the moisture content at oven at 60 °C, ground using a grinder, and treated by fermentation using the enzyme glucanase.

2. Preparation of treatment feed: Preparing feedstuff both for starter and finisher treatment feed using 4 main feedstuffs (yellow corn, broiler concentrate, rice bran, and EAP), mix feed with substitution of corn using EAP according to each treatment.

Table2. Nutrient content of treatment feeds

Nutrients	PO	P1	P2	P3
	<i>Starter</i>			
EM (Kcal/kg)	2982.26	2943.41	2791.0	2904.55
CP (%)	21.736	21.55	23.738	21.363
Crude fat (%)	3.432	3.3155	3.699	3.199
Crude fiber (%)	2.748	3.169	3.428	3.59
Ca (%)	1.126	1.13	3.428	1.134
P (%)	4.156	4.145	4.63	4.134
	<i>Finisher</i>			
EM (Kcal/kg)	2734.55	2695.7	2656.84	2617.99
CP (%)	18.38	18.194	18.007	17.821
Crude fat (%)	4.36	4.2435	4.127	4.0105
Crude fiber (%)	4.49	4.911	5.332	5.753
Ca (%)	0.869	0.873	0.877	0.881
P (%)	3.172	3.161	3.15	3.139

3. Maintenance Rearing of broilers: preparing 24 postal cages, code marking according to treatment, installing the brooder, weighing DOC body weight, Calculation of feed consumption, body weight, and FCR every week

4. Slaughter, in the end of the experimental period for visceral organs in broiler chickens, includes gizzard, liver, bile, lipa, pancreas and heart and calculation of the percentage of organs in broilers

The variables measured in the study were:

1. Production Performances include:

- a. Feed consumption (g/bird/ day): Calculated every week by reducing the amount of feed given with leftover feed (North, 1984).
- b. Initial and final body weight (g/bird): Counted from 1-day old chickens and at the end of the grower period.
- c. Body weight gain (g/bird/ week): Bodyweight at the end of the week is reduced by body weight at the beginning of the week.
- d. Feed conversion (FCR): Feed conversion is calculated by dividing the amount of feed consumption by body weight.
- e. Income over Feed Cost (IDR/bird): Income over feed cost is calculated based on the results of calculations by comparing the average amount of revenue from the sale of chickens and the total expenses for rations.

2. Internal Organ

The variables observed in this study were the percentage of organ weight in broilers (liver, gizzard, and heart). The

percentage of internal organs is obtained by weighing the heart, liver, and gizzard (gizzard) weight, then divided by the live weight multiplied by 100%

The data obtained were tabulated with Microsoft Excel, then analyzed using analysis of variance (ANOVA) from a completely randomized design (CRD). If there is an effect of treatment, it is continued with Duncan's Multiple Range Test. Based on Steel and Torrie (1993), the mathematical model of a completely randomized design (RAL) is as follows: $Y_{ij} = \mu + \tau_i + \epsilon_{ij}$ where: Y_{ij} = Observation value of the i treatment and j replication. μ = mean, τ_i = Effect of treatment, ϵ_{ij} = Error treatment- i and repetition j , $J_i = 1, 2, 3, 4, 5$ and $J = 1, 2, 3, 4$

RESULT AND DISCUSSION

The Substitution of apple extract pomace in broiler feed is done by fermentation of apple pomace using glucanase enzymes. Based on research on the substitution of enzyme apple pomace in broiler feed, it can be seen in the table 2 below:

4.1 Substitution of apple extract pomace on broiler production performance

Table 2. The broiler production performance

Treatment	Feed consumption	Body weight gain	FCR
P0	2417.80±269.93	1786.00±108.77	1.35±0.11
P1	2889.59±467.31	1814.17±72.63	1.59±0.26
P2	2503.27±282.34	1852.17±28.92	1.35±0.16
P3	2558.56±278.70	1823.33±94.15	1.41±0.19

Based on the results of research on the substitution of Enzymed apple pomace, the results were not significantly different ($P < 0.05$) on feed consumption, body weight gain, and FCR. This indicates that the substitution of EAP up to a level of 15% does not affect the performance of broiler production. The consumption of feed substituted using apple extract pomace tended to be higher than the control feed (without substitution of Enzymed apple pomace). However, it can be seen that the weight gain of the treated chickens is higher

than the control feed. So that the feed conversion ratio (FCR) of feed with a substitution of 10% of apple extract pomace is lower than the substitution of 5% and 15%. Enzymated Apple pomace contains an average crude protein of 4.45% and crude fiber of about 7.4% meaning that the EAP has a lower crude protein and higher fiber compared to yellow corn and the chicken has difficulty digesting the feed ingredients. However, the fermentation treatment using glucanase can break the crude fiber bonds in apple pomace, so that the consumption of

feed substituted using apple extract pomace can increase. Fermentation technology aims to reduce fiber content in agricultural waste which generally has high fiber content. Pasaribu (2007) stated that the addition of microorganisms in the fermentation process

can produce certain enzymes that can accelerate the process of breaking down food substances. Besides, the type of microorganism used will affect certain protein content in feed ingredients (Kompiang et al., 1994)

4.2 Substitution of apple extract pomace against the percentage of organs in broilers

Table 3. Percentage of Internal Organs in broiler broilers (%)

Treatments	Gizzard	Liver	Bile	Spleen	Pancreas	Heart
P0	1.75±0.23	1.93±0.23	0.21±0.17	0.22±0.18	0.28±0.07	0.58±0.12
P1	1.71±0.22	1.92±0.18	0.21±0.19	0.15±0.14	0.24±0.06	0.46±0.07
P2	1.64±0.20	1.87±0.07	0.08±0.03	0.11±0.01	0.27±0.05	0.50±0.07
P3	1.92±0.22	2.16±0.31	0.07±0.04	0.10±0.04	0.26±0.05	0.51±0.08

The percentage of internal organs is calculated by dividing the internal organ weight and the chicken body weight multiplied by 100%. Based on research on the substitution of Enzymed apple pomace, it showed no different results on the percentage of organs in broiler chickens. This shows that the substitution of apple extract pomace does not affect internal organs in chickens. Internal organs function as enzyme producers and carry out metabolism in the body.

The percentage of gizzard and liver weight in P3 is greater than the other treatments. This is probably because the high crude fiber content in the pomace of apple extract makes the work of the gizzard in digesting the feed mechanically harder compared to other feed treatments. Meanwhile, the liver works harder to secrete bile and metabolizes substances from protein, fat, bile secretion, and the excretion of metabolite compounds that are no longer useful for the body (Amrullah, 2004). The secretion of bile from the liver can help absorb fat (Yuwanta, 2004). The percentage of bile, spleen, pancreas, and heart in control diets was greater than that of other treatments.

CONCLUSIONS

Substitution of apple extract pomace up to a level of 15% can be done to replace corn in broiler feed, without affecting

production performance and internal performance of broiler chickens. Replacement of corn with apple dregs that have been processed using glucanase enzyme should be given from the age of 7 days to ensure the initial growth of broilers is still good and normal. Due to the treatment does not improve production performance, further research can be carried out on a higher level of substitution.

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