Scientific Papers. Series D. Animal Science. Vol. LXIV, No. 1, 2021
ISSN 2285-5750; ISSN CD-ROM 2285-5769; ISSN Online 2393-2260; ISSN-L 2285-5750

# EFFECTS OF USING FERMENTED DUCKWEED ON VOLATILE FATTY ACID AND COLON pH IN RAMBON DUCK

**Lovita ADRIANI[1], Muhammad BAEHAQI[2], Hendi SETIYATWAN[1], Leni NURLAENI[2]**

[1]Laboratory of Animal Physiology and Biochemistry, Department of Animal Nutrition and Feed Technology, Faculty of Animal Husbandry, Universitas Padjadjaran, Bandung
Jl. Raya Bandung-Sumedang KM. 21, Jatinangor, Sumedang, Jawa Barat, 45363, Indonesia
[2]Animal Science Program, Faculty of Animal Husbandry, Universitas Padjadjaran, Bandung
Jl. Raya Bandung-Sumedang KM. 21, Jatinangor, Sumedang, Jawa Barat, 45363, Indonesia

Corresponding author email: lovita_yoghurt@yahoo.co.id

***Abstract***

*The research was conducted from October to December 2019. Testing samples at the Laboratory of Ruminant Animal Nutrition and Animal Food Chemistry, Animal Husbandry Faculty, Padjadjaran University. This study aims to determine the effect of using fermented duckweed in duck ratio on VFA (Volatile fatty acid) and pH in large intestine. The method used experimentally with a completely randomized design (CRD) with six treatments and four replications. The six treatments were follows: P0 = rations without fermented Duckweed, P1 = rations + 10% Duckweed, P2 = rations + fermented Duckweed 20%, P3 = rations + fermented Duckweed 30%, P4 = rations + fermented Duckweed 40%, P5 = rations + fermented Duckweed 50%. The research data were processed using variance and followed by Duncan's test. The result showed that using 20% of duckweed fermented had a significant effect ($P<0.05$) on the pH large intestine but had no effect ($P>0.05$) on the VFA content.*

***Key words****: duckweed fermented, pH of the large intestine, Rambon duck, volatile fatty acid.*

## INTRODUCTION

Rambon duck is a dual-type duck that can produce eggs and meat. Rambon ducks are ducks originating from the Cirebon area of West Java, the result of a cross between Tegal ducks and Magelang ducks. Ducks are generally bred to produce eggs, but the demand for duck meat continues to increase in Indonesia, so many duck farmers switch their production to produce meat. Various efforts are made by farmers to increase the productivity of meat, one of which is the feed. Morphology of the digestive system of ducks will change in case of a sudden change of feed. Then it is necessary to look for feed materials that have a high nutrient value, among others by utilizing aquatic plants that are processed with fermentation technology, namely fermented duckweed.

Fermented duckweed is a protein source feed material, which will improve the performance of Rambon ducks, the result of the analysis is a crude protein content of 33.84% coarse fiber 8.16% (Setiyatwan et al., 2018). The use of fermented duckweed produces destitute of coarse fiber can be seen in the content of VFA (Volatile Fatty Acid) in the cecum.

The higher the content of VFA means that the coarse fibers in fermented duckweed can be digested. The content of VFA in the duck secretary will affect digestion in the colon because the cellulolytic microbes in the cecum will descend into the colon. These microbes will affect the pH value of the gastrointestinal tract. The use of fermented feed-containing microbes will affect the pH value of the gastrointestinal tract. Fermented duckweed will increase the number of lactic acid bacteria in the colon. The decrease in the pH value in the colon causes the number of lactic acid bacteria to be more and more numerous. The optimum pH value in the colon will increase the number of lactic acid bacteria that will suppress the number of pathogenic microbes so that livestock become healthier, therefore it is necessary to research "Effects of Using Fermented Duckweed on Volatile Fatty Acid and Colon pH in Rambon Duck".

## MATERIALS AND METHODS

The study used a day-old duck (DOD) of 120 heads without the straight run. Ducks are placed randomly into 24 cage units and each cage is filled with five (5) heads. Each duck is wing-tagged on the right wing for easy observation and data collection. Ducks are kept from the age of 1 day to the age of 42 days. The cage used is a litter system cage. The cage of 24 flocks is 1 meter x 1 meter x 1 meter per flock for five (5) ducks with the Completely randomized design. The study was conducted experimentally with six (6) treatments and four (4) replications, namely:

P0: Basal ration
P1: Basal ration + duckweed fermentation 10%
P2: Basal ration + duckweed fermentation 20%
P3: Basal ration + duckweed fermentation 30%
P4: Basal ration + duckweed fermentation 40%
P5: Basal ration + duckweed fermentation 50%

The data obtained from the results of the study were analyzed by ANOVA method and further tests of Duncan's.

