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The functions of *Cinnamomum burmannii* as an antioxidant feed additive for broiler chickens: A review

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Abstract. Broiler chickens are livestock poultry that produces meat and are mostly maintained by the community. The increasing demand for broilers causes breeders to try to accelerate and improve the performance of broilers. The increase in broiler chickens must also pay attention to immunity because of the changing seasons which usually causes disease and can cause death in chickens. The addition of feed additives as a supplement for broiler chickens can increase immunity, one example is cinnamon because it contains antioxidants. Antioxidants are compounds that can counteract or reduce the negative effects of free radicals. We can find natural antioxidants in cinnamon (*Cinnamomum burmannii*). Feed additives have now been limited by the government in the feeding additive containing chemicals so the need for innovation of feed additives made from herbal materials that do not harm chickens and humans who consume them. This cinnamon study has a real influence on broiler chickens as a feed additive in their influence on antioxidants and chicken cholesterol. Broiler chicken antioxidants have a noticeable effect on femoral musculus in a combination of 100% kombucha tea with 5% cinnamon with ratio (1:1) (49.7%) and a combination of 100% kombucha tea with 5% cinnamon with ratio (1:3) (69.6%) in musculus pectoralis major. The content of cinnamon phytochemical compounds from the phenylpropanoids class in the form of cinnamic acid (Cinnamaldehyde compound) which belongs to the phenylpropanoid group is a derivative of phenol compounds, where the phenol compound also plays an important role in antioxidant activity. High antioxidants can have a positive effect on broiler chickens that are easily exposed to disease because it has the effect of preventing the formation of free radicals, eliminating radicals before damage appears, repairing oxidative damage, eliminating damaged molecules in broiler chicken cells. While on cholesterol parameters we know that broiler chicken meat has a high cholesterol content of 98.82-104.31 mg/100 g. The results of the study obtained a combination of 100% kombucha tea with 5% cinnamon with ratio (3:1) results of 3.71% femoral musculus and a combination of 100% kombucha tea with 5% cinnamon with ratio (1:1) (4.04%) musculus pectoralis major. The cinnamon content of saponins and tannins managed to lower the cholesterol content in broiler chicken meat.

1. Introduction

The broiler chicken farming business continues to increase in the period 2015-2019 meat consumption ranges from 87,232 thousand tons – 94,529 thousand tons both in terms of business scale and in terms of efficiency level. The increasing demand for broiler chickens is causing farmers to try to speed up and improve the performance of broiler chickens. The increase in broiler chickens should also pay attention



to immunity due to the changing seasons that usually lead to the onset of disease and can lead to death in chickens. Increased immunity in broiler chickens is needed to keep chickens from contracting the disease. The addition of feed additives as a supplement to broiler chickens can boost immunity. A feed additive is an additional feed supplement that serves as a growth booster, improves feed efficiency in poultry, and maintains and maintains the health of the livestock body, one example is antioxidants. Antioxidants are compounds that can ward off or dampen the negative effects of free radicals. Antioxidants work by donating one of their electrons to oxidant compounds so that the activity of these oxidant compounds can be inhibited [1]. Natural antioxidants can be found in cinnamon. Cinnamon (*Cinnamomum burmannii*) is a herbal plant that can grow in subtropical and tropical regions that has many properties. Essential oils are containing phytochemical compounds that are phenol compounds that can affect antioxidants in broiler chicken livestock, essential oils are found in many parts of cinnamon bark. Cinnamon is only used by the public as a spice and medicine as a cholesterol-lowering in humans but can also be given to broiler chicken cattle.

2. Antioxidants

Antioxidants are compounds that can ward off or dampen the negative impact of oxidants. Antioxidants work by donating one electron to an oxidizing compound so that the activity of the oxidant compound can be edified [1]. Antioxidants are needed by the body to protect the body from attacks of free radicals. Antioxidants are compounds or chemical components that in a certain amount or amount can inhibit or slow down damage due to oxidation processes. Antioxidants can be enzymatic antioxidants such as dismutase superoxide, catalase, and glutathione peroxidase, and non-enzymatic antioxidants such as vitamins A, C, E, β -carotene, flavonoids, isoflavones, flavone, anthocyanins, catechins, and iso-catechins [2]. Free radicals are molecules that have electrons not paired in their outermost orbital so they are highly reactive. These radicals tend to hold a chain reaction that if it occurs in the body will be able to inflict ongoing and continuous damage. Antioxidants are also used in foods to control lipid oxidation. Butylated hydroxyanisole (BHA) and Butylated hydroxytoluene (BHT) are used as food antioxidants, but the possibility of adverse side effects is not used for therapeutic ingredients. The development of natural antioxidants has gained great attention in recent years, it is intended for preventive treatment purposes and the food industry. Natural antioxidants in addition to being able to protect the body from free radical attacks are also able to slow the sling of chronic diseases caused by the decline of reactive oxygen species (ROS), especially hydroxyl radicals and superoxide radicals. Natural antioxidants also serve to inhibit lipid oxidation which causes inflammation and damage [3].

