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LIPID METABOLISM OF PAJAJARAN DUCKS FED POMACEA CANALICULATA AND MANIHOT ESCULENTA CRANZT LEAF MEAL IN RATIONS CONTAINING SARDINELLA OIL LEMURU

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ABSTRACT

The purpose of this study was to evaluate the effectiveness of utilizing local feed ingredients, namely Golden Snail (Pomacea Canaliculata) as a source of protein and Cassava Leaf Meal (Manihot Esculenta Cranzt) in rations containing Lemuru Fish Oil (Sardinella Lemuru) against cholesterol reduction and lipid metabolic profile in Pajajaran ducks. This study uses 28-week Pajajaran ducks with an average body weight (bw) of 1648 grams as many as 180 ducks. The diet contains cassava leaf meal and lemuru fish oil with protein 14.26-18.53 energy level 3905-4172 kcal kg-1. The study design used was Factorial 3x2 completely randomized design, with the first factor being the use of cassava leaf meal (0%, 5% 10%) and the second factor being the use of golden snail (0%, 5%).

The results showed that the administration of 10% (D10K0) cassava leaf meal was significant ($P<0.05$) increasing feed consumption by 5.78%, the use of 5% golden snail increased the ration palatability by 5.17%. There was a significant interaction ($P<0.05$) between cassava leaf and golden snail meal to meat fat and cholesterol consumption, the treatment was able to reduce meat cholesterol level (27.98%). The treatment had no significant effect on blood lipid and egg profiles. The use of 5% golden snail can reduce egg MDA 37.03%, the use of 5% cassava meal decreases MDA eggs by 47.98% while at 10% use cassava leaf meal reduces egg MDA levels by 57.60% and egg fat 2.43%.

Keywords: cassava meal, golden snail, pajajaran ducks, fat metabolism

1. INTRODUCTION

Local poultry meat consumption increased 9.98% in 2013 and 2014 (Directorate General of PKH 2017). One type of bird that is widely preserved in Indonesia and has the potential as an alternative source of animal protein for the needs of the Indonesian people is ducks. The highest egg and duck meat production in 2016 was found in West Java province, namely 59.853 tons of eggs and 7.099 tons of meat (Directorate General of PKH 2017).

High fat in ducks tends to be the main consideration for consumers in consuming because it is a source of cholesterol that can cause degenerative diseases such as coronary heart disease. Efforts to improve the quality of duck meat and eggs can be done by manipulating duck rations with the use of locally available ferns that are sufficiently available. Duck meat is one of the leading commodities because it contains nutrients such as protein, fat and other nutrients that are high compared to chicken. The protein, fat and energy content of duck meat is 21.4%; 8.2%. and 159 kcal while in chicken is 20.6%; 4.8% and 126 kcal (Srigandono 1997). USDA (2008) states that the nutritional value of duck eggs is higher than that of chicken eggs. Duck eggs contain 12.81 g of protein and 13.77 g of total fat in every 100 g of duck eggs, and chicken eggs contain 12.56 g of protein and 9.51 g of total fat in 100 g of eggs.

Ducks have a high ability in fat biosynthesis, so an effort is needed to improve the quality of duck meat and eggs, namely by supplementing local feed ingredients that have high protein also have essential fat content. Essential fatty acids include unsaturated fatty acids which have double double bonds that cannot be synthesized by the body.

The source of omega-3 for duck feed has been studied by utilizing waste from fish processing, one of which is lemuru fish oil. Giving lemuru fish oil in feed can reduce egg and plasma cholesterol levels in quail (Atakisi et al. 2009), increasing omega 3 and lowering cholesterol of chicken eggs (Saleh 2013), producing duck eggs containing balanced omega 3 and omega 6 and low cholesterol (Sumiati and Wiryawan 2013).