Table 1. Nutrients Content and Metabolic Energy of Feed Ingredients for the Ration

| No. | Feed Ingredient | CP | Cfat | CF | Ca | P | Lys | Meth | Zn | ME |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | (%) | | | | ppm | kcal/kg |
| 1 | Soybean Meal | 41.13 | 6.36 | 6.13 | 0.32 | 0.67 | 2.90 | 0.65 | 40 | 2440 |
| 2 | Kip-Cp144 | 37.00 | 2.00 | 8.16 | 1.2 | 1.2 | 1.36 | 0.78 | 72.3 | 3250 |
| 3 | Coconut Meal | 20.5 | 8.20 | 1.31 | 0.73 | 0.47 | 1.26 | 0.45 | 0 | 2540 |
| 4 | Bran | 7.13 | 11.3 | 11,8 | 0.12 | 1.5 | 0.34 | 0.13 | 30 | 2400 |
| 5 | Corn | 8.5 | 7.42 | 2.86 | 0.02 | 0.3 | 0.22 | 0.2 | 18 | 3300 |
| 6 | Coconut oil | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 8600 |
| 7 | Premix | 0 | 0 | 0 | 23.3 | 18 | 0 | 0 | 0 | 0 |
| 8 | Bone meal | 0 | 0 | 0 | 36 | 0 | 0 | 0 | 0 | 0 |

Note: Results of Laboratory Analysis of Ruminant Animal Nutrition and Animal Feed Chemistry, Faculty of Animal Husbandry, Universitas Padjadjaran.

Table 2. Nutrien Duckweed, Duckweed Fermentation and KKK
(Mix Coconut Meal; 35.0%, Soybean Meal; 63.4% and Kip-Cp 144; 1.6%)

| Nutrient Content | Duckweed | Duckweed Fermentation | KKK |
|---|---|---|---|
| Crude Protein (%) | 30.20 | 33.84 | 33.84 |
| Crude Fat (%) | 2.39 | 4.73 | 6.93 |
| Crude Fiber (%) | 19.9% | 8.16 | 4.48 |
| Ca (%) | 0.7 | 0.93 | 0.48 |
| P (%) | 0.4 | 0.36 | 0.61 |
| Zn (mg/kg) | 76.73 | 84.60 | 26.52 |
| Methionine (%) | 0.53 | 0.55 | 0.58 |
| Cystine (%) | 0.14 | 0.57 | 0.57 |
| Lysine (%) | 0.24 | 1.11 | 2.50 |
| Metabolisable Energy (kcal/kg) | 2495 | 2597.4 | 2487.96 |

Note: Results from Laboratory Analysis of Ruminant Animal Nutrition and Animal Feed Chemistry, Faculty of Animal Husbandry, Universitas Padjadjaran.

Table 3. Nutrients content and Metabolisable Energy in Treatment

| Nutrient | Ransum Treatment | | | | | |
|---|---|---|---|---|---|---|
| | $P_0$ | $P_1$ | $P_2$ | $P_3$ | $P_4$ | $P_5$ |
| Crude Protein (%) | 20.74 | 20.74 | 20.74 | 20.74 | 20.74 | 20.74 |
| Crude fat (%) | 9.44 | 9.22 | 8.99 | 8.78 | 8.56 | 8.34 |
| Crude Fiber (%) | 4.70 | 5.07 | 5.44 | 5.81 | 6.17 | 6.54 |
| Ca (%) | 0.56 | 0.60 | 0.65 | 0.69 | 0.74 | 0.78 |
| P (%) | 0.69 | 0.66 | 0.64 | 0.61 | 0.59 | 0.56 |
| Zn (mg/kg) | 23.22 | 29.03 | 34.84 | 40.64 | 46.45 | 52.26 |
| Lysine (%) | 1.37 | 1.23 | 1.09 | 0.95 | 0.81 | 0.67 |
| Methionine (%) | 0.38 | 0.37 | 0.37 | 0.37 | 0.36 | 0.36 |
| Met + Cystine (%) | 1.75 | 1.60 | 1.46 | 1.32 | 1.17 | 1.03 |
| ME (kcal/kg) | 2854.48 | 2865.42 | 2876.36 | 2887.31 | 2898.25 | 2909.2 |

Note: The calculation result of Tables 1 and 2

## RESULTS AND DISCUSSIONS

### Effect of Treatment on Volatile Fatty Acid (VFA)

Based on the results of the study the influence of the use of fermented duckweed in Rambon duck rations on the content of VFA (volatile fatty acids) can be seen in Table 4.

