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Effect of Biofeed-H-lysine Supplementation in Feed on Performance, Blood Lipid Profile and Intestinal Pathogenic Bacteria in Ducklings

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ABSTRACT

The study aimed to determine the effect of "Biofeed-H-lysine" on production performance, blood lipid profiles and pathogenic bacteria in the intestines of ducks. A total of 240 male Bali ducklings (*Anas sp*.) were randomly divided into four experimental groups with 6 replicates and each replicate with 60 ducklings. Ducklings in Group 1 (n=60) served as healthy controls and were fed a basic diet without the addition of Biofeed-H-lysine. Ducklings in Groups 2, 3 and 4 were fed with addition of 1, 2 and 3% Biofeed-H-lysine per kg of feed. The results showed that the body weight gain, and feed efficiency in the group of ducklings that received biofeed-h-lysine were significantly different ($P<0.05$) higher than the control. Supplementation of 2-3% Biofeed-H-lysine in feed significantly ($P<0.05$) reduced blood serum cholesterol and triglyceride levels, and significantly ($P<0.05$) reduced the population of *Coliform* and *E. coli* bacteria in the intestines of ducks. It can be concluded that supplementation of 2-3% biofeed-H-lysine in feed can improve performance, as well as reduce serum cholesterol and pathogenic bacteria in the intestines of ducks.

Key words: Ducklings, Lysine, Pathogenic bacteria, Probiotics

INTRODUCTION

The implementation of biotechnology products as feed supplements for duck feed which is able to increase the quantity and quality of products with a high level of feed efficiency is a future policy strategy that is highly expected as a substitute for the use of antibiotics which have been banned since 2018. In the tofu processing industry, around 35-40% solid waste is produced (Faisal et al. 2016) or around 1,024 million tonnes/year (Ajijah et al. 2019). The limiting factor for using tofu waste as poultry feed is the high crude fiber content, ranging from 19-24.03% which can reduce poultry productivity (Mulia et al. 2015; Sari et al. 2016; Nurhayati et al. 2019).

Biofeed-H-lysine is a feed biotechnology product in powder form based on tofu waste and carrots which is fermented with probiotic inoculants which are high in protein (22.96±1.37%), lysine (2.15±0.014%) and contains probiotic microbes (10^7 cfu/g) (Bidura et al. 2023). The combination of phytogenic additives with probiotics in feed significantly increases nutrient intake, feed efficiency, and jejunal villi height in laying hens (Hedayati and Manafi 2018; Hidayat et al. 2021).

Probiotics are beneficial microorganisms that enhance the immune system, produce organic acids so that the intestinal microflora is always in a balanced state, thus improving the absorption of nutrients in the host's digestive tract. Good absorption of nutrients in the digestive tract can affect productivity in poultry (Priastoto et al. 2016; Kalita et al. 2023). Microorganisms that are often used as probiotics are strains of *Lactobacillus, Bifidobacterium*, *Bacillus*, *Pediococcus* and *Yeast* (Soccol et al. 2010). The use of probiotics from the yeast *Saccharomyces spp*. in the diet can lead to increased production performance, increased feed digestibility, feed efficiency, and egg production (Zurmiati et al. 2014; Jannah et al. 2022). Supplementation of probiotics *Lactobacillus parabuchneri, Lactobacillus buchneri, Lactobacillus harbinensis,* and *Lentilactobacillus parabuchneri*) at a level of 1.0mL/L via drinking water, significantly increases feed efficiency and carcass quality in broilers (Susalam et al. 2024).

Based on this, researchers are interested in studying the effect of fermented feed products (Biofeed-H-lysine) as feed supplements to promote growth and bio-control of pathogenic bacteria in ducklings.

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MATERIALS AND METHODS

Ethical approval

This experiment was conducted using 240 two-week-old male Bali ducks (*Anas sp*.) with the approval of the Animal Ethics Commission, Faculty of Veterinary Medicine, Udayana University, and Denpasar, Indonesia.

Experimental design

Ducks were provided with standard duck feed (Table 1) and given *ad libitum*. Ducklings (n=240) were randomly divided into four experimental groups with six replicates and each replicate with sixty birds. Ducklings in Group 1 (n=60) served as healthy controls and were fed a basal diet without the addition of Biofeed-H-lysine. Ducklings in Groups 2, 3 and 4 were fed with the addition of 1, 2, and 3% Biofeed-H-lysine per kg of feed. The feed given was formulated based on nutritional requirements for ducklings for a 10-week trial. The composition of feed and nutrients is presented in Table 1.

