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The Effect of Giving Black Cumin Seed (*Nigella Sativa*) Extract on Broiler Body Weight and Death Rate at Broiler Chicken Farming

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Abstract: This study aims to determine the effect of black cumin seed extract (Nigella sativa) on body weight and mortality of broiler chickens. Broiler chickens were randomly selected to represent 4 dose groups: control group (P0), 1.5 ml/liter extract (PI), 2 ml/liter extract (PII), and 2.5 ml/liter extract (PIII). The treatment was given by mixing black cumin seed extract (Nigella sativa) into the drinking water of broiler chickens for 3 weeks. The variables observed included body weight and mortality of broiler chickens. Data analysis used the one way ANOVA test followed by the LSD (Least Significant Difference) test. The results showed that the higher the dose of black cumin seed extract (Nigella sativa) given, the greater the broiler weight gain, while the mortality rate did not show any effect on the dose given. It can be concluded from this study that black cumin seed extract (Nigella sativa) has a significant effect on weight gain, but has no effect on broiler mortality.

Keywords: Black cumin seeds; Body weight; Mortality rate

Introduction

Indonesia is a region that has abundant natural resources, so it is known as an agricultural country or region. Livestock as an agricultural sub-sector has a very important role in strategic development including livestock as a food provider, especially in meeting people's needs for animal protein, livestock as a source of income and employment opportunities, as a sustainable agricultural business and environmental improvement (Hayati et al., 2019).

Broiler chickens are poultry that can grow quickly and efficiently to produce animal meat which is highly favored by the public, because it has a soft and tender meat texture and is easy to process, but is less tolerant of hot temperatures. Broiler chickens are prone to heat stress, decreased appetite, decreased immune system, which can cause various diseases and stress. According to Tabiri et.al (2000), heat stress in poultry can trigger the emergence of various diseases, growth rates and egg production caused by reduced protein retention and continues to decrease the digestibility of protein and some amino acids.

The main problem which is the toughest challenge in broiler farms is the emergence of disease, so that management needs to be done efficiently and professionally. The causes of disease in chickens are viruses, bacteria, fungi, protozoa, worms and fleas. In addition, it can occur due to mineral and vitamin deficiencies, therefore many broiler chicken farms die before harvest, causing losses to the farm (Ismail, Cahyadi, & Hardjomidjojo, 2019).

The use of black cumin as a medicine is in the seeds. The benefits of black cumin seeds are to treat various diseases such as strengthening the immune system, asthma, bronchitis, diabetes, increasing breast milk production, anthihistamines, maintaining skin elasticity, antioxidants, antitumor, cancer, antibacterial, increasing heart work, repairing the digestive tract, and lower cholesterol. The chemical constituents contained in black cumin seeds (Nigella sativa) are thymoquinone, thymohydroquinone, fatty oils, oleic nigellienine, nigellamine-n-oxide, essential oils, alkaloid group compounds, saponins, steroids, isoquinoline alkaloids, and linolenic acid (Marlinda, 2015).). Thymoquinone, a ketone monoterpenoid compound, can increase the

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immune system in bronchial asthma sufferers due to allergies, in addition to its main properties as an anti-allergic and anti-inflammatory.

Method

This research was conducted in May 2022 at a broiler farm in Rade Village, Madapangga District, using a Completely Randomized Design (Harjosuwono et al, 2011). Caraway seed extract is made through the following steps, black cumin seeds are washed thoroughly using running water. After that, it was dried, then in a blender until it was in the form of dry powder and then macerated with 96% ethanol for 72 hours. The black cumin seed extract solution was evaporated to evaporate the ethanol, leaving black seed oil to be used in the study. Then the black cumin seed extract was measured using a measuring cup according to the treatment dose, namely 1.5 ml/liter, 2 ml/liter, and 2.5 ml/liter.

The method of giving black cumin seed extract is by mixing black cumin seed extract into the drinking water of broiler chickens. All treatments were given for 3 weeks or 21 days with the observed variables namely body weight and broiler mortality rate. Observation of broiler weight gain was carried out by weighing it every week from the first week of the study to the third week, while the broiler mortality rate was observed in the third week or at the end of the study. To determine the effect of black cumin seed extract on weight gain and mortality of broiler chickens, a one-way Anova test was analyzed and to determine the effect of dosing in each experimental group, it was continued with Least Significance Differences (LSD) analysis.

