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(RESEARCH ARTICLE)

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The combined effect of herbal leaves and yeast in feed as a growth promoter and bio-control of pathogenic bacteria in the intestines of native chickens

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Abstract

The combination of herbal leaves with probiotics in feed causes the jejunal pH value of chickens to be within normal values, so that nutrient absorption can be maximized. Phytochemical compounds and probiotics, both of which have the ability to bio-control pathogenic bacteria. This study aims to examine the effect of adding a mixture of *Moringa* leaf flour and Yeast (80% *Moringa*-20% Yeast; g/g) in the diet on the growth and population of pathogenic bacteria in the intestines of native chickens. A total of two hundred and forty chickens aged 2 weeks were randomly divided into 4 treatment groups, namely: the group of native chickens fed a diet supplemented with 2% *Moringa*-Yeast (M1); 4% *Moringa*-Yeast (M2); and 6 *Moringa*-Yeast (M3). The control group of chickens was fed without *Moringa*-Yeast (M0). Each treatment with 6 repetitions with 40 birds per repetition. The results showed that the birds in the *Moringa*-Yeast group had the highest growth, body weight gain, and feed efficiency ($P<0.05$) compared to the control group (M0). *Moringa*-Yeast supplementation in the diet had a significant ($P<0.05$) effect on *Coliform* and *E.coli* bacteria in the intestine of birds. It can be concluded that supplementation of 2-6% *Moringa*-Yeast in feed for native chickens from 2-10 weeks of age, can increase growth and feed efficiency, and conversely reduce the population of pathogenic bacteria in the intestines of birds.

Keywords: Cholesterol; *Moringa*; Native chicken; Pathogenic bacteria; Yeast

1. Introduction

Over the last decades, antibiotics have played an important role as growth-promoting agents and eliminating pathogenic bacteria populations in the gut, so that nutrient absorption can be maximized. The use of antibiotics as growth promoters is growing in line with the development of the livestock industry for food. However, due to the effects of resistance and residual effects on livestock products, this has led to a ban on the use of antibiotics in animal feed [1,2]. Alternatives to antibiotics are phytogenic feed additives combined with probiotics. Phytochemical compounds contained in herbal leaves can stimulate digestion and utilization of nutrients , so that livestock growth can be [3,4,5,6].

The phytochemicals contained in *Moringa* can act as an antibacterial and β-carotene can increase carcass color [7,8]. The combination of herbal leaves with probiotics in the feed causes the jejunal pH value of the chicken to be in a normal value, so that nutrient absorption can be maximized [9], which ranges from 5.80-6.90 [2]. The height of the jejunal villi increases by administering a diet of probiotics, phytobiotics and their combinations [9]. This increase appears to be due to the antibacterial activity of probiotics and phytobiotics, which can reduce the population of pathogenic bacteria in the intestinal villi [10], so that these conditions have an impact on increasing the growth and development of the intestinal villi and can also inhibit the development of pathogenic [11,12].

Probiotics are beneficial microorganisms that are used as feed additives that work to produce organic acids so that the microflora of the digestive tract is always in a balanced state, so that the absorption of nutrients can be absorbed

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properly. Good absorption of nutrients in the digestive tract can affect productivity in chickens [13]. Microorganisms that are often used as probiotics are strains of *Lactobacillus, Bifidobacterium, Bacillus*, *Pediococcus* and *Yeast* [14]. The use of probiotics in feed can improve production performance, feed digestibility and feed efficiency in poultry [15,1617]. Probiotic microbes in the gut can inhibit the growth of pathogenic bacteria, such as *Escherichia coli, Salmonella* and *Clostridium* bacteria [18].

Condensed tannins in *Moringa* leaves can inhibit its utilization for poultry feed [19,20], so its administration in feed needs to be combined with probiotic microbes. This is evident from the research by [21] who combined phytogenic additives with probiotics in feed significantly increased nutrient intake, feed efficiency and quail health.

The aim of this study was to examine the effect of adding *Moringa* leaf flour (*Moringa oleifera*) and yeast (*Saccharomyces spp*.) in diet to promote growth and suppress the population of pathogenic bacteria in the intestines of native chickens.

