Cholesterol Contents and Carcass Yields of Broiler Meats Fed Different Level of Garlic Meal

Hafsah, Nuun Marfuah, & Sugiarto*

Animal Science Department Agricultural Faculty Tadulako University
Jl. Soekarno-Hatta Km. 9 Kampus Bumi Tadulako Tondo Palu
Sulawesi Tengah – 94118-Indonesia
**E-mail: hafsah_62@yahoo.co.id*

Abstracts

Garlic is one spice herbal that can be used to reduce levels of fat and cholesterol in the human blood. This materials can also be applied to reduce fat and cholesterol content of meat products through the manipulation of animal diets. The study objective was to identify the cholesterol content of meats and carcass yield of broiler fed different level of garlic meals. The experiment was used 100 day old chicks (DOC) of broiler. It was designed by Completely Randomized Design with 5 treatments and 4 replicates. Differences every treatment were tested with Duncan's multiple range test. Experimental diets used were: control diet (R0); inclusion of 1.5% garlic meal (R1); inclusion of 3% garlic meal (R2); inclusion of 4.5% garlic meal (R3); and inclusion of 6% garlic meal (R4). Feed and water were offered ad libitum, birds were slaughtered at 42 days old. The result showed that feed treatments had significant effect (P<0.05) on cholesterol content of meat with the value as 123.20mg/100g (R0); 123.00mg/100g (R1); 102.95mg/100g (R2); 73.29mg/100g (R3); and 58.69mg/100g (R4). The inclusion of 6% of garlic meal in the diets reduced cholesterol contents from 123.2 mg/100g (R0) to 58.69mg/100g (R4), or reducing to be 47.26%. While the carcass yields (carcass persentage, components, and abdominal fat), actually an increased but not to significant effects. Increasing of garlic meal in the broiler ration reduced the cholesterol content of the broiler meats.

Keywords: broiler, carcass, garlic meals, meat cholesterol

Introduction

High quality meat associated with the feed quality and maintenance management. Quality of the feed affects the quality of meat produced. The broiler chicken as well known to be more efficient in converting feed to animal product. The nature of the broiler meat of which is a high fat and water contents. High water content in

meat is one of the factors that support the development of fungi or micro-organisms that can reduce the meat quality (Ketaren, 1989). In addition broiler meat are also known to contain high levels of fat and high cholesterol, thereby reducing the level of palatability for people suffering from heart disease and cholesterol. To overcome this constraint the manipulation of feed needed to improve the quality of meat produced, one of the local feed ingredients that can be added to improve the quality of animal meat is garlic. The inclusion of garlic in chicken diets may reduce the fat and cholesterol of the produced.

Garlic (*Allium sativum*) is widely distributed and used in all parts of the world as a spice and herbal remedy for the prevention and treatment of a variety of diseases, ranging from infections to heart diseases. In the past two decades, particular attention has been focused on the cholesterol-lowering activity of garlic. Garlic that had metabolic effects may decrease blood glucose, blood cholesterol and triacylglycerol (Horie *et al*., 1991). Wibowo (1989) stated that garlic may accelerate growth and increase the weight gain. Bordia *et al*. (1975) reported that the essential oils of onion and garlic can prevent fat-induced hyperlipemia. A marked reduction of serum cholesterol levels (53% and 34%) were observed in rats fed a diet supplemented with 2 or 3% garlic powder. Similar effects of garlic were found in rats fed diets containing either cholesterol or lard. Plasma and liver cholesterol as well as total liver lipids were reduced by about 30% by garlic supplementation, whereas plasma triacylglycerols were reduced only in the group fed lard (Chashnidl et.al., 1982). Depressed hepatic cholesterol levels in chickens fed 2% garlic for 14 d were observed by Sklan *et al*. (1992). Various garlic extracts exhibited hypocholesterolemic effects on chickens, mainly through the inhibition of the key enzymes in cholesterol and lipid synthesis (Qureshi *et al*., 1983). Konjufca *et al*. (1997) found that the essential oils of garlic can reduce cholesterol content of meat broiler. The objective of this study was to identify the cholesterol content of meats and carcass compostion of broiler fed different level of garlic meals

Materials and Methods

Chicken and Housing

A total of 100 one-day-old chicks (DOC)broiler mixed sex (males and females) strain Arbor Arcres CP 707 was used. Chickens were kept in 20 plots with the size for each plot 1 x 1 x 0.5 m and placed 5 chicks. Each plot was equipped with a feed and drinking water. The treatments were randomly distributed among the plots. During the experiment all of the chicken were given ad-libitum feeding and drinking water. The chicken was weight individually at the begining of the experiment and at six day interval thereafter.

