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Effects of Additional Mint Leaf (*Mentha Piperita*, L) Fermentation on the Percentage of Broiler Carcass, Liver and Heart

Nelzi Fati ^a, Debby Syukriani ^b, Nilawati ^c

^{a, b, c} Livestock Production Technology Study Program, Payakumbuh State Agricultural Polytechnic, Kabupaten Limapuluh, Kota Sumbar.

Corresponding author : nelzifati@gmail.com

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ABSTRACT

Research with the addition of fermented mint leaves in drinking water aims to determine the effect of treatment on the percentage of carcass weight, liver and heart. This research was carried out for 2 months in the Animal Feed and Nutrition Laboratory and in the broiler cage at the Livestock Production Laboratory, Payakumbuh State Agricultural Polytechnic. This study started from DOC until the age of 35 days, as many as 100 broilers were the subjects, 5 treatments and 4 replications were given. The treatments were without the addition of fermented mint leaves (A), the addition of 0.3% fermented mint leaves in drinking water (B), the addition of 0.6% fermented mint leaves in drinking water (C), the addition of 0.9% fermented mint leaves in drinking water (D) and the addition of 1.2% fermented mint leaves in drinking water (E). The basal ration consisted of corn, palm oil meal, soybean meal, fish meal, coconut oil and top mix. The variables measured were the percentage of carcass weight, liver, and heart. The research method used a completely randomized design. The results showed that the addition of fermented mint leaves in drinking water had no significant effect ($P > 0.05$) on the percentage of carcass weight, liver and heart. The conclusion is that the addition of fermented mint leaves in drinking water up to a level of 1.2% can be tolerated by broilers until the age of 5 weeks.

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1. Introduction

Herbal plants have become a potential source of medicine in overcoming health problems. So far, research is still being done on the effectiveness of herbal plants for humans and livestock. The use of medicinal plants in the poultry industry has become popular and requires the most suitable herbal plants for their use. The benefit of herbal plant as medicine is the contain of active compounds such as essential oils, saponins and tannins that act as antibacterial antioxidants. They improve health conditions in both humans and livestock.

The increase in poultry production for farmers cannot be separated from the use of synthetic drugs, including antibiotic growth promoters (AGP), which were previously used by broiler breeders in both rations and drinking water. The use of AGP is now prohibited for broilers in both rations and drinking water. In 2006, to be precise in January, the use of antibiotics as feed additives was banned in Europe. The ban on the use of AGP in Indonesia started on 1 January 2018, as regulated in the Law no. 18/2009 Juncto No. 41/2014[1]. The ban is due to the fact that antibiotics have the potential to be

incorporated into animal products, and consumers indirectly receive low levels of antibiotics that increase bacterial resistance and chemical residues and can cause allergic effects in humans [2][3]. Several studies have demonstrated some side effects resulting from the use of multiple antibiotic growth promoters (AGP) [4]. In addition to the ban for the use of antibiotics as growth promoters, researchers have found alternatives to natural growth promoters such as phytogens.

The use of phytogens as feed additives, which can improve the digestive system through stimulating and antimicrobial effects, is increasing [5]. One of the active ingredients found in many herbal plants are flavonoids. Flavonoids are compounds that are widely recommended as substitutes for AGP for their antibacterial, antioxidant, anti-inflammatory, and hepatoprotective properties [6], so that it can improve broiler performance, including reduction in feed conversion and reduction in mortality [7]. One of the plants that contains flavonoids is mint (*Mentha piperita*), which acts as a feed additive both in the ration and drinking water. Feed additive is an ingredient that is added to feed in small amounts and aims to increase the growth rate and improve feed conversion efficiency.

