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Supplementation of Brotowali Stem Meal (*Tinospora Crispa L*) in the Diet on Performance, and Organ Immunity of Hybrid Ducks Gunsi 888

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ABSTRACT

The management of microbial infections in poultry farming continues to be largely antibiotic-dependent. Despite this, the application of Antibiotic Growth Promoters (AGPs) in poultry feed has been banned, necessitating the use of herbal feed additives such as Brotowali (*Tinospora crispa*). This study aimed to evaluate the effects of Brotowali stem meal on the performance and immune organs of hybrid ducks. A total of 200 hybrid ducks Gunsi 888 were used in this study, reared from 11 to 46 days of age. The ducks were fed either a basal diet as a control (P1) or a basal diet supplemented with 0.5% Brotowali stem meal (P2), 1% (P3), and 1.5% (P4). The observed immune organs included the thymus, bursa of Fabricius, and spleen. The study was conducted in Bogor, West Java, while the an analysis of Brotowali's phytochemical properties was conducted at the Tropical Biopharmaca Research Center of IPB University. All collected data were analyzed using analysis of variance (ANOVA), and significant differences were further analyzed using Duncan's Multiple Range Test (DMRT) with SPSS version 25. The results showed that Brotowali stem meal had no significant effect (P>0.05) on the immunity of hybrid ducks. However, Brotowali stem meal significantly (P<0.05) improved the performance of hybrid ducks, as evidenced by increased body weight and decreased feed conversion ratios. In conclusion, Brotowali can enhance the performance of hybrid ducks, and it does not affect the stress levels of the livestock.

Keywords: brotowali stem meal, gunsi 888, immune Organs, performances.

ABSTRAK

Manajemen infeksi mikroba pada peternakan unggas masih sangat bergantung pada penggunaan antibiotik. Namun, larangan penggunaan Antibiotic Growth Promoters (AGP) dalam pakan unggas telah mendorong pemanfaatan aditif pakan herbal, seperti Brotowali (*Tinospora crispa*). Penelitian ini bertujuan untuk mengevaluasi efek serbuk batang Brotowali terhadap performa dan organ imun itik hibrida. Sebanyak 200 ekor itik hibrida gunsi 888 digunakan dalam penelitian ini, dipelihara dari usia 11 hingga 46 hari. Itik diberi pakan basal sebagai kontrol (P1) atau pakan basal yang ditambahkan dengan 0.5% serbuk batang Brotowali (P2), 1% (P3), dan 1.5% (P4). Organ imun yang diamati meliputi timus, bursa Fabricius, dan limpa. Penelitian dilakukan di Bogor, Jawa Barat, sedangkan analisis fitokimia Brotowali dilakukan di Tropical Biopharmaca Research Center, IPB University. Data yang dikumpulkan dianalisis menggunakan analisis varian (ANOVA), dan perbedaan signifikan diuji lebih lanjut menggunakan Duncan's Multiple Range Test (DMRT) dengan perangkat lunak SPSS versi 25. Hasil penelitian menunjukkan bahwa serbuk batang Brotowali tidak memiliki pengaruh signifikan (P>0.05) terhadap imunitas itik hibrida. Namun, serbuk batang Brotowali secara signifikan (P<0.05) meningkatkan performa itik hibrida, yang ditunjukkan dengan peningkatan bobot badan dan penurunan rasio konversi pakan. Sebagai kesimpulan, Brotowali dapat meningkatkan performa itik hibrida dan tidak mempengaruhi tingkat stres ternak.

Kata kunci: batang brotowali, gunsi 888, organ imunitas, performa

INTRODUCTION

Ducks are a type of poultry widely utilized and developed by the Indonesian people. Ducks are raised for their meat and eggs, serving as one of the sources of animal protein (Rohmah *et al*. 2016). According to Destiana (2010), intensive duck maintenance requires feed costs of 60%–70% of production costs. In order to reduce production costs, some time ago Antibiotic Growth Promoter (AGP) supplements such as penicillin, cephacosporin, sulfanamide were used because they were considered to be able to improve poultry performance. However, currently the use of (AGP) has been banned in various countries (Windsich *et al*. 2007), due to concerns about causing resistance in humans. The Food and Agriculture Organization of the United Nations (FAO) through the concept of Sustainable Animal Diets (StAnD) states that in feeding it is better not to use synthetic antibiotics as growth promoters (Makkar and Ankers 2014). Efforts to overcome pathogenic microbial infections in Indonesia currently still depend on the use of antibiotics which are generally mixed into broiler rations. The use of antibiotics in addition to treatment is also used as a feed additive to accelerate livestock growth, improve ration conversion and increase feed efficiency (Zuprizal 2006).