Result and Discussion

The average weight gain of broiler chickens after being given black cumin seed extract (Nigella sativa) is summarized in Table 1 and Figure 1. Table 1 shows that there were twenty-four test animals from four different treatment groups and had an average weight gain different. The average weight gain of chickens after being given black cumin seed extract, the lowest was 1.82 kg in the 1.5 ml/liter treatment, while the highest was 2.25 kg in the 2.5 ml/liter treatment.

Table 1. Average Weight Gain for Broiler Chickens (kg)

		N	Mean	Min	Max	SD
Control		6	1.74	1.72	1.77	0.03
Treatment	P1	6	1.82	1.80	1.90	0.02
	P2	6	1.96	1.94	2.00	0.02
	P3	6	2.25	1.98	2.42	0.01

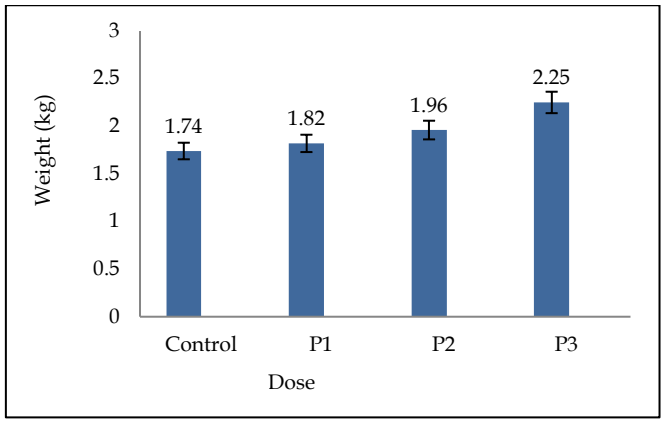

Figure 1. Graph of Average Broiler Weight

Figure 1 shows that the higher the dose of black cumin seed extract given, the greater the broiler weight gain. The weight gain of broiler chickens is probably caused by the chemical content of black cumin seeds, namely thymoquinone which functions as an antioxidant, anti-inflammatory and anti-infective, so that it can increase the immune system of broiler chickens (Ragheb, 2009).

The results of the One Way Anova analysis of the effect of black cumin seed extract on broiler weight gain (Table 2), show F count = 5.56 > F table = 3.1, Ha is accepted, meaning that there is a significant difference in average body weight between the four treatments given to each group of broiler chickens.

The results of further tests with the Least Significant Differences (LSD) test showed only broiler weight gain between the control group with the 1.5 ml/liter treatment which was not significantly different, namely 0.09 > 0.05 which caused no difference in average weight significant body weight between the control group and the 1.5 ml/liter extract group.

Thymoquinone substances can also improve digestion and absorption of nutrients by stimulating digestive enzymes (Nasir, 2009). According to Salama (2010) thymoquinone in black cumin seeds has uses as an antioxidant, so it can be used to optimize the work of the digestive organs in poultry, stimulate the gallbladder, secrete bile and stimulate the release of pancreatic juice, which can increase appetite and can increase chicken weight. broilers. In addition, giving black cumin extract to feed or drinking water can protect chickens from free radicals and stress, so that it can stimulate feed consumption and growth of broiler chickens.

The poultry pancreas functions to secrete pancreatic juice which functions in the digestion of starch, fat and protein. The poultry pancreas has two main functions which are all related to the use of ration energy, namely exocrine and endocrine. The exocrine pancreas functions to supply enzymes that digest carbohydrates, proteins and fats by secreting the

enzymes amylase, trypsin and lipase which are carried to the duodenum (Rahayu, Sudaryani, & Santosa, 2011). The endocrine pancreas functions in regulating nutrients in the form of energy to be absorbed in the body for digestive processes (Aqsa, Kiramang, & Hidayat, 2016).

According to Yuniusta et al (2007), the essential oils contained in black cumin seed extract can help enzymatic metabolic processes in the body of broiler chickens. Essential oils can control stomach acid to normal and can reduce the work of the intestines that are too heavy in digesting food substances. Black cumin has a stimulating effect on the digestive system, by improving absorption and growth of broiler chickens. Black cumin seed extract will improve the rate of secretion of bile and increase the emulsification of pancreatic juice, thus improving the digestion and absorption of fat-soluble vitamins (Kamel & Jamroz, 2002).