2. Material and methods

2.1. Material

This research was conducted at the Research Station, Faculty of Animal Husbandry, Udayana University on Jl. Raya Sesetan, Denpasar, Bali. The tools used consist of a set of scalpels and scissors, analytical scales, and a heating stove. The chicken used was a healthy 2 week old native chicken obtained from a native chicken nursery in Mengwi Village, Badung Regency, Bali. The feed given was commercial complete feed 511 HI-PRO-VITE, produced by PT. Charoen Pokphand Indonesia, Tbk., at Jl. Raya Surabaya-Mojokerto Km. 26, Keboharan Village, Krian District, Sidoarjo Regency, East Java, Indonesia. Recommended feed for native chickens in the starter-grower phase. All chickens were kept in battery colony cages made of aluminum.

2.2. Methods

A total of 240 hens aged 2 weeks were randomly divided into 4 treatment groups, namely: the group of native chickens fed a diet supplemented with 2% *Moringa-Yeast* (M1); 4% *Moringa-Yeast* (M2); and 6 *Moringa-Yeast* (M3), repectively. The control group of chickens was fed without *Moringa*-Yeast (M0). Each treatment with 6 repetitions with 40 birds per repetition.

All chickens were kept in battery colony cages made of wire and bamboo slats. The dimensions of each cage plot were: 200 cm long, 150 cm wide and 40 cm high. Each plot contained 10 two-week-old native chickens with homogeneous body weight. All chickens were given feed and water *ad libitum*. The feed container was made of PVC pipe and the drinking water container was made of plastic with a volume of 5 liters.

2.3. *Moringa*-Yeast

The *Moringa* leaves used in the *Moringa-yeast* mixture are obtained from the *Moringa* plantation in the Penebel area, Tabanan Regency, Bali. *Moringa* leaves are picked from the tree from old to young (except for the tops), then dried in the sun for two days, then finely ground and filtered. The yeast used is yeast that was commonly used in making tape. Tape yeast obtained from the local public market. *Moringa-Yeast* is made by mixing *Moringa* leaf flour (80%) with *Yeast* tape (20%) with a ratio of 80:20 (4:1; g/g).

2.4. Observed Variables

The variables observed were body weight gain (LWG) and feed consumption (FI) which were measured every week. Feed conversion ratio (FCR) was measured during the study period, which is a comparison between LWG and FI in the same unit of time. Testing for *Coliform* and *Escherichia coli* bacteria uses the scatter method in EMBA media [22]. The data obtained were analyzed by means of variance and if there were significant differences ($P<0.05$) between treatments, then it was continued with Duncan's multiple range test.

3. Results and discussion

3.1. Growth performance

The results of the research on the performance of native chicken fed *Moringa-Yeast* (MY) in rations from 2-10 weeks of age on final body weight (FBW), live weight gains (LWG), feed consumption, and feed conversion can be seen in Table 1.

Feed intake in group M0 was lower than in groups M1, M2, and M3, but statistically it was not significantly (P>0.05) different. The mean final body weight in the M0 group were lower, namely: 13.90%; 12.39%; and 16.78% compared to the M1, M2, and M3 groups, and statistically they were significantly (P<0.05) different. The mean LWGs groups M1, M2 and 33 were significantly different (P<0.05) than grup M0. Native chicken groups M1, M2, and M3, have FCR values, namely: 9.74%; 8.88%; and 10.89 significantly (P<0.05) lower than the chickens in the M0 group.More detail is presented in Table 1.

Table 1 Performance of native chicken fed *Moringa*-Yeast (MY) in diets from 2-10 weeks of age

Variables	**Addition of *Moringa*-Yeast in the diet (%)**				**SEM**
	0	**2**	**4**	**6**	
Feed intake (g 56 days^{-1})	2774.10	2975.49	2942.49	2957.33	42.90
Initial body weight (g head^{-1})	131.02	130.74	131.61	130.36	1.035
Final body weight (g head^{-1})	925.89b	1075.34a	1056.92a	1081.27a	31.17
LWGs (g 56 days^{-1})	794.87b	944.60a	925.31b	950.91a	30.71
FCR (FI:LWGs)	3.49a	3.15b	3.18b	3.11b	0.102

Note: The mean with superscript (a,b) was significantly different (P≤0.05); SEM= Standard error of the treatment means

Supplementation of 2-6% MY in feed significantly increases FBW, LWG and feed efficiency. Increased FBW and LWG, because MY contains phytochemical compounds that have antimicrobial properties [5,6], and has been shown to increase nutrient absorption and feed efficiency [23]. In contrast to research [24] which found carrot herbal supplementation in feed, it significantly reduced feed consumption in laying hens.