Excessive use of antibiotics and errors in their use can spur the emergence of pathogenic bacterial resistance both in livestock and in consumers themselves, even world health researchers predict that in 2045 the number one killer in the world will be caused by antibiotic resistance. Seeing this danger, the government has issued a policy prohibiting the use of AGP (antibiotic growth promoter) in livestock rations, the Ministry of Agriculture issued a regulation No. 14/2017 concerning the classification of animal drugs contained in articles 16 and 17, namely the prohibition of the use of antibiotics as ration additives and explaining the mixing of animal drugs in rations for therapy according to instructions and under the supervision of a veterinarian, this policy has been in effect since January 2018. Some alternatives that have been found include phytobiotics which are expected to be an alternative to antibiotics, especially in Indonesia there are many plants that have the potential to be used as feed additives, which have active ingredients that can be used as an alternative to antibiotics, improve the digestive tract so that it can increase ration efficiency and optimize the digestibility of food substances (Ulfah 2006).

Herbal plants that can be used as phytobiotics are brotowali, which contain a lot of alkaloids berberine, soft resin, starch, glycosides, harsa, bitter substances picroretin, tinocrisposide, palmatin, columbine, and caoculin or picrotoxin. The crude extract of the brotowali plant has antimicrobial activity on several gram-positive and gram-negative bacteria in certain treatments. The results of Triawati's research (2019) showed that the most effective herbal plants in increasing the weight of broiler chickens were the treatment of brotowali plant extract mixed into drinking water, this was proven by the results of measurements and observations listed in the graph of the average weight of 36-day-old broiler chickens in the treatment of adding brotowali extract, the average was higher than other treatments, namely 2.62 g. Brotowali plants can increase the weight of broiler chickens more effectively than other plants, so seeing the potential of brotowali plants, further studies were carried out through research on the use of brotowali stem meal supplementation in rations on broiler performance.

MATERIAL AND METHODS

The study was conducted in Pakansari Village RT/RW 8/9, Cibinong, Bogor, West Java. Blood profiles were conducted at the Animal Nutrition Science Laboratory, Meat and Work, Faculty of Animal Husbandry, Bogor Agricultural University. Phytochemical analysis of brotowali was conducted at the Bogor Center for Agro Industry. Proximate analysis was conducted at the Poultry Nutrition Science Laboratory, Faculty of Animal Husbandry, Bogor Agricultural University. The livestock used in this study were 200 hybrid gunsi 888 ducks raised from 11 to 46 days of age. The ration used in this study was commercial feed named D1 produced by Putra Perkasa Genetika Company. The following are the nutrient contents:

Table 1. Nutrient content of research rations

Component	Commercial Feed D1
Metabolism Energy (kkal kg^{-1})	2820.0–2920.0
Moisture Content (%)	12.0
Protein (%)	20
Fiber (%)	5.0
Fat (%)	3.0
Ash (%)	8.0
Phosporus (%)	0.45
Calsium (%)	0.8–1.2

Based on the formulation using the trial-and-error method: P0 = control diet, P1 = control diet + 0.5% brotowali stem meal supplementation, P2 = control diet + 1% brotowali stem meal supplementation, P3 = control diet + 1.5% brotowali stem meal supplementation.

The observed variables were the measurement of immune organs and performance of hybrid ducks. The immune organ variables included thymus weight, spleen weight, and bursa Fabricius weight. The measurement of duck performance included feed consumption, body weight gain, feed conversion, mortality, and Income over feed and duck cost (IOFDC) which were calculated during 4 weeks of maintenance. The experimental design used was a Completely Randomized Design (CRD) consisting of 4 treatments and 5 replications. The treatment rations given during the study were:

P0 = Control Ration
P1 = Control ration + 0.5% brotowali stem meal supplementation
P2 = Control ration + 1% brotowali stem meal supplementation
P3 = Control ration + 1.5% brotowali stem meal supplementation

RESULTS AND DISCUSSION

Duck Performances

Feed Consumption

Based on the research results regarding the supplementation of brotowali stem meal, the weekly feed intake data obtained is presented in Table 2.