The chickens were reared up to 41 days old and were weight individually.

At 42 days old the chickens were deprived of feed for 8 hours and all the chicken were wight individually prior to slaughter. After slaughter, feather were removed by dipping the chicken in to the warm water (approx.60-70 ^{o}C). Carcass yield was weight of dead chicken without feather, head, neck, legs, and digestive organs. The chickens were cut into the parts according to standar procedure of dissection (Jensen, 1989). Variable determined were carcass weight, carcass components, abdominal fat, and cholesterol content of breast meat. The meat samples for cholesterol analysis was taken from the breast meat as much as 100g of each treatment. Cholesterol analyzes performed by the method of Lieberman-Burchrad (Tranggono *et al.*, 1989).

Diets and Treatments

The control diets was performed to be met the nutrient requirement with protein and metabolyzable energy with 21% and 3000 kcal respectively. The diet was fed as crumbles form and was specially prepare for this research. The composition and analyzed value of the diets in shown in Table 1. The diets used in this experiment were not separated between starter and grower diets according to NRC (1994) recomended. The chickens were fed similar feed composition througout the experiment. Feed ingredients used and the composition of treatment rations are listed in Table 1.

Table 1. Diets Composition and Nutrient Content of the Feed Treatmens

Diets	Treatments				
	R0	R1	R2	R3	R4
Yellow corn	52	51	50	49.5	49
Ricebran	7	6.5	6	7	6.5
Coconut meals	10	10	10	11.5	11.5
Soybean grain	15	15	15	13.5	12
Fish meal	15	15	15	13.0	14
Topmix	1	1	1	1	1
Garlic meal	0	1.5	3.0	4.5	6.0
Nutrient Contents*):					
Crude protein (%)	21.01	21.02	21.02	20.02	20.01
Crude fat (%)	1.08	1.07	1.71	1.05	1.04
ME (kcal/kg)	3,009	3,022	3,034	3,007	3,004
Crude fiber (%)	4.57	4.51	4.45	4.70	4.67
Ca (%)	0.33	0.33	0.33	0.29	0.31
P (%)	0.09	0.09	0.09	0.09	0.08

*) Based of feeds analysis in the Nutrition Laboratory Animal Science Department, Argicultural Faculty Tadulako University, Palu (2010)

The dietary treatment are as follows: R_0= control diets without inclusion garlic meals; R_1= diets with the inclusion garlic meals 1.5%; R_2= diets with the inclusion garlic meals 3.0%; R_3= diets with the inclusion garlic meals 4.5%; R_4= diets with the inclusion garlic meals 6.0%.

Design Experiment and Statistical Analysis

The experiment included 5 dietary treatments, and the experimental design is Completely Randomized Design with 5 treatment and 4 replicates. Data from the experiments were analyzed by using analysis of variance according to the type design was used, if there is a difference between the treatments followed by Duncan Multiple Range Test (Steel and Torrie, 1991).

Results and Discussion

Cholesterol Contents

Results of cholesterol contents that influenced by inclusion of garlic meal in the diets as shown in Figure 1.