The use of high black cumin concentrations will affect the activity of the amylase enzyme, namely the increasing addition of black cumin extract to feed or drinking water for broiler chickens, it will increase the activity of the amylase enzyme because the essential oil content increases along with the administration of cumin extract to broiler chickens. An increase in the digestive process will produce substrates for metabolic processes into products that will be absorbed by the intestine more and more and will improve the nutritional status of the feed, thereby supporting the body's physiological processes. In addition to the amylase enzyme, the activity of the lipase enzyme in the small intestine of chickens also increases with the increase in the addition of black cumin, because black cumin contains linoleic acid, palmitic acid, amoleic acid, linolenic acid, and stearic acid which can provide an optimum environment for lipase enzyme activity. Lipase enzyme activity is related to the type of substrate, pH and temperature. The lipase enzyme has an optimum pH of 5.6-8.5 (Effendy, 2014).

Protein consumed in feed will be digested by pepsin in the proventriculus and gizzard by proteolytic enzymes (trypsin and chymotrypsin) in the small intestine which produce peptides and amino acids. Peptides and amino acids will be absorbed by the mucosal cells of the small intestine. In addition, the feed contains carbohydrates. Carbohydrates are hydrolyzed by the enzymes amylase and glucosidase into glucose which is then absorbed by the small intestine. Feed also contains fat which will later be broken down by lipase enzymes into fatty acids. Fat is needed for egg production, a layer of fat between meat and a source of energy for poultry. Other content in the form of minerals, consisting of macro minerals and micro minerals. Micro minerals are calcium, phosphorus, sodium, potassium, magnesium, and chloride needed for acid-base balance in the body's osmosis process. The macro minerals are copper, iodine, manganese, selen, and zinc. Macro and micro minerals are needed for bone formation, balance in cells and help the digestive system (Ketaren, 2010).

Livestock environmental conditions can directly affect the heat balance in the livestock body (homeostasis). According to Setiawati (2021), cattle get a heat load from: (1) metabolic heat; (2) direct solar radiation in the form of long waves and short waves; (3) diffuse radiation from the atmosphere; (4) reflection (reflection) from the ground. This total heat load will be balanced by releasing heat by: (1) conduction; (2) convection; (3) radiation and (4) evaporation. Cattle that are able to balance heat production with heat released cause livestock to be in a comfortable condition, while the inability of livestock to balance this heat causes stress. Excess heat in the animal's body is called heat stress while a lack of heat in the animal's body causes cold stress. Further explained, temperature is related to the function of the endocrine glands. Heat stress has a major effect on the endocrine system of livestock due to changes in metabolism. Cattle that experience heat stress due to increased environmental temperature, the function of the thyroid gland will be disrupted. This will affect the appetite and appearance. Chronic heat stress also causes decreased concentrations of growth hormone and glucocorticoids.

Broiler chickens are less tolerant of hot temperatures, because it can reduce the physiological processes of broiler growth. Black cumin contains antioxidants which can help reduce heat stress in broiler chickens. Heat stress conditions in chickens will increase the production of adenocorticotropic hormone (ACTH) by the anterior pituitary gland. One of the effects of high levels of this hormone is a decrease in the body's metabolism in general, including the absorption of nutrients seen in slower growth (May, 2004).

The hormone that is closely related to growth is the hormone thyroxine. The control of thyroxine hormone secretion is influenced by the secretion of thyrotropin or TSH (Thyroid Stimulating Hormone) from the anterior pituitary gland which functions as a feedback, i.e. when the level of thyroxine hormone in the blood is low, stimulation of the release of TSH occurs which in turn stimulates the thyroid gland to secrete thyroxine hormone. Conversely, if the level of thyroxine in the blood is high, there will be an inhibition of TSH release, so that the thyroid gland will reduce the secretion of the hormone thyroxine. Thyroxine hormone affects growth in chickens, namely affecting enzymes related to food metabolism processes and also interactions with metal ions which are the composition of coenzymes. The activity of the thyroid gland is closely related to the surrounding air temperature. The higher the ambient temperature, the lower the activity of the thyroid gland. This is due to the high ambient temperature which

suppresses the release of the hormone thyrotropin, which is a hormone that stimulates the formation and release of the hormone thyroxine. Conversely, if the ambient temperature is low, it will increase the release of the hormone thyrotropin, which stimulates the release of thyroxine (Soeharsono, 1976).