The analysis results in Table 2 show that the treatments did not result in significant differences (P>0.05) in the hybrid duck feed intake during the second, third, and fourth weeks, while significant effects (P<0.05) were observed in the first and fifth weeks. This was due to the feed provided having a relatively high metabolic energy content. This aligns with the statement by Nadzir *et al.* (2015), who suggested that for optimal growth, efforts such as providing high-nutrient food, improving management, and maintaining optimal environmental temperatures in the poultry housing are necessary. Feed consumption is influenced by environmental temperature, poultry health, housing conditions, feeding equipment, the nutritional content of the feed, and stress in the poultry (Faiq *et al*. 2013). The feed intake results throughout the study were relatively consistent, which is suspected to be due to the relatively similar nutritional content of the feed provided, resulting in little variation in feed intake across the treatments. In line with this, several factors influence feed intake, such as animal body size, genetic traits, environmental temperature, feed quality and quantity, as well as the presence of diseases (Suprijatna *et al*. 2005).

Weight Gain

The performance of the ducks in this study includes the weight gain of the hybrid ducks. The data on the weight gain of hybrid ducks that were given brotowali stem meal supplementation in the feed can be seen in Table 3.

Based on the analysis results (Table 3), the supplementation of brotowali stem meal in the hybrid duck's diet showed no significant effect (P>0.05) on body weight gain in the first, second, and third weeks. However, significant effects (P<0.05) were observed in the fourth and fifth weeks. This is suspected to be because the addition of brotowali stem meal in the feed consumed by the hybrid ducks helps to destroy pathogenic bacteria that might enter their bodies, thus improving the absorption of the feed. Other studies have indicated that antibacterial compounds in the brotowali plant consist of alkaloids, saponins, and phenols (Andi *et al.* 2021). These chemical compounds in brotowali work by damaging the bacterial cell walls through the breakdown of peptidoglycan bonds, preventing the formation of intact cell layers (Asis 2016). The highest average body weight gain in hybrid ducks occurred with the supplementation of 1.5% brotowali stem meal, which was 22.545± 0.166 g/head, while the lowest was without supplementation, at 20.304± 0.108 g/head. This finding is consistent with the study by Triawati (2019), which showed that treatments with traditional medicinal plant extracts increased hybrid duck body weight, with brotowali extract supplementation at 10 cc/liter of water resulting in an average increase of 2.62 g/three days. Similar results were found in the study by Sami (2019), which showed the highest body weight gain with the supplementation of phytobiotics (20 cc/liter of water) at 0.84 kg/head/week. Nuningtyas (2014) also stated that the administration of herbal supplements to broiler chickens could significantly increase body weight due to the active compounds in traditional medicinal plants. With the 1.5% brotowali stem meal supplementation, there is an effective antimicrobial process that leads to improved digestibility, which likely contributes the most to the

Table 2. Duck feed consumption (g/head) from 11 to 46 days of age with brotowali stem meal supplementation.

Study Period	Treatment			
	P0	P1	P2	P3
Week-1	1.048±0.028	1.050±0.009b	1.046±0.035b	1.035±0.0254b
Week-2	1.79±0.050	1.79±0.034	1.79±0.073	1.78±0.079
Week-3	2.52±0.150	2.52±0.138	2.59±0.103b	2.62±0.150b
Week-4	3.43±0.168	3.49±0.142	3.52±0.126 b	3.55±0.181 b
Week-5	4.43±0.008	4.44±0.052	4.49±0.072b	4.62±0.134 c

Note: Different superscript letters in the same row of the table indicate significant differences at P<0.05. P0 = Control feed, P1 = Control feed + 0.5% brotowali stem meal, P2 = Control feed + 1% brotowali stem meal, P3 = Control feed + 1.5% brotowali stem meal.

Table 3. Weight gain of hybrid ducks (g/head) from 11 to 46 days of age with brotowali stem meal supplementation in the feed.