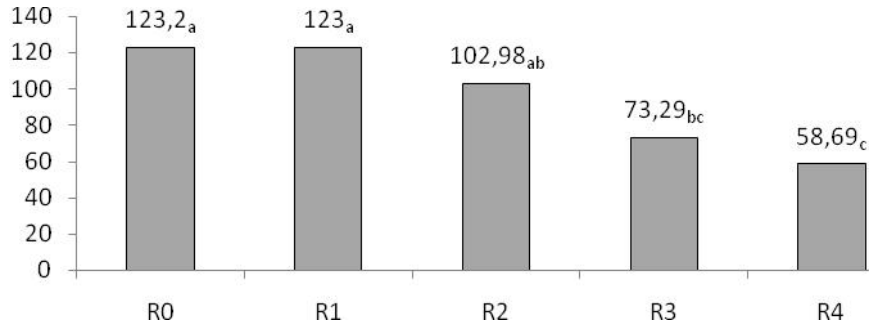

Figure 1. Mean of cholesterol content of meats of each treatment in mg/100g

Results of variance analysis showed that garlic treatment had significant effect ($P<0.05$) on meat cholesterol. It was found a decrease of cholesterol content of the meats by increasing of dietary garlic meals in the diets. The treatment that inclusion of 4.5% and 6% of garlic meal in the diets had cholesterol contents significantly lower compared to control diets. This is possible because the component in garlic-containing sulfur called *allicin* reduced the development of cholesterol in the meat. Keusgen (2002) found that garlic contains *allicin*, a component that acts as an antibacterial. *Allicin* from fresh garlic extract has a wide-ranging antibacterial activity for both gram negative and gram positive. *Allicin* is not formed on the intact plant garlic, because garlic contains *aliin* and enzymes intact alinase. When garlic is chopped or crushed then reacts with the enzyme alinase to be form *alicin*. The use of garlic in the form of pasta 3.8% in the diets can reduce cholesterol 18% and 23%,

respectively in broiler and layer chickens in an age of 12 weeks had been carried out for 4 weeks (Qureshi *et al*., 1983). Thiosulfanat compounds in garlic are formed due to enzyme activity *alinase* of *aliin* (an amino acid containing sulfur), through it can be influenced the *alicin* content and resulted lower cholesterol levels in the blood (Wahyuono 1999). Mamonto (1992) stated that there is a relationship between blood cholesterol and meats cholesterol, decreased of blood cholesterol will be followed by a decrease in cholesterol of meat. This statement was applied by Jaya (1997) that resulted the addition of 1% garlic in broiler feed can reduce about 17.10 mg/dl (8.97%) and blood cholesterol levels around 13.02 mg/dl (7.06%) cholesterol levels of meat. Another experiment was done by Eckner *et al* (1993) that found the inclusion of garlic extract in the chicken diets could be reduced the triglyceride, total cholesterol, and phospholipids in the blood. Garlic extract was also reported have a fibrinolytic effect, increase the mobility of cholesterol and triglycerides (Schneider, 1985), and as antiaterogenik which prevents the occurrence of atherosclerosis by preventing oxidation of LDL (Heinle and Betz, 1994). Effects of hipocholestrolemia in the garlic probably caused by the presence of alicin as a bioactive compound (Borek, 2001).

Carcass Yields

Results of carcass yields that consist of carcass percentage, abdominal fat, and carcass component as shown in Table 2. The results of variance analysis showed that the treatment provided no significant effect on carcass composition, abdominal fat and carcass components. This is probably caused by the content and quality of diets consumed relatively the same nutrients content, resulting relative the same of body weight and ultimately result in similar carcass component as well. Jull (1979) states that the percentage of broiler carcass in the range of 65%-75% based on live weight,

Table 2. The mean of carcass, abdominal fat, and carcass component for each treatment

Carcass yields (%)	Treatments					P-value
	R0	R1	R3	R3	R4	
Carcass	66.76	66.82	67.26	68.88	69.29	0.28
Abdominal fat	2.21	1.51	1.24	1.14	0.99	3.01
Carcass components:						
Breastmeat	38.30	39.67	38.51	38.84	37.15	0.89
Drumstick	15.57	14.48	14.95	14.96	14.77	0.83
Thigh	13.89	13.96	13.61	13.45	14.18	0.40
Back	21.36	20.78	21.36	21.17	22.31	0.60
Wings	10.88	11.11	11.56	11.58	11.59	1.99

while the results of this study is in the range from 65.55 to 70.15%, slightly lower. Budiansyah (2003) reported that carcass components relative to body weight gain equal to the percentage of carcasses that would produce no different.

Although there is no significant difference among the treatments effect on carcass yield, but the higher used of garlic powder in the ration resulted a higher percentage of carcasses. Increase the percentage of carcass due to the increase in body weight, the higher body weight resulted the greater percentage of carcass as well (Siregar *et al.*, 1980). This indicated that garlic had fungtion to become a growth promotor. Substances that play role as a growth promoter in garlic is *scordinin*. Physiological effects of *scordinin* was tested by Wibowo (1989) on mice, that indicated that it increase growth and body weight. In contrast, the results of abdominal fat content showed reduced with the increasing of garlic meals in the diets.