VFA (Volatile Fatty Acid) is the result of the digestive process of coarse fiber. The process of digestion of coarse fibers in ducks occurs in the cecum. The use of high coarse fiber in rations will affect the digestive process in duck rations. The results of the fingerprint analysis showed t the various levels of use fermented duckweed in Rambon duck rations did not significant (P>0.05) on the content of VFA in the cecum. Although the increase in P1 treatment (142.25 mM) due to the increase in the content of fermented duckweed in rations, but P2 and other treatment did not have an increase in VFA content. This is in line with Mangisah et al. (2005) statement that the use of 15% coarse fiber in duck rations has not increased the absorption of VFA in the cecum.

Based on the analysis gave an idea that the use of fermented duckweed in each treatment at the same range even though the coarse fiber contained in the feed 8.16%. Fermented feed does not affect the content of VFA even though the content of coarse fiber is still quite high. This is in line with Supranoto's research (2000), which tested coarse fibrous rations of 5.10 and 15% and it turns out that the VFA produced in the cecum is also not significantly affected by the treatment. The use of fermented duckweed has not increased the content of VFA in the cecum. The fermented feed has not been able to increase the absorption of VFA. Although fermented duckweed has a high content of crude protein that is 33.84% and has coarse fiber (SK 8.16%). Such coarse fibers for poultry are not very high. This is in line with Sutrisna's research (2010) that the provision of coarse fibers ranging from 5-20% in ducks to fermentative digestion, the total VFA content does not differ markedly.

The results of this study provide information that ducks as one type of monogastric livestock turn out to have the ability to digest coarse fiber into VFA as the final product as in ruminant livestock, although the results are not as much in ruminants. This VFA can be absorbed and utilized as an energy source. VFA fermentation results in cecum can be absorbed and transported to the liver through the port vein. Additional energy generated from the degradation of fibers in the cecum will be used by ducks for basic living and production, one of which is growth. This is by the statement of Nugroho (2000) that the fermentation results can be used as an energy source and help the lack of metabolic energy rations due to increased levels of crude fiber rations.

The increase in crude fiber content in the ration causes the flow rate of the ration in the digestive tract to become fast (Bidura et al., 2008), as a result the digestive tract becomes empty, so that the ducks will consume more rations. In addition, the increase in crude fiber in the ration will reduce the efficiency of metabolic energy use caused by the transfer of some of the net energy fraction for muscular energy activity required for additional activity of the gizard and to push food waste along the digestive tract of chickens (Jhori et al., 1979).

Table 4. Average Content of VFA (Volatile fatty acids) in cecum on various Treatments

| Repeat | Treatment | | | | | |
|---|---|---|---|---|---|---|
| | P0 | P1 | P2 | P3 | P4 | P5 |
| | mM | | | | | |
| 1 | 132 | 141 | 110 | 116 | 139 | 96 |
| 2 | 125 | 128 | 122 | 112 | 142 | 136 |
| 3 | 130 | 149 | 114 | 128 | 100 | 99 |
| 4 | 130 | 151 | 123 | 148 | 151 | 126 |
| Average | 129.25 | 142.25 | 117.25 | 126 | 133 | 114.25 |