Study Period	Treatment			
	P0	P1	P2	P3
Initial Weight	301±0.004	306±0.006	305±0.014	301±0.004
Week-1	653±0.206	686±0.075	674±0.073	664±0.024
Week-2	847±0.215	852±0.057	936±0.181b	919±0.103 b
Week-3	1.420±0.069	1.438±0.052	1.5±0.178 b	1.527±0.080 b
Week-4	1.639±0.172	1.681±0.118 b	1.73±0.101c	1.80±0.111d
Week-5	2.03±0.108	2.053±0.110	2.156±0.266 b	2.254±0.166c

Note: Different superscript letters in the same row of the table indicate significant differences at P<0.05. P0 = Control feed, P1 = Control feed + 0.5% brotowali stem meal, P2 = Control feed + 1% brotowali stem meal, P3 = Control feed + 1.5% brotowali stem meal.

increase in body weight. This is in line with Yang *et al*. (2019), who stated that phytobiotics in the feed can improve poultry health and performance by reducing the potential for pathogenic bacteria, thus promoting the growth of beneficial bacteria. This opinion is also confirmed by Widiana *et al.* (2016), who stated that crude extracts of brotowali plants have antimicrobial effects against certain gram-positive and gram-negative bacteria under specific conditions.

FCR (Feed Conversion Ratio)

The following data presents the results of a study on the Feed Conversion Ratio (FCR) from the supplementation of brotowali stem meal in hybrid ducks. Based on the analysis results (Table 4), it shows that the supplementation of brotowali stem meal in the feed conversion ratio of hybrid ducks had a significant effect (P<0.05). This is because the supplementation of brotowali stem meal contains many additives that can improve feed quality. According to Lacy and Vest (1997), the main factors influencing feed conversion ratio are feed quality, type of feed, use of additives, water quality, disease, as well as management of care and maintenance.

Based on the analysis of variance, the supplementation of brotowali stem meal in the feed for hybrid ducks showed a highly significant effect (P<0.05) on body weight gain. In Table 4, it is observed that the feed supplementation with brotowali stem meal resulted in a decrease in the feed conversion ratio. In this study, the high feed conversion ratio was due to the increasing difference between the feed consumed and the body weight gain achieved. A high feed conversion ratio indicates that the lower body weight gain reduces the efficiency of feed utilization. This is in line with Wahyu's (2004) statement that feed conversion ratio can be used to measure feed efficiency. The hybrid duck management in this study was conducted at a low ambient temperature, which resulted in increased feed intake to maintain body temperature. According to Murtidjo (1987), in cold temperatures, poultry feed intake will increase by 20%-30% compared to feed intake at normal temperatures.

Mortality

In this study, no hybrid ducks died. Throughout the maintenance period from 11 days to 46 days of age, there were no recorded deaths. This may be due to the controlled feeding treatments or the supplementation of brotowali stem meal, which did not affect the animals' immune system. This is consistent with research conducted by Dapawole and Sudarma (2020) and Matitaputty and Bansi (2016), which showed that the rearing of ducks up to 8 weeks or 12 weeks of age did not result in animal deaths, as they used feed that met the minimum nutritional requirements for survival and production.

Immunity Organs

One of the indicators used to determine animal health is by measuring the immune organs. The analysis results in this study, shown in Table 5, indicate that the feed treatments provided had no significant effect (P>0.05) on the spleen, bursa of Fabricius, and thymus organs.

Spleen

Based on Table 5, the analysis of variance shows no interaction (P>0.05) between the control feed (P1) and the addition of brotowali stem meal on spleen weight. The average relative spleen weight was 0.105% - 0.112%. Leung *et al.* (2019) reported that the average relative spleen weight was 0.094% - 0.096%. The slight increase in spleen weight may be due to the potential impact of heat stress, which increases the likelihood of foreign substances entering the body and exposing the animals to heat stress. In addition, the thymus weight in natural temperature conditions is not very large, so the spleen works harder (Hakim *et al.* 2021). According to Zulfa *et al.* (2019), spleens affected by foreign substances have a higher weight percentage, and spleen weight growth will be disrupted if the animals are exposed to heat stress or infection by foreign substances. The spleen

Table 4. Feed conversion ratio of hybrid ducks from 11 to 46 days of age with brotowali stem meal supplementation in the feed.