Table 1: The composition of feed and nutrients in ducklings aged 2-10 weeks

Basal Diets		Compositions
Ingredients (%):		
Yellow corn		54.10
Rice bran		13.10
Coconut meal		13.10
Soybean		8.00
Fish meal (CP, 58%)		10.32
Oysters shell grit		0.50
Total		100
Chemical composition:		
Metabolizable energy	(kcal/kg)	2901
Crude protein	(%)	18.0
Crude Fiber	(%)	5.12
Ether Extract	(%)	7.30
Calcium	(%)	2.93
Phosphorous	(%)	1.10
Arginine	(%)	0.63
Lysine	(%)	1.16
Metionin+sistein	(%)	0.68
Tryptophan	(%)	0.20

The variables observed were: final body weight (FBW), body weight gain (LWG), feed consumption (FC), and feed efficiency (comparison between FC and LWG). Determination of *Escherichia coli* and *Coliform* populations followed the procedure of Sudatri (2021) by scatter method in EMBA media, namely 5g of digesta sample was put into an Erlenmeyer containing 0.1% peptone water solution with a volume of 45ml, resulting in a 10^{-1} dilution. Planting at a dilution level of 10^{-1} to 10^{-7} was to count bacterial colonies that grow using the cup count method (30-300 colonies). The cholesterol content in the serum was evaluated from the blood sample. Cholesterol levels were analyzed according to the Lieberman-Burchard method (Lieberman and Burchad 1980).

Statistical analysis

The data obtained were analyzed with one-way analysis of variance, if there was a significant difference ($P<0.05$) between the treatments, then it was continued with Duncan's multiple range test.

RESULTS AND DISCUSSION

Table 2 shows the growth and feed efficiency of ducklings fed biofeed-h-lysine from 2-10 weeks of age. The addition of Biofeed-H-lysine in feed significantly ($P<0.05$) improved duckling performance. The addition of 2-3% Biofeed-H-lysine in the feed significantly ($P<0.05$) increased the FBW of ducks, namely 7.83 and 8.79% higher than the control. The duck group that received feed containing 2 and 3% Biofeed-H-lysine, their LWG for 8 weeks of observation, were 10.45 and 11.64% significantly ($P<0.05$) higher than the control (without Biofeed-H-lysine).

The addition of Biofeed-H-lysine at a level of 2 and 3% in feed significantly ($P<0.05$) increased feed efficiency, respectively 9.28 and 11.14% higher than the control. The addition of 1% Biofeed-H-lysine to feed had no significant effect ($P>0.05$) on feed efficiency.

The impact of adding Biofeed-H-lysine to duckling feed from 2-10 weeks of age on *Coliform* and *E. coli* populations in the jejunum is presented in Table 3. Addition of 1% Biofeed-H-lysine to feed did not have a significant effect ($P>0.05$) on the population of *Coliform* and *E. coli* in the duckling jejunum. However, the addition of 2 and 3% Biofeed-H-lysine in the feed significantly ($P<0.05$) reduced the population of *E. coli* bacteria, namely 33.48 and 35.53% significantly ($P<0.05$) lower than the control. The same thing happened to the number of *Coliforms* in the jejunum of ducks which decreased significantly ($P<0.05$), namely: 13.99 and 17.01% lower compared to the control diet.

Table 4 presents the blood lipid profile (total cholesterol, LDL, HDL, triglycerides) of ducklings given additional Biofeed-H-lysine supplements in feed from 2-10 weeks of age. The addition of biofeed-h-lysine had a significant ($P<0.05$) effect on the duckling blood lipid profile. The total blood serum cholesterol levels of the ducks that were given 2 and 3% Biofeed-H-lysine in the feed decreased significantly ($P<0.05$), namely: 12.32 and 18.13% lower than the control. Likewise, blood serum triglyceride levels experienced a significant decrease ($P<0.05$), namely: 15.82 and 15.55% lower than the controls.

The addition of 2-3% Biofeed-H-lysine in feed significantly increases LWG and feed efficiency. This is due to the high content of the amino acid lysine in Biofeed-H-lysine. According to Jiang et al. (2021), the content of the amino acid lysine in the ration is very important, because the amino acid lysine is the first limiting amino acid in poultry and is very suitable for improving the quality of low-protein feed. As reported by Liao et al. (2015) and Batool et al. (2021), the amino acid lysine is involved in physiological processes, particularly in body protein synthesis, and helps digestion and utilization of nutrients (Zeng et al., 2013). Besides that, Biofeed-H-lysine is a fermented feed product, where the protein and mineral content of fermented products is higher than non-fermented (Mulia et al. 2015; Nurhayati et al. 2019).

Saccharomyces cerevisiae can break down complex carbohydrates into simple compounds, increasing enzymatic activity, digestibility, and absorption of nutrients (Saferi et al. 2005; Zurmiati et al. 2014).