One of the plants that can be used as a natural feed additive is mint (*Mentha piperita* L.). Peppermint (*Mentha piperita* L.) is a medicinal plant that contains several types of essential oils including: menthol, menton, methyl acetate, piperitone and cavone [8]. Essential oils also have antimicrobial properties [9]. Peppermint leaves also contain about 0.5 to 4% essential oil, which consists of 25 to 78% menthol, 14 to 36% menthone, 1.5 to 10% isomenthone, 2.8 to 10% menthyl acetate, and 3.5 to 10% menthyl acetate consists [10][11][12], as well as inhibits the growth of pathogenic microbes such as *Escherichia coli*, *Staphylococcus aureus*, *Salmonella enteridis* and *Candida albicans* and does not affect carcass quality [13]. The chemical composition of peppermint leaves can vary depending on geographic area, plant maturity, and processing conditions [12]. Based on the above, studies were conducted on the addition of fermented mint (*Mentha piperita* L.) to the carcass, liver and heart portion of broilers.

2. Method

The Process of Making Fermented Mint Leaves (*Mentha piperita*).

Preparation of Fermented Mint Leaves (*Mentha piperita*): Mint leaves + saka and EM4 (effective microorganism). Mint leaf fermentation procedure: 500g mint leaves were washed and blended until smooth, then was filled into canisters. 500g of Saka was diluted to 500ml with water, 500ml of EM4 was added and then placed in a canister. Afterwards, 20 liter gallons were poured. 500g of Saka were diluted to 500ml with water, 500ml of EM4 were added and then filled into gallons. Water was added to canisters until the volume was 10 liters, stirred evenly and tightly closed. The fermentation process lasted 15 days, with the characteristic as no more gas was produced. If gas was formed during the fermentation process, it was removed by opening the gallon cap for a while and then closed again. The result of the mint leaf fermentation process was then filtered so that it was in the form of a liquid. The fermented mint leaves were placed in a plastic bottle and stored under aerobic conditions, ready to be fed to broilers.

The study was conducted on 100 broilers that were one day old. Broilers were kept until 5 weeks old. The ration given was a commercial ration up to 1 week old. After the second week, commercial rations were given with mixed rations. The aim was that the broilers were not stressed about getting new rations. The addition of fermented mint leaves according to the treatment was started at week 2 to week 5, which was administered via the drinking water. Commercial rations contain protein content of 21-22%, metabolic energy content of 3000 kcal. Mixed rations with protein content of 22% as well as metabolic energy of 3000 kcal were also prepared. Rations and drinking water were given ad libitum.

Research Method

This study used a fully randomized design with 5 treatments and 4 replicates.

The treatments are as follows:

- A0 : Without the addition of fermented mint leaves
- A1 : Adding 0.3% fermented mint leaves to drinking water
- A2 : Adding 0.6% fermented mint leaves to drinking water
- A3 : Adding 0.9% fermented mint leaves to drinking water
- A4 : Adding 1.2% fermented mint leaves to drinking water

Each cage unit was filled with 5 broilers with 4 replicates for each treatment. Each treatment was repeated four times. The broilers were dissected at 35 days old to calculate the percentage of carcass, liver and heart. The parameters measured in this study were carcass percentage, heart weight and liver weight. If there was a difference between treatments, Duncan Multiple Range Test/DMRT test would be conducted [14].

The nutritional content of mint leaves and ration were analyzed by proximate analysis. The basic ration formulation was 40% soybean meal, 4.75% fish meal, 52% maize, 0.25% mineral. The nutritional content of the mixture of rations and mint leaves is presented in Table 1.

Table 1. Composition and nutritional content of mixed rations and mint leaves (*Mentha piperita*)

Nutritional content	Ration	Mint leaves
Water content (%)	12,68	11,90
Dry matter (%)	87,32	88,10
Ash content (%)	7,48	13,06
Organic matter (%)	92,52	86,94
Crude protein (%)	21,15	22,29
Crude fiber (%)	1,00	6,16
Crude fat (%)	3,62	5,50
BETN (%)	54,07	41,07
BOTN (%)	71,37	71,37
TDN (%)	3,53	3,46

Source: Proximate analysis results of Nutrition and Animal Feed Labor (2022)

3. Result and Discussion

Percentage of Carcass

Table 2 shows the average results of the carcass from the addition of mint leaves (*mentha piperita*, l) fermentation in drinking water for 5 weeks of maintenance areas of 63.55 ± 0.070 to 64.75 ± 0.076 %. Table 2 and Figure 1 show that the percentage of carcass from the highest to the lowest are A0 (65.75 ± 0.076)%, A2 (64.74 ± 0.004), A1 (64.17 ± 0.112)%, A3 (63.93 ± 0.098)%, A4 (63.55 ± 0.070)%. The results of the analysis of the variety show that the addition of mint (*mentha piperita*) leaf of fermentation to a level of 1.2% in drinking water does not have a significant effect ($P > 0.05$) on the percentage of broiler carcass.