3. Feed additive

Feed additives are ingredients that do not include small amounts of added food substances and aim to spur growth and increase the population of beneficial microbes that exist in the digestive tract of chickens. Feed additive serves as a trigger for growth and improves feed efficiency in chickens, among others antibiotics and hormones. The use of commercial additive feed in addition to its high price is also less guaranteed safety aspect due to the residue of chemicals in the feed [4]. The benefits of feeding additives or supplements in terms of physiological are (1) livestock avoided from vitamin deficiency (avitaminosis) and mineral deficiencies, which are likely to be paralysis, muscle spasms, milk fever (paresis puerperalis, poor growth of epithelial tissue, and easily exposed to infection; (2) livestock are protected from malnutrition, for example curing during the long dry season because the quality of the ration has decreased; (3) maintain production both in quality and quantity [5]. The feeding additive needs to pay attention to the withdrawal time which is 5 days before the chicken is cut. After the downtime of the drug can be skipped it is expected that residue is no longer found or has been below the maximum residue limit according to the Indonesian National Standard (SNI) in 2000. The dosage used should be 50 tons⁻¹ feed [6].

4. Cinnamon (*Cinnamomum burmannii*)

Cinnamon is grown in mountainous areas up to an altitude of 1,500 meters and cultivated for bark. The height of cinnamon trees can reach 1-12 meters. The plant is oval-leaved or egg-round, the color is green, the young leaves are red, the color of the shoots is reddish, while the old leaves are dark green and the skin is grey. Cinnamon bark can come from branches or branches. The fruit is in two or perfect flowers with yellow color, small size, one-seeded and fleshy, the shape are round elongated. The young fruit is dark green, and the dark fruit is dark purple [7].

The main mechanism of action of cinnamon essential oil is the antimicrobial activity by damaging and altering microbial cell wall conformations that will affect electron transport, gradient ions, protein translocation, and loss of chemiosmotic control. This mechanism is more effective against Gram-positive bacteria because its cell membranes directly interact with the hydrophobic components of essential oils. However, many essential oils are small so they can penetrate the walls of hydrophilic gram-negative bacterial cells [8]. This activity will affect the population of digestive microbes and the metabolism of livestock when essential oils are used as feed. The use of essential oils as feed also needs to pay attention to its dosage and anti-nutrient properties. The use of essential oils with high doses is toxic to chickens. The optimum dosage of the use of essential oils as feed on the chicken is 20-200 ppm.

The results have proven that cinnamon contains many polyphenol compounds that have beneficial antioxidant activity to maintain human health, such as free radical scavenging, preventing tissue damage due to metabolic diseases, and decreased function or syndrome in the body related to the age factor. Polyphenols on the stem of cinnamon plants, consisting of 90.1% rutin, 1.9% catechins, 0.2% quercetin, 0.02% kaempferol, and 0.103% isorhamnetin. Polyphenols are also known to inhibit the absorption of cholesterol in the gastrointestinal tract by forming complex compounds [9]. Essential oils in cinnamon have catechins that serve as high antioxidants. Catechins are one of the derivatives of polyphenols that have high antioxidant properties. Factors that affect catechin levels are varieties and tea clones, the height of the place [10]. Catechins are synthesized via the phenyl-propanoic and flavonoid pathways. Chalcone synthase (CHS) is thought to be a key enzyme involved in catechin biosynthesis. Catechins are antimicrobial (bacteria and viruses), antioxidants, antiradical, strengthen blood vessels, secrete urine secretions, and inhibit the growth of cancer cells [11]. The benefits of eating cinnamon include lowering cholesterol, lowering blood sugar levels, antifungal, anti-viral, anti-parasitic, antiseptic, and antibacterial. The problem of microorganism resistance to antibiotics was first discovered in the 1980s and has become a very important issue for the medical world today. High use of antibiotics is the main trigger for the emergence of resistance [12].

Cinnamon also benefits rabbits and quail. The addition of cinnamon extract to rabbit feed can lower cholesterol and triglyceride levels, as well as increase high-density lipoprotein (HDL) levels of rabbit blood cholesterol [13]. Meanwhile, in quail, research has been conducted on the influence of omega 3 fatty acids and other sources of fatty acids in rations on cholesterol levels and components of quail egg fatty acids [14].