Increase in body weight and feed efficiency in MY group chickens, because MY contains the probiotic *Saccharomyces sp*. According to [25], *Saccharomyces sp*. apart from being a crude fiber degradation, it can also increase feed digestibility. Probiotics in the digestive tract of chickens can increase nutrient digestibility, so that growth and feed efficiency can be optimal. Jannah et al.[26] reported that the addition of *Bacillus sp*. probiotics to the diet increased digestibility and feed efficiency.

Li et al.[27] proved that the probiotic *B. subtilis* can effectively improve growth performance in broilers and through beneficial modulation of the microbiota in the cecum. Supplementation of herbal leaves in feed resulted in an increase in average daily body weight (ADG) and nutrient digestibility in pigs and in broilers [28,29]. Flour *Moringa* leaves contain crude protein ranging from 28.52-32.46% [30], which is sufficient to meet the needs of chicken production. Supplementation of *Moringa* leaf powder in feed can increase the production and quality of chicken eggs [27].

3.2. Choliform and *Eschericia coli*

The addition of MY to the native chicken diet from 2-10 weeks of age turned out to have a significant effect (P<0.05) on the number of *Coliform* and *E.coli* populations, but not significantly different (P>0.05) on TPC (Table 2).

The total *Coliform* population in the intestines of group M1, M2, and M3 chickens were: 37.13%; 39.79%; and 37.54% significantly (P<0.05) lower than the chickens in the M0 group. Likewise, the total *E.coli* bacteria in the intestines of group M1, M2, and M3 chickens were: 46.22%; 47.79%; and 42.97% significantly (P<0.05) lower than the chickens in the M0 group.

MY supplementation in free-range chicken feed aged 2-10 weeks was able to reduce the number of *Coliform* and *E.coli* bacteria, but had no effect on TPC in the chicken intestine. According to [31], increasing herbal extract supplementation linearly reduced the amount of *Escherichia coli* in excreta. *Escherichia coli* bacteria are commensalistic in broilers and its presence in chicken feces is very high which can be an agent of disease transmission [32]. It was reported by [33], that the cell walls of pathogenic bacteria can be lysed by phenolic and terphenoid compounds in herbal leaves [33]. The type of herb and the concentration of hebar extract greatly affect the level of inhibition on the growth of pathogenic bacteria [34]. The decrease in the number of pathogenic bacteria in the intestine, has an impact on increasing the absorption of nutrients into the body of the chicken, so that the growth of the chicken can be optimal. Herbal extracts have a promising ability to maintain growth performance, by increasing nitrogen digestibility and modulating intestinal bacterial populations in broilers[31].

Table 2 The effect of adding MY to the native chicken diet from 2-10 weeks of age on the amount of TPC, *Choliform*, and *Eschericia coli* (cfu g-1) in the native chicken intestine

Variables	Addition of *Moringa*-Yeast in the diet (%)				SEM
	0	2	4	6	
TPC (cfu g^{-1})	$4.12x10^{7a}$	$3.72x10^{7a}$	$4.93x10^{7a}$	$5.15x10^{7a}$	2.906
Choliform (cfu g^{-1})	$9.75x10^{4a3)}$	$6.13x10^{4b}$	$5.87x10^{4b}$	$6.09x10^{4b}$	0.172
E. choli (cfu g^{-1})	$1.72x10^{4a}$	$9.25x10^{3b}$	$8.98x10^{3b}$	$9.81x10^{3b}$	0.204

Note: The mean with superscript (^{a,b}) was significantly different (P≤0.05); SEM= Standard error of the treatment means

Probiotic microbes in the digestive tract of the host can maintain the balance of the intestinal microflora through an acidic mechanism (decreased intestinal pH). The acidic atmosphere causes the growth of pathogenic bacteria to be inhibited [35]. Probiotics can eliminate *Salmonella* colonization and increase chicken intestinal immunity [36]. The results of [37] reported that the addition of the probiotic *Bacillus subtilis* or *Yeast* culture to the rations of weaning piglets showed the same health effects compared to the addition of an antibiotic (zeng bacitrasin).

4. Conclusion

Based on the research results, it can be concluded that the addition of 2-6% *Moringa*-Yeast in the native chicken diet from 2-10 weeks of age can improve the performance and health of native chickens as seen from the decrease in pathogenic bacteria in the intestine.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of ethical approval

This research was approved by the Research Ethics Commission, Faculty of Veterinary Medicine, Udayana University.

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