Table 2. Average percentage of carcass, heart and liver of 35 days old broilers.

Perlakuan	Carcass (%)	Heart (%)	Liver (%)
A0	$65,75 \pm 0,076$	$0,475 \pm 0,034$	$1,948 \pm 0,899$
A1	$64,17 \pm 0,112$	$0,469 \pm 0,034$	$2,223 \pm 0,356$
A2	$64,74 \pm 0,004$	$0,498 \pm 0,006$	$2,129 \pm 0,200$
A3	$63,93 \pm 0,098$	$0,464 \pm 0,065$	$2,355 \pm 0,474$
A4	$63,55 \pm 0,070$	$0,485 \pm 0,027$	$2,146 \pm 0,102$

There are no differences in the percentage of the Broiler carcass, which is caused by the active content of mint leaves in the form of menthol. Menthol is one of the essential oils that increase the appetite of the broilers, increase the production of digestive enzymes and act as antioxidants[10] Giving 0.3% mint fermentation leaves from the results of this study can increase the consumption of rations, and body weight, and simultaneously, reduce the conversion of broiler rations compared to control in line with the results of the study [15], while the percentage of carcass is slightly lower than control. Additionally, the research results of [16] shows that the supplementation of dry *M. cordifolia* at 0.5, 1.0, 1.5, and 2.0% have no effect on carcass characteristics. This is thought to be the lack of role for menthol and essential oils in the digestive process, and only affect animal health. Mint leaves have physiological properties in the form of strong anti-microbial *Escherichia coli*, *Salmonella pullorum*, *Comamon asterrigena*, *Streptococcus faecalis*, *Acinetobactersp*, *Streptococcus thermophiles*, *Lactobacillus bulgaricus*, *Staphylococcus pyogenes*, *Staphylococcus aureus*, *Streptococcus pyogenes*, *Serratiamarcescens*, *Mycobacterium avium*, *Salmonella typhi*, *Salmonella paratyphi A/B*, *Proteusvulgaris*, *Enterobacteraerogenes*, *Yersinia enterocolitica* dan *Shigella dysenteriae*[17][18][19][20][21], *Shigella disentri*, *Bacillus cereus*, and *Salmonella typhi* [22].

The percentage of carcass produced in this study is different from the results of the study [23] that the ration added with a mixture of 1% oregano, 0.5% ziziphora and 0.5% peppermint increased the percentage of carcass through increased body weight, higher carcass percentage and decreased abdominal fat, carcass percentage ranged from 68.02 – 70.76%. While the results of the study [22] with the addition of mint leaf flour 4 g/kg rations produced a high percentage compared to the control and other doses. Research result [21], the addition of *Mentha pulegium* L. 0.25% supplement in the ration can increase the percentage of carcasses, the range of carcass percentages produced is (71.01 ± 0.14)% to (73.95 ± 0.56)%. Research result [13], addition of mint leaves in the form of flour, carcass percentage ranged from (59.98 ± 3.00)% to (64.03 ± 4.13)%, while the research results [15] the percentage of carcasses produced was 75.18 – 77.4%. The addition of *Mentha pulegium* L. to broiler rations at a level of 1-3% has a significant effect on the percentage of carcasses [24]. The percentage of carcass produced ranged from (66.63 ± 1.49)% to (68.86 ± 1.78)%[25].