5. Broiler chicken performance with cinnamon extract (*Cinnamomum burmannii*).

Research conducted by [15] on kombucha and cinnamon supplements to produce broiler meat rich in antioxidants and low in cholesterol can be found in table 1.

The administration of cinnamon extract and kombucha tea into broiler supplement ingredients can have a good impact on cholesterol both femoral musculus and major musculus pectoralis. The lowest cholesterol levels in femoral musculus are found in P2 treatment which is 3.71%, while for musculus pectoralis major is found in P3 treatment, which is 4.04%. The highest antioxidant levels in femoral musculus in P3 were 49.7% and P4 (69.6%) in musculus major pectoralis. The content in cinnamon is polyphenols can lower cholesterol levels and is assisted by the content of kombucha tea which is a phenolic compound. This is by the opinion of [10] polyphenols on the stem of cinnamon plants, consisting of 90.1% rutin, 1.9% catechins, 0.2% quercetin, 0.02% kaempferol, and 0.103% isorhamnetin. Polyphenols are also known to inhibit the absorption of cholesterol in the gastrointestinal tract by forming complex compounds. Suharti et al. [16] stated that the content of saponins and tannins

can also inhibit cholesterol. The mechanism of action of tannins or saponins in lowering cholesterol is known in several ways, among others by inhibiting cholesterol absorption or by increasing cholesterol excretion through faeces. Saponins from extracted tea leaves have anti-hypercholesterolemia activity by suppressing increased serum cholesterol levels induced hypercholesterolemia and increasing cholesterol excretion through faeces. Saponins from tea leaf extract in vitro experiments, can inhibit the inclusion of cholesterol into micelles and inhibit its absorption in the small intestine. Beef cholesterol levels are known to be 60.63-63.02 mg/100 g, while chicken cholesterol levels are known to be 98.82-104.31 mg/100 g [17]. This data shows that chicken meat has higher cholesterol levels compared to beef as much as 30-40 mg/100 g. Cholesterol is synthesized in the body about 67% mainly in liver tissue and 33% comes from food.

Table 1. Bodyweight, antioxidant, and total cholesterol levels in broiler chicken femoral musculus after treatment using cinnamon and kombucha tea supplements.

Treatment	Bodyweight (kg)	<i>M. femoralis</i> (%)		<i>M. pectoralis</i> (%)	
		Antioxidant %	Cholesterol %	Antioxidant %	Cholesterol %
P0	1.43 ^a ±0.42	56.77 ^a ±4.13	3.96 ^c ±2.05	67.78 ^a ±12.11	3.39 ^d ±0.09
P1	1.26 ^a ±0.21	34.75 ^c ±8.23	5.31 ^b ±1.27	62.73 ^a ±10.03	8.33 ^a ±1.08
P2	1.13 ^a ±0.53	46.87 ^b ±7.13	3.71 ^c ±2.13	61.21 ^a ±11.02	5.02 ^{bc} ±1.23
P3	1.38 ^a ±0.13	49.70 ^b ±8.05	4.33 ^{bc} ±1.04	39.39 ^b ±10.04	4.04 ^c ±1.26
P4	1.16 ^a ±0.37	36.97 ^c ±5.03	6.82 ^a ±1.03	69.60 ^a ±10.11	5.14 ^b ±0.18

^{abcd}Values with different letters in the same column show a noticeable difference ($p < 0.05$), control (P0), cinnamon flour 5% (P1), a combination of 100% kombucha tea with 5% cinnamon with ratio (3:1) (P2), 1:1) (P3) and 1:3 (P4). Source: [15].

High antioxidants are caused by the content of phenolic in kombucha tea and cinnamaldehyde, polyphenols, and other compounds active in cinnamon. This is following [18] opinion said cinnamon is found many phytochemical compounds from the class of phenylpropanoids in the form of cinnamic acid (cinnamaldehyde compound) which belongs to the phenylpropanoid group is a derivative of phenol compounds, where phenol compounds also play an important role in antioxidant activity. This compound can serve as an antioxidant that can prevent the formation of free radicals, eliminate radicals before damage appears, repair oxidative damage, eliminate damaged molecules in cells. Antioxidants in cinnamon have an active content when inserted into the body will increase the formation of antioxidants according to [19] that the evidence reinforces that when the active ingredients enter the body, those ingredients will be dissatisfied and distributed into the body's tissues, such as femoral musculus stored in them and or can induce other types of antioxidants in the target tissue. As a result, antioxidant levels in the target tissue will be increased and higher, and conversely, if the levels are low then the stored and inducing the formation of other types of antioxidants is also low.

6. Conclusion

Polyphenol contained in *Cinnamomum burmannii* can reduce cholesterol levels in broiler chicken meat so that it can function as an antioxidant and alternative feed additive.

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