Table 2: Performance of male Bali ducklings aged 2-10 weeks fed with Biofeed-H-lysine supplementation

Variables	Level of addition of Biofeed-H-lysine in feed (%)				SE
	0	1	2	3	
Initial body weight (g/head)	351.15	349.94	350.73	351.53	2.795
FBW (g/head)	1418.32^{a}	1435.74^{a}	1529.37^{b}	1542.93^{b}	21.062
LWGs (g/head/56 days)	1067.17^{a}	1085.80^{a}	1178.64^{b}	1191.40^{c}	19.318
FC (g/head/56 days)	4599.50	4658.08	4608.48	4563.06	48.752
FC (g/head/days)	82.13	83.18	82.29	81.48	0.815
FCR	4.31^{a}	4.29^{a}	3.91^{b}	3.83^{b}	0.083

Means with a common superscript within a row are significantly not different at probability P<0.05; FCR=Feed conversion ratio (FC/LWG)

Table 3: Impact of Biofeed-H-lysine in duckling feed from 2-10 weeks of age on *Coliform* and *E. coli* populations in the intestine

Variables	Level of addition of Biofeed-H-lysine in feed (%)				Normal population
	0	1	2	3	
Bakteri *E. coli* (cfu/g)	$9.26x10^{3} \pm 0.25x10^{3a}$	$8.72x10^{3} \pm 0.17x10^{3a}$	$6.16x10^{3b} \pm 0.12x10^{3b}$	$5.97x10^{3} \pm 0.15x10^{3b}$	10^{4}-10^{5}
Coliform bacteria (cfu/g)	$7.29x10^{4} \pm 0.16x10^{4a}$	$7.13x10^{a} \pm 0.13x10^{4a}$	$6.27x10^{4} \pm 0.11x10^{4b}$	$6.05x10^{4} \pm 0.14x10^{4b}$	$4.0x10^{6}$ to $9.4x10^{6}$

Means with a common superscript within a row are significantly not different at probability P<0.05; cfu=Colony forming unit

Table 4: Blood lipid (mg/dL) profile (total cholesterol, LDL, HDL, triglycerides) of male Bali ducklings fed with the addition of Biofeed-H-lysine supplements

Variables	Level Biofeed-H-lysine dalam pakan (%)				SEM
	0	1	2	3	
Total cholesterol	198.35^{a}	190.27^{a}	173.92^{b}	162.38^{b}	3.052
High density lipoprotein	65.91	67.38	62.75	71.46	2.036
Low density lipoprotein	160.28	156.24	159.25	148.37	4.792
Triglycerides	149.37^{a}	141.29^{a}	125.74^{b}	126.15^{b}	3.035

Means with a common superscript within a row are significantly not different at P<0.05.

Poultry productivity is influenced by several factors, namely the age of the chicken, ambient temperature, strain, and the nutritional content of the feed (Sodak 2011; Nupur et al. 2023). The average feed conversion value in this study indicated that probiotic supplementation in the ration tended to increase the ration conversion value. Jannah et al. (2022) reported that increasing the feed conversion value in chickens given the probiotic *Bacillus sp.* enabled the digestibility of feed ingredients to be of a higher quality (Haque et al. 2021).

Beta-carotene plays a role in increasing host immunity, preventing acute respiratory infections, playing a role in the process of epithelialization of digestive cells, and also in the proliferation of intestinal mucosal cells (Çalişlar 2019). Probiotic microbes in the digestive tract of poultry can create an acidic environment, thereby spurring the growth of lactic acid bacteria, otherwise suppressing the growth of pathogenic bacteria, so that nutrient absorption can be optimal (Purwati et al. 2015).

Biofeed-H-lysine contains the probiotic *Saccharomyces spp.* which can eliminate *Salmonella* colonization and enhance chicken intestinal immunity (Chen et al. 2012; Yu et al. 2012). Chang et al. (2019) reported that feed supplementation with multi-strain probiotics improved the gut microbiota of chickens and induced different cytokine expression patterns in *Salmonella* infection. According to Kogut and Arsenault (2015), *Salmonella* infection can reduce growth performance and cause dysbacteriosis which results in huge financial losses in the poultry industry.

The total blood serum cholesterol and triglycerides of chickens decreased with the presence of biofeed-H-lysine in the ration. Probiotics as feed additives have been reported to improve nutrient digestibility, growth performance, and the balance of microflora in the intestinal tract. The combination of phytogenic additives with probiotics in feed significantly increases nutrient intake, feed efficiency, and quail health. These results are supported by Hidayat et al. (2021) who reported that jejunal villi height increased by administering a diet of probiotics, phytobiotics and their combinations. The activity of probiotics and phytobiotics in the intestine can reduce the population of pathogenic bacteria in it, so that these conditions have an impact on increasing the growth and development of intestinal villi (Hedayati and Manafi 2018).

Conclusion

It can be concluded that there was an increase in the performance of male Bali ducklings fed with the addition of 2-3% Biofeed-H-lysine from 2-10 weeks of age, especially in weight gain and feed efficiency. Conversely, there was a decrease in serum cholesterol and triglyceride levels and total pathogenic bacteria in the intestine.

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Authors' contributions

All authors (IGNGB, NWS, AAPPW, DPMAC, EP and IMN) were actively involved in the research and writing of this article.

Conflict of interest

All authors of the manuscript have no conflict of interests to declare.

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