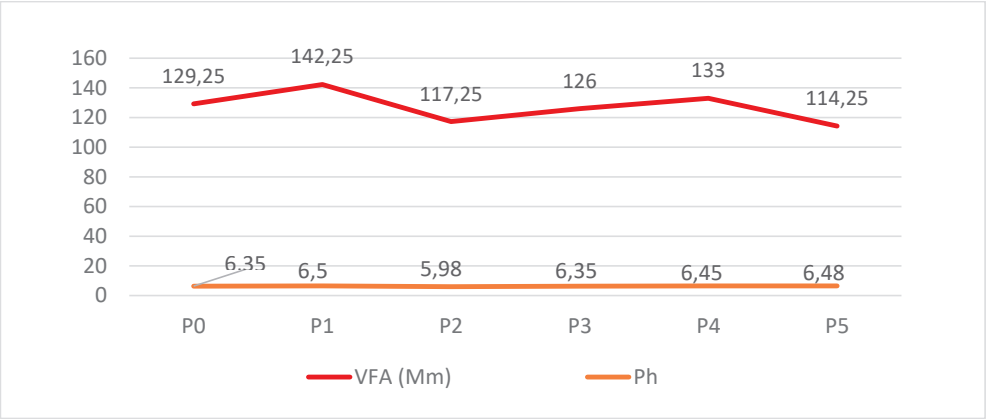


Figure 1. Average VFA and pH Value

**Effect of Treatment on colon pH**

The colon is the last of the digestive tract before exiting through the cloaca. In the colon, there is the absorption of water and food substances that have not been absorbed by the small intestine. According to McNaught & MacFie (2002), a good colon can be seen from the value of acidity (pH), because if the pH value in the gastrointestinal tract increases or becomes more acidic it will increase lactic acid bacteria. This study to find out the effect of fermented duckweed on the pH of the colon in ducks. The average pH value of the colon of the Rambon duck can be seen in Table 5.

Table 5. Average pH Value of Rambon Duck Colon on various Treatments

| Repeat | Treatment | | | | | |
|---|---|---|---|---|---|---|
| | P0 | P1 | P2 | P3 | P5 | P6 |
| 1 | 6.3 | 6.6 | 5.9 | 6.1 | 6.6 | 6.5 |
| 2 | 6.5 | 6.4 | 5.9 | 6.3 | 6.4 | 6.6 |
| 3 | 6.1 | 6.6 | 6 | 6.6 | 6.3 | 6.4 |
| 4 | 6.5 | 6.4 | 6.1 | 6.4 | 6.5 | 6.4 |
| Average | 6.35 | 6.5 | 5.98 | 6.35 | 6.45 | 6.48 |

Based on the results of the study obtained the pH value of the colon contained ranging from 5.975 - 6.5 with a large average compiled from the lowest treatment P2 (5.975), treatment P0 (6.35), treatment P3 (6.35), treatment P5 (6.45), treatment P6 (6.475), and treatment P1 (6.5). The use of fermented duckweed in the ration of Rambon ducks has a real influence ($P<0.05$) on the pH value of the Colon. It gives an idea that the use of fermented duckweed has an influence on the digestive system of ducks, especially in the colon. Duncan's Double Distance Test was conducted to determine the effect between treatments, the results are listed in Table 6.

Table 6. Duncan Multiple Distance Test Results Effect treatment on pH Value of Large Intestine Duck Rambon

| Treatment | average pH value | Significan (0.05) |
|---|---|---|
| $P_2$ | 5.98 | b |
| $P_0$ | 6.35 | a |
| $P_3$ | 6.35 | a |
| $P_4$ | 6.45 | a |
| $P_5$ | 6.48 | a |
| $P_1$ | 6.50 | a |

Description: The different letters in the column significantly indicate the influence of real different treatments ($P<0.05$).

Table 6 showed that the pH of the colon of ducks on the influence of real P2 treatment ($P<0.05$) was lower compared to pH in the treatment of P0, P3, P4, P5, and P1. Based on the results of the Duncan multiple test analysis that P2 has the most influence on other treatments. This shows that 20% of the use of fermented duckweed in Rambon duck rations can decrease the pH value of the colon. Changes in the pH value in the duck colon are influenced by fermented feed and coarse fiber content contained in fermented duckweed, which leads to a decrease in pH value. This is following the statement of Sun (2005) that fermented feed will affect the pH value in the colon. And in line with Sutrisna research (2010), the administration of coarse fiber between 5-20% in duck rations affects the pH value in the colon. The degree of acidity (pH) plays a role in the digestive tract of ducks, such as in the process of re-absorption of food and water substances. The two parameters are interconnected. If the pH value is not in a balanced condition, it will affect the absorption process of food substances, such as B vitamins and water. The pH changes that occurred in the study were due to the presence of microbes in the ration. Fermented duckweed is a feed ingredient that has been done biologically processing by fermenting with *Trichoderma harzianum* and *Saccharomyces cerevisiae* so that there are various types of microbes. This is in line with the statement of Havenaar et al. (1992) probiotics are defined as the living culture of one or more microbes given to farm animals to maintain digestive microflora. The results of research by Hendi et al. (2018) stated that combination with *Trichoderma harzianum* and *Saccharomyces cerevisiae* fermentation can increase the nutritional value of duckweed in terms of increasing crude protein and zinc content and decreasing crude fiber content. Fermented feed that has microbial content in it can affect the pH atmosphere of the colon to increase lactic acid bacteria. Hardiningsih (2006) states that lactic acid bacteria grow optimally at pH 5.8-6.7. According to Widodo (2015), a decrease in pH then bacteria that grow dominated by lactic acid bacteria, bacteria can suppress the presence of pathogenic bacteria. The digestive process in the colon becomes optimal and livestock becomes healthy. The use of fermented duckweed in Rambon duck rations is good for the digestive system of ducks because it does not interfere with microbial activity in the colon.