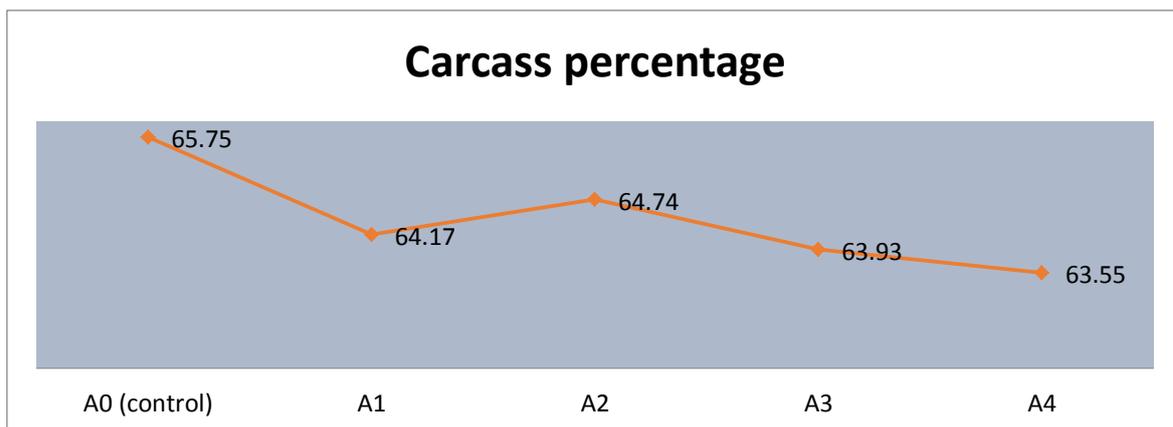


Figure 1. Percentage of broiler carcass age 5 weeks

Heart

The effect of the addition of fermented mint (*Mentha piperita*, L) leaves on the percentage of broiler heart aged 5 weeks can be seen in Table 2 and Fig 2. The results showed that the average percentage of heart per broiler body weight for each treatment ranged from 0.464% ± 0.065% to 0.498% + 0.006% as shown in Table 2.

The results of variance showed that the addition of fermented mint leaves (*Mentha piperita*, L) had no significant effect ($P > 0.05$) on the percentage of heart weight per broiler live weight. The absence of this difference was due to the addition of fermented mint leaves (*Mentha piperita*, L) did not contain toxins or anti-nutritional substances, resulting in less excessive contraction of the heart muscle.

The percentage of heart weight resulting from Figure 2 shows that the addition of fermented mint leaves (*Mentha piperita*, L) was $0.464\% \pm 0.065\%$ to $0.498\% + 0.006\%$. The results obtained were still in the range of normal heart weight percentage $0.42\% - 0.70\%$ of live weight [26]. These results are in line with the research [27] that shows the ration added with mint leaves has no effect on the percentage of heart weight. Additionally, the range of heart weight percentage produced was $0.58\% + 0.04\%$ to $0.66\% \pm 0.04\%$. The percentage of heart weight obtained from the results of the study [28] was $0.37\% - 0.56\%$ which resulted from the addition of various herbs in the ration and lighting in broiler rearing. The percentage of heart weight given burahol leaf extract in the ration was $0.57\% - 0.68\%$ [29]. The percentage of heart weight was $0.402\% - 0.504\%$, added papaya leaf flour in the ration [30]. The addition of *Mentha pulegium* L. had no significant effect ($P > 0.05$) on the percentage of heart weight given $0 - 1.5\%$ in the ration [21]. The addition of mint leaves at a dose of $5 - 15$ g/kg had no significant effect ($P > 0.05$) on the percentage of heart weight [15]. The results obtained from several researchers with the provision of herbal feed additives, the percentage of heart weight is still in the normal weight range. This means that mint leaves and other herbs have not had a negative impact on the percentage of heart weight or the heart is not enlarged or reduced due to the addition of herbs in the ration that functions as a feed additive.