Conclusion

There were reducing of cholesterol contents of broiler meats by inclusion of garlic meal in the diets. The use of garlic meal up to a level of 6% in the ration of broiler was reduced significantly cholesterol contents of meats from 123.2 mg/100g to 58.69 mg/100g, or reducing 47.26%. While the carcass yields (carcass persentage, components, and abdominal fat), actually an increased but not to significant effects. Increasing of garlic meal in the broiler ration reduced the cholesterol content of the broiler meats.

References

Borek, C. 2001. Antioxidant health effects of aged garlic extract. J.Nutr.131: 1010s-1015s

Bordia, M.D. 1981. Effects of garlic on blood lipids in patients with coronary heart disease. Amer.J.Clin.Nutr. 56:154-156

Budiansyah, A. 2003. The use of silage flour meat of gold snail (*Pomaceae* sp) in rations on growth performance and carcass yield of broiler. Jurnal Ilmiah Peternakan 6 (4): 227-234

Chashnidel, Y., H. Moravej, A. Towhidi, F. Asadi and S. Zeinodini. 2010. Infl uence of different level of n-3 supplemented (fish oil) diet on performance, carcass quality and fat status in broiler. African Journal of Biotechnology. Vol.9(5): 687-691

Eckner, M.M., C.A.J. Erdelmeier; O. Sticher, and H.D. Reuter. 1993. A novel amino acids glycocyde and three amino acids from *Allium sativun* L. J.Nat. Prod. 56: 864-869

Heinle, H. and E. Betz. 1994. Effects of dietary garlic supplementation in a rat model of atherosklerosis. Arzneimitte Forschung. 44:614-617

Horie, T., S.Awazu, Y. Itakura, and T.Fuwa. 1991. Identified diallyl polysulfides from an aged garlic extract with protect the membranes from lipid peroxidatio. Planta Medica. 58:468-469

Jaya, I.N.S. 1997. The effects of garlic (*Allium sativum* L.) supplementation in the broiler diets on the cholesterol contents of meats.. Thesis. Institut Pertanian Bogor, Bogor

Jensen, J.F. 1981. Method Of Dissection Of Ayam pedaging Carcase And Description Of Parts. Printed at Popwoths Pendagron Press. Papworth Everad, Denmark

Jull, M. A. 1979. Poultry Husbandry. New Delhi: Tat Mc Graw Hill Publishing Co. Tld

Ketaren, S. 1989. Introduction of Oil Technology and Fat of Food. University of Indonesia. Jakarta

Keusgen M. 2002. Health and Alliums. Allium Crop Science:*Recent Advances. New York:CABI:*365-366.

Konjufca, V.H., G.M. Pesti, and R.I. Bakalli. 1997. Modulation of cholesterol levels in broiler meats by dietary garlic and copper. Poultry Science 76: 1264-1271

Mamonto, S. 1992. The substitution of corn oil with soy bean oil in the diets as an efforts to reduced cholesterol contents of broiler meats. Thesis. Gadjah Mada University Yogyakarta

National Research Council, 1994. *Nutrient Requirement of Poultry*. 9 revised ed. Washington DC: National Academy Press

Qureshi, A.A., Z.Z. Din, N.Abuirmeileh, W.C. Burger, Y. Ahmad, and C.E. Elson. 1983. Suppresion of avian hepatic lipid metabolism by solvent extract of garlic impact on serum lipids. J.Nutr. 113:1746-1755

Schneider, G. 1985. Pharmazeutiche Biologic 2. Auff. Wissenschaftsveriag. Mannheim. Germany

Sklan, D., Y.N. Berner, and H.D. Rabinowitch. 1992. The effects of dietary onion and garlic on hepatic lipid concentration and activity of antioxidative enzym in chicks. J.Nutr. Biochem.3:322-325

Siregar, A.P., M. Sabrani, and P.Suroprawiro. 1980. Broiler Husbandry Practices in Indonesia. Margie Group. Jakarta

Steel, R.G.D. and J.B. Torrie, 1991. Principles and Procedures of Statistics, a Biometrical Approach. Gramedia. Jakarta

Tranggono, B. Setiaji, Suhardi, Sudarmoto., Y. Marsono., A. Murdiati., I.S. Utami and Suparmo. 1989. Food Biochemistry. Pusat Antar Universitas Pangan and Gizi. page .239-240

Wahyuono S, 1999. Garlic (*Allium sativum L.*) as reduced blood cholesterol. *Bull. Piogama* 1(2):1-2.

Wibowo, S. 1989. Budidaya Bawang Putih. Swadaya. Jakarta.