Study Period	Treatment			
	P0	P1	P2	P3
Week-1	1.612±0.055	1.53±0.018	1.552±0.0165	1.558±0.007
Week-2	2.118±0.060	2.108±0.018	1.93±0.040 b	1.942±0.021 b
Week-3	1.78±0.019	1.754±0.016 ab	1.728±0.020 ab	1.716±0.005 b
Week-4	2.1±0.013	2.05±0.014 b	2.034±0.017 b	1.97±0.012 c
Week-5	2.186±0.012	2.164±0.009	2.084±0.027 b	2.052±0.0168 b

Note: Different superscript letters in the same row of the table indicate significant differences at P<0.05. P0 = Control feed, P1 = Control feed + 0.5% brotowali stem meal, P2 = Control feed + 1% brotowali stem meal, P3 = Control feed + 1.5% brotowali stem meal.

Table 5. Immune organs in hybrid ducks

Immune Organs	Variable			
	P0	P1	P2	P3
Spleen	0.109±.0227a	0.105±0.211 a	0.112±0.245 a	0.110±0.360 a
Bursa oFFabricius	0.109±0.221 a	0.105±0.216 a	0.112±0.240a	0.102±0.220 a
Timus	0.129±0.255 a	0.115±0.272 a	0.140±0.309 a	0.153±0.210 a

Note: Different superscript letters in the same row of the table indicate significant differences at P<0.05. P0 = Control feed, P1 = Control feed + 0.5% brotowali stem meal, P2 = Control feed + 1% brotowali stem meal, P3 = Control feed + 1.5% brotowali stem meal.

is an organ that functions to filter antigens from the blood related to lymphocytes, and if the spleen size increases, it indicates more antibodies, which results in a decrease in free lymphocytes in the blood (Sjofjan *et al.* 2020). Jamilah *et al.* (2013) in their study on poultry stated that the growth of immune organs during the starter phase greatly affects the subsequent phases, namely the grower and finisher phases. Frasiska *et al.* (2021) reported that the protein content in feed can influence spleen weight, with sufficient protein supporting optimal spleen organ growth. Optimal spleen growth reduces the likelihood of immunosuppression. Immunosuppression is a condition where the immune system's capacity is reduced, which can occur if the spleen organ does not develop optimally (Zahra and Yunistya 2020). The spleen will be damaged if its relative weight is at an abnormal level; spleen weight increases if there are antigens or as a result of disease emergence in the body (Frasiska *et al.* 2021). The absence of increased spleen weight indicates that there is no formation of lymphocytes, which also suggests that the supplementation of inulin prebiotics did not have a negative effect on the hybrid ducks.

Bursa of Fabricius

The results of the effects of adding brotowali stem meal to the feed for hybrid ducks are presented in Table 5. Statistical analysis shows no significant effect (P>0.05) from the interaction of the treatments between brotowali stem meal supplementation and the proportion of the weight of the bursa Fabricius. Rearing under different ambient temperature conditions also showed no significant effect (P>0.05) on the proportion of the weight of the bursa Fabricius. The average proportion of the weight of the bursa was 0.102% - 0.112%, which is lower compared to the study by Leung *et al*. (2019), who reported that the average bursa weight was 0.103% - 0.174%. The bursa Fabricius serves a vital function in the immune system in the body's defense response, playing a role in B lymphocyte differentiation. Stress conditions can stimulate the function of this organ, leading to depletion. Heat stress causes hybrid ducks to experience stress, which can trigger the release of corticosterone hormones. According to Tamzil (2014), Corticosterone is capable of affecting with the function of the immune system and lymphoid tissues. Kusnadi (2019) also reported that increased corticosterone hormone levels stimulate the breakdown of proteins into glucose, which leads to a reduction in the weight of the bursa Fabricius.

Thymus

Based on Table 5, it shows that there is no interaction effect (P>0.05) from the addition of brotowali stem meal in the feed of hybrid ducks. The results from the treatment with the addition of nucleotides on the proportion of the weight of the thymus also show no significant effect (P>0.05). The average proportion of the weight of the thymus ranged from 0.115% to 0.153%, which is lower than the study by Leung *et al.* (2019), which ranged from 0.203% to 0.226%. This may occur because the feed provided with brotowali stem meal did not meet the nutritional requirements for the thymus organ.

CONCLUSION

The performance of hybrid ducks with the supplementation of brotowali stem meal in the diet is optimal when brotowali stem meal is provided at a concentration of 1.5%. At this level, there are no negative effects on mortality rate, livestock health, immunity, or stress levels, making it safe for use.

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