The calorigenic (heat-producing) activity of thyroid hormone accounts for half of the total basal metabolic rate (BMR) of a normal animal, because it increases oxygen consumption in all cellular metabolism and stimulates cytoplasmic protein synthesis. Animals subjected to prolonged cold temperatures also experience an increase in thyroid hormone release, with increased metabolism resulting in increased internal heat production (Frandson, 1992). In general, heat stress will inhibit the work of the thyroid gland due to obstacles to the entry of iodide into the thyroid gland. Stress that has a negative effect on the function of the thyroid gland is caused by corticosteroid hormones produced by the adrenal cortex. Corticosteroids will cause increased excretion of iodine through the urine which causes a decrease in the concentration of iodide in the blood which ultimately causes a decrease in the supply of iodide in the thyroid gland. Corticosteroid production will always increase when the subject is experiencing stress. Low temperatures that do not cause stress will actually stimulate the production of the hormone thyroxine. This is due to the low temperature which does not cause stress, so that it will increase the synthesis and secretion of TSH. Optimum production of thyroxine results in increased metabolism which in turn increases livestock production.

According to Kasiyati (2018), light received by photoreceptors, both through the retinal and extra-retinal pathways, becomes a positive stimulant for the hypothalamus. The hypothalamus will secrete releasing factors, such as growth hormone releasing factor (GHRF) and thyroid realising factor (TRF). The releasing factor then stimulates the anterior pituitary to synthesize and secrete growth hormone (GH) or thyroid stimulating hormone (TSH). Further explained, growth hormone stimulates the growth of bone and muscle cells, as well as lipid and protein metabolism. Meanwhile, TSH stimulates the thyroid gland to secrete the hormone thyroxine. Thyroxine hormone can affect various enzymes involved in metabolism, increase metabolic activity, stimulate the use of oxygen, and increase energy supply. Thyroxine hormone also has an impact on increasing growth.

Guyton (2000) added, growth hormone has an effect on fat metabolism, growth hormone causes the release of fatty acids from adipose tissue, so that it can increase the concentration of fatty acids in body fluids. Administration of GH in vivo causes an increase in circulating free fatty acids and increases fatty acid oxidation in the liver, reduces carcass fat, fat deposits and increases muscle growth. Growth hormone is necessary for protein metabolism. It was further explained that the increase in protein in the body as a result of administration of growth hormone was caused by increased transport of amino acids through the cell membrane, increased protein synthesis by ribosomes, and decreased protein and amino acid catabolism.

Table 3. Description of the Average Mortality Rate of Broiler Chickens

		N	Mean	Min	Max	SD
Control		6	0.33	0	2	0.47
Treatment	P1	6	0.33	0	2	0.47
	P2	6	0.16	0	1	0.37
	P3	6	0.16	0	1	0.37

Hasil pengamatan pengaruh pemberian ekstrak biji jintan hitam (Nigella sativa) terhadap angka kematian ayam broiler terdapat pada Tabel 3 dan Gambar 2 yang menunjukkan bahwa terdapat dua puluh empat ekor hewan uji dari empat kelompok perlakuan yang berbeda dan memiliki rata-rata angka kematian yang berbeda. Pada kelompok kontrol dan pada perlakuan 1,5 ml/liter memiliki rata-rata angka kematian sebesar 0,33%, sedangkan kematian pada kelompok yang diberikan ekstrak biji jintan hitam perlakuan 2 ml/liter dan 2,5 ml/liter sebesar 0,16 % ml/liter.

The results of observing the effect of black cumin seed extract (Nigella sativa) on broiler mortality rates are shown in Table 3 and Figure 2 which shows that there were twenty-four test animals from four different treatment groups and had different average mortality rates. In the control group and the 1.5 ml/liter treatment had an average mortality rate of 0.33%, while the mortality in the group given black cumin seed extract 2 ml/liter and 2.5 ml/liter treatment was 0.16 % ml/liter.