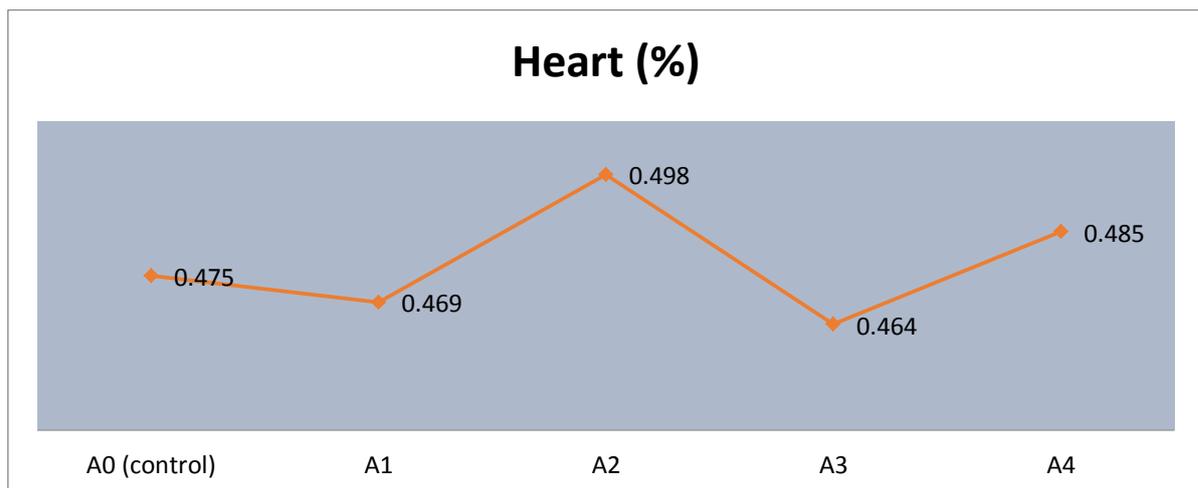


Figure 2. Broiler heart weight percentage age 5 weeks

According to [31] the heart is an internal organ that is very susceptible to toxins and anti-nutritional substances, enlargement of the heart can occur due to the accumulation of toxins in the heart muscle. If the blood contains toxins and anti-nutrients, it will trigger excessive contractions, causing swelling of the heart. Besides that, factors that affect liver size are sex, age, body weight and activity of the livestock. The heavier the weight of the heart, the more smooth the flow of incoming and outgoing blood, and the impact on the metabolism in the animal's body [32]. The active components contained in mint leaves are flavonoids, tannins, saponins, steroids, quinones and essential oils [33][34], glycosides, phenols, and alkaloids [34] which work to support each other in inhibiting microbial growth. The action mechanism of flavonoids as antimicrobials is to form complex compounds with extracellular and dissolved proteins so that they damage the microbial membrane [35]. Besides that, flavonoids have phenol compounds which are kind of acidic alcohol, which is often called carboic acid. Phenol has the ability to denature proteins and damage bacterial cell walls [36].

Liver

The effect of the addition of fermented mint leaves (*Mentha piperita*, L) on the percentage of liver weight of broilers aged 5 weeks can be seen in Table 2 and Fig 3. The results showed that the addition of fermented mint leaves (*Mentha piperita*, L) had no significant effect ($P>0.05$) on the percentage liver weight per broiler body weight. The results showed that the average percentage of liver per broiler body weight for each treatment ranged from $(1.948 \pm 0.899)\%$ to $(2.355 + 0.474)\%$ as shown in Table 2.

The results of variance showed that the addition of fermented mint (*Mentha piperita*, L) had no significant effect ($P>0.05$) on the percentage of broiler liver weight. The results of this study showed that the percentage of liver weight was still in the range of normal liver weight percentage, between 1.7 - 2.8% of liver weight of broilers [26]. The function of the liver is detoxification of toxins and one of the liver disorders is indicated by the enlargement or shrinkage of the liver. This means that the addition of fermented mint (*Mentha piperita*, L) leaves containing active substances that can function as antibacterial and antioxidant that does not interfere with liver function, so that the addition of fermented mint (*Mentha piperita*, L) leaves can be added to the broiler ration without disturbing the physiological organs of broilers with the addition of 1.2% in the ration. Physiological functions of the liver are detoxification of toxic compounds for the body, bile secretion, storage of fats and vitamins, formation of plasma proteins, inactivation of polypeptide hormones, metabolism of proteins, carbohydrates and lipids [32].