Local food ingredients used as a source of protein are golden snails, which are very high pest populations and hard to eradicate because they are able to breed quickly and survive on long dry land. The snail mas (Pomacea canaliculata) has a crude protein content of 54.2% and crude fat of 4.8% (Sundari 2004), whereas according to Anderson and Richardson (2004) the protein content reaches 51%, fat is 13.61%, fiber

is 6.09% and ash is 24% and rich unsaturated fatty acids such as stearic acid (C 18: 0), oleic acid (C 18: 1), linoleic acid (C 18: 2) and linolenic acid (C 18: 3) (Subhan et al. 2010). According to Sulistiono (2007) golden snails contain omega 3 acid, omega 6 and omega 9. The use of 10% snail meal significantly increases the omega 3 content in chicken eggs (Nurmufidah et al. 2015).

Omega 3 fatty acids are susceptible to lipid oxidation and thus have a negative impact on nutrient value, food taste and texture (Arab-Tehrany et al. 2012 and Avila-Ramos et al. 2013). Therefore, alternatives are needed to prevent lipid oxidation by utilizing natural antioxidants Antioxidants are compounds that can inhibit oxidation reactions by binding to free radicals and highly reactive molecules, so that cell damage can be inhibited (Winarsi 2007) One of these antioxidant ingredients is cassava leaf meal Cassava leaves (Manihot esculenta Crantz) contains high protein, which is 16.6-39.9% and can be harvested at 4-5 months after planting (Borin et al., 2005; Morgan and Choct 2016). Tsumbu et al. (2011) reported that cassava leaf meal contains flavonoid compounds 1.53 % per 100, and has antioxidant activity. Suresh et al. (2011) also revealed the antioxidant activity of flavonoids 116 mg g-1 and phenol 136 mg g-1 cassava leaf extract. Darmawan et al. (2016) the use of cassava leaf meal as much as 11% can increase daily egg production (duck day) compared to the use of indigofera leaf meal. The use of golden snail and cassava leaf meal in rations containing lemuru fish oil is expected to improve blood lipid profiles, meat and duck eggs.

2. MATERIALS AND METHODS

2.1. Pajajaran Duck and Experimental Diets

A total of 180 laying duck,20 weeks of age,with an average body weigh of 1.64 kg were put in litter cages (2 x 1.25 m). Each cage was filled up by 10 duck and grouped by treatment at the poultry Research Unit, Departement of Nutrition and feed Tecnology, Faculty of Animal Science, Bogor Agricultural University, laying duck were raised in litter cages with room temperature and the ligh-dark cycle was set at 12 h each.

2.2. Cassava leaf meal preparation.

Cassava leaf harvested at 6th stem til the 15th. The leaf were dried in the greenhouse until half dry so as not to cause discoloration of the green colour then continued dried using an oven on 60°C for 24 hours. Cassava leaf meal leaf was ready to produce

2.3. Procedure

Laying ducks were divided into 6 groups,each treatment was subjected to three replications. The layers were given 200 g of feed per bird per day which fed in the (morning at 06.00 and afternoon at 16.00). Drinking water was given ad libitum. The ducks were adjusted pre-experimentally, by feeding them a commercial diet on week 20 to 21. Between week 21 to 28, were fed a dietary treatment. Experimental data were recorded between week 22 and 28 (a total of 7 weeks). Eggs were collected two times daily (morning and afternoon) and weighed daily. Composition and nutrient content used in this study is presented in Table 1.

2.4. Rations

The diets were formulated according to Leeson and Summers (2005), namely 16 protein and 2850 kcal kg-1 metabolic energy. The first ingredient is mixed with yellow corn, palm oil, soybean meal, fish meal, Sardinella lemuru fish oil. The second ingredient is mixed with cassava leaf meal, rice bran, CaCO3 (calcium carbonate), premix and DL-methionine.The entire material then stirred until homogeneous in amixing macine (mixer). The arrangement of laying duck rations is presented in Table 1 below:

Table 1. Laying of duck rations, aged 20-32 weeks

Feed ingredients	R0	R1	R2	R3	R4	R5

Yellow Corn (%)	54.2	52	52.3	50	50.5	48
Rice bran (%)	9.8	13.2	8.7	12	7.5	11
Soybean meal (%)	18.6	13	16.8	11.4	15	10.2
Cassava leaf meal (%)	0	0	5	5	10	10
Golden snail (%)	0	5	0	5	0	5
Fish meal	7	7	7	7	7	6.5
Fish oil	3	3	3	3	3	3
CaCo3	6.6	6	6.4	5.8	6.2	5.5
Nacl	0.2	0.2	0.2	0.2	0.2	0.2
Premix	0.5	0.5	0.5	0.5	0.5	0.5
DL-Methionine	0.1	0.1	0.1	0.1	0.1	0.1
total	100	100	100	100	100	100
Nutrient content (%)						
Dry ingredients	88.08	88.34	86.17	87.25	88.95	89.32
Crude protein	14.26	14.80	16.59	18.53	18.31	17.86
Coarse fiber	7.36	5.43	4.05	6.51	7.57	6.25
Crude fat	5.85	4.44	0.78	1.31	3.00	4.71
Ca	2.10	2.38	2.56	2.94	3.28	3.80
P	0.75	0.77	0.80	0.82	0.82	0.89
GE (Kcal / Kg)	4133.0	3976.0	3905.0	3966.0	4101.0	4172.0

Description: R0 = Control ration (0% cassava meal, 0% golden snail), R1 = Ration contains 0% cassava leaf meal, 5% golden snail, R2 = Ration contains 5% cassava leaf meal, 0% golden snail, R3 = Rations contain 5% cassava leaf meal, 5% golden snail R4 = Ration contains 10% cassava leaf meal, 0% golden snail, R5 = Ration contains 10% Cassava leaf meal, 5% golden snail.

2.5. Data collection

2.5.1. Blood Collecting

Blood samples were taken in the 6 week of the study with 18 samples (3 samples per treatment) of blood and carried out in the morning. Blood was taken from pectoralis vena by 3 ml syringe and then was placed in the sample tube. Blood sample was placed in Styrofoam box containing ice cubes and transported to the laboratory. In the laboratory, blood sample was placed in 4°C refrigerator for 12 hours before it was centrifuged by 3500 rpm for 10 minutes. Supernatant in the form of plasma was takenusing sterile pipette and placed in eppendorf tubefor further analysis.

2.5.2. Sampling of Meat and Eggs

On the 4th week of each test, egg yolks were taken from two grains and homogenized, then taking duck meat samples at the end of the study (week 8th), for analysis of fat and cholesterol.

2.5.3. Parameters Observed

Ration consumption, fat consumption, the lipid profile of blood plasma and lipid profile of egg consisted of triglyseride, total cholesterol (TC), Low Density Lipoprotein (LDL), High Density Lipoprotein (HDL) using CHOD-PP method, and meat profile analysis includes levels of meat fat and cholesterol using Liebermann-Burchard method (Spektrofotometer) and Eggs profile analysis using Soxhlet method (AOAC 2005) that covers triglyserida, cholesterol, HDL dan LDL, and to determine antioxidant activity (MDA analysis).

2.6. Data Analysis

Data of research results were analyzed by variance (ANOVA), and continued with Duncan test for data that was significantly different in factor a, factor b and interaction (Steel and Torrie, 1980), using SPSS software (IBM®SPSS® version 16.0) with @ 5 %.

3. RESULT AND DISCUSSION

3.1. The Effect of Giving Cassava Leaf Meal To Consumption

The use of 10% cassava leaf meal (D10K0) significantly increased consumption, namely 9104.56 g head-1, and the lowest consumption was in the treatment of 5% cassava leaf meal (D5K0) which was 8067.03 g head-1. This is because the high crude fiber in the ration (7.57%) compared to the ration containing 5% cassava leaves (D5K0) which is 4.05%, high crude fiber will reduce the digestibility and absorption capacity

of food substances because crude fiber is difficult to digest ducks, so crude fiber that cannot be digested can carry digestible food substances from other food ingredients, and come out through faeces (Wahju 1997), as a result of duck livestock lacking food substances. To meet their needs, ducks will increase their feed consumption.

3.2. The Effect of Giving Golden Snail To Consumption

This increase in feed consumption also