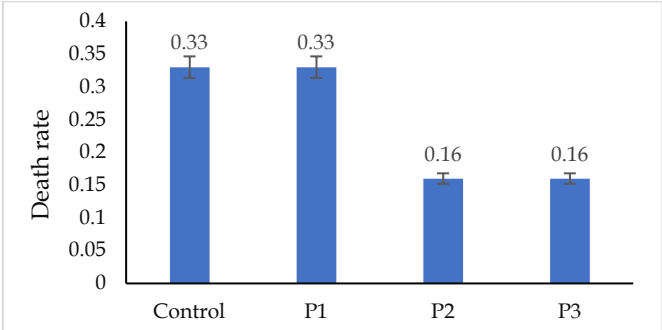

Figure 2. Graph of Average Broiler Mortality Rate

Table 4. One Way Anova Analysis of Broiler Chicken Mortality Rate

Variant source	JK	Db	RJK	Fcount	Ftable (α=0,05)
Between	0.17	3	0.06	0.26	3.1
In	4.33	20	0.22		
Total	4.50	23			

The results of the One Way Anova analysis on the effect of black cumin seed extract on the mortality rate of broiler chickens are shown in table 4. Table 4 shows the one way Anova test Fcount = 0.26 < Ftable = 3.1, Ha is rejected, which means there is no difference in average mean significant mortality rate between the four treatments given to each group of broiler chickens. This is possible because the condition of the chickens are not experiencing stress and stress, so that the immune system is maintained.

The immune system is a defense system that plays a role in recognizing, destroying and neutralizing foreign objects or abnormal cells that are detrimental to the body (Wijaya, 2022). Immunity is a complex system of cells, tissues and organs to protect the body. Wicaksono (2020) states, immunomodulators are substances or substances that can modify the immune response by activating natural and adaptive defense mechanisms, such as restoring an imbalance in the disturbed immune system. According to Akrom (2015), black cumin can function as an immunomodulator because it can increase phagocytic activity. Sasmito, (2017), added that there are 2 types of immunomodulators, namely immunosuppressants and immunostimulators. Immunosuppressants are agents used to control the pathological immune response in auto-immune diseases. Immunostimulators are substances that play a role in increasing the body's resistance to infection. Immunomodulators work by increasing the amount of activity of T cells, NK cells and macrophages and by secreting interferons and interleukins to increase cellular defense.

Furthermore, Wicaksono (2020) added that there are many immunostimulants in herbs such as extracts of ginseng, saffron, black cumin, turmeric, Sambiloto, garlic, ginger, gotu kola, temulawak, and so on. Black cumin seeds contain fixed oils, essential oils, proteins, alkoloids and saponins, but the biological activity that is most prominent in black cumin seeds is thymoquinone. Thymoquinone is known to be a source of antioxidants (Ali & Blunden, 2003). According to Fetriza (2013) the content of the active substance thymoquinone in Nigella sativa affects the area of the thymus cortex, the area of the bursa of Fabricius follicles and increases the size of the white pulp (lymphoid follicle) in broilers. In addition, the thymoquinone content in Nigella sativa stimulates bone marrow and immune cells, interferon production, protects cell damage by viral infections, destroys tumor cells, and increases the amount of antibodies produced by B cells, increasing the size of the white pulp area will also increase cell density, so that the center germinativum in the spleen will increase and perform its role in the humoral response, namely by producing antibodies.

The condition of imbalance between free radicals and antioxidants is called oxidative stress. Free radicals increase under stressful conditions, so if you don't get exogenous antioxidant intake, it can cause damage to organs and cells (Surai, 2007). Broiler chickens that experience heat stress and do not receive additional exogenous antioxidants can interfere with the growth of lymphoid organs such as the bursa of Fabricius and the spleen, thereby reducing the body's resistance. Bursa Fabricius and spleen play an important role in the immune response and the formation of antibodies. The harder the bursa of Fabricius activity to form antibodies, the smaller the lymphoid follicles, so that the relative weight of the bursa of Fabricius decreases. Impaired growth of lymphoid organs can affect the number of lymphocytes produced. Lymphocytes play a role in responding to the presence of antigens (foreign bodies) by increasing the circulation of antibodies in the blood and in the development of the immune system (Tizzard, 1987).

Conclusion

The conclusion of this study is black cumin seed extract (Nigella sativa) has a significant effect on broiler weight gain, the higher the dose of black cumin seed extract (Nigella sativa) given, the more it affects broiler weight gain and has no effect on broiler mortality. .

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