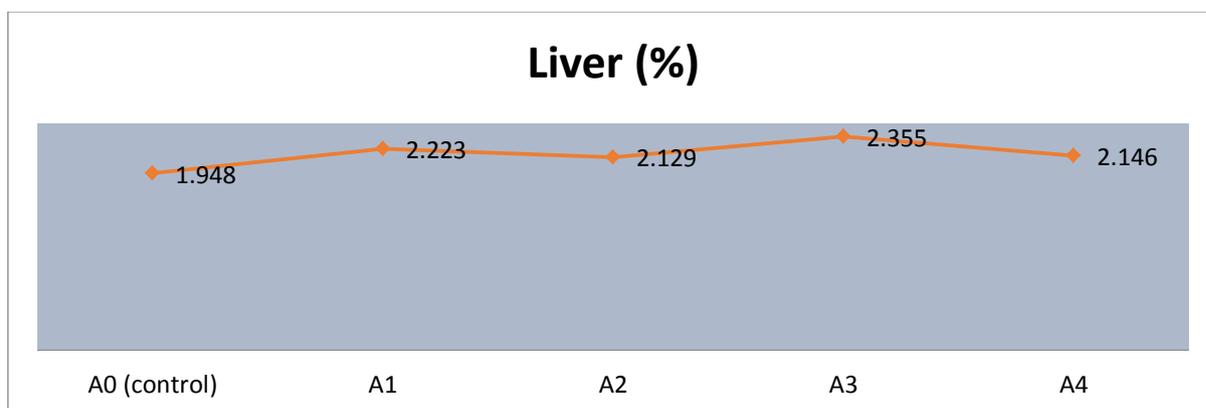


Figure 3. Broiler liver weight percentage age 5 weeks

Figure 3 shows that the average percentage of liver weight produced in the study of adding fermented mint leaves (*Mentha piperita*, L) is between the ration of $1.948\% \pm 0.899\%$ to $2.355\% + 0.474\%$. The broiler live weight is still within normal limits. These results are in line with research [37] that the addition of flour and mint leaf oil had no significant effect ($P>0.05$) on the percentage of broiler liver weight. The range of liver weight percentage was 2.257% – 2.672%. Meanwhile [21], the addition of *Mentha pulegium* L.0-1.5% in the ration had no significant effect ($P>0.05$) on the percentage of liver weight. The addition of mint leaf flour in the basal ration of 5 – 15 g/kg had no significant effect ($P>0.05$) on the percentage of liver weight. The percentage of liver weight produced ranged from 1.91% to 2.04% [15], addition of 1.5 g/kg to 6 g/kg mint leaf powder in the basal ration reduced the percentage of broiler liver weight [22]. Based on the research result by [38], with the addition of aloe vera, *Morinda citrifolia* and ginger herbs until the broilers are five weeks old, the percentage of liver obtained is 1.88% - 3.01%, and the percentage of liver weight obtained in drinking water is 1.78% -2.01% [39]. The difference in the percentage of liver weight produced by each researcher is still within the normal limits. Sturkie [38] stated that the factors that affect liver weight are body weight, species, sex, age and pathogenic bacteria.

Studies have shown that peppermint extract prevents the growth of bacterial organisms such as *Shigella dysentery*, *Bacillus cereus*, and *Salmonella typhi* [22]. Sefidcon et al. in [22] showed that the limonene present in peppermint eliminates Pneumococcal bacteria in one to three hours, Staphylococcus in 20 minutes, and Streptococcus in 12 hours. Blakely and Bade [40] stated that the

physiological functions of the liver are bile secretion in emulsifying fats, neutralizing toxins, storing energy that is ready to be used for glycogen, and breaking down protein residues into uric acid to be excreted by the kidneys. Excess poison cannot be completely detoxified, this causes damage.

4. Conclusion

Fermentation of mint leaves (*Mentha piperita*, L) in drinking water has not been able to increase the percentage of carcass weight, liver weight and heart weight of broilers. Giving up to 1.2% in water is still tolerated by broilers.

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