## CONCLUSIONS

Based on the results of the study, it was concluded that the use of fermented duckweed in the ration of Rambon ducks had not been able to increase the VFA content and could reduce the pH value of the large intestine. The use of 20% fermented duckweed has decreased the pH value of the large intestine, the lower the pH value of the large intestine, the fermented duckweed is good for use in the Rambon duck ration.

## ACKNOWLEDGEMENTS

The author would like to thank to student researchers and all parties involved in the implementation of this research and funding.

## REFERENCES

Bidura, I.G.N.G, Susila T.G.O., & Partama, I.B.G. (2008). *Limbah, Pakan Ternak Alternatif dan Aplikasi Teknologi*. Udayana University Press, Denpasar.

Hardiningsih, R., Napitupulu, R.N.R., & Yulinery, T. (2006). Isolation and resistance test of several isolates of Lactobacillus in low pH. *Biodiversitas*, 7(1), 15–17.

Havenaar, R., Brink, B.T., & Huis, J.H.J. (1992). *Selection of Strains for Probiotics Use. In: Probiotics the Scientific Basis*. London, UK: R. FULLER (Ed). Chapman & Hall Publishing House, 209–224.

Jhori, T.S., & Sharma, P.N. (1979). Studies on Utilization of Dried Duckweed (*Lemna minor*) in Chicks. *Indian Journal Poult. Sci*., 14, 14–18.

Mangisah, I., Nasoetion, M.H., Murningsih, W., Arifah, F. (2007). Pengaruh serat kasar ransum terhadap pertumbuhan, produksi dan penyerapan "volatile fatty acids" pada itik tegal. *Majalah Ilmiah Peternakan*, 10, 1–16.

McNaught, C.E., & MacFie, J. (2000). Probiotics in clinical practice: a critical review of the evidence. *Int Dairy J. Nutr. Res.*, 21, 343–353.

Nugroho, S. (2000). *Kinerja Itik Turi yang Diberi Feed Additive pada Tingkat Serat Kasar Ransum yang Berbeda*. Tesis. Program Pasca Sarjana Universitas Gadjah Mada, Yogyakarta.

Setiyatwan, H., Harlia, E., & Rusmana, D. (2018). Lignin, Selulos and Non Nitrogen Free Extract *L. minor* Fermentation Using *Trichoderma harzianum*

and *Saccharomyces cerevisiae*. *Jurnal Ilmu Ternak*, 18 (2), 115–120.

Setiyatwan, H., Harlia, E., Rusmana, D., Tubagus, B. & Adriani, L. (2018). Effect of Fermentation using *Trichoderma harzianum* and *Saccharomyces cerevisiae* on Crude Protein, Crude fibre and Zinc Content of Duckweed. *International Journal of Poultry Science*, 17 (12), 605–609.

Srigandono, B. (1997). *Produksi Unggas Air*. Cetakan ketiga. Gadjah Mada University Press, Yogyakarta

Sun, X., McElroy, A., Webb, J., Sefton, A.E.K.E. & Novak, C. (2005). Broiler Performance and Intestinal Alterations When Fed Drug-Free Diets. *Journal of Poultry Science*, 84, 1294–1302.

Sutrisna, R. (2010). *Peranan ransum berserat kasar tinggi dalam sistem pencernaan fermentatif itik*. Disertasi. Universitas Gadjah Mada, Yogyakarta.

Widodo, T.S., Sulistiyanto B., & Utama, C.S. (2015). The amount of lactic acid bacteria in ileal digesta and secal digesta of broiler fed ration containing fermented abandoned feed. *AGRIPET*, 15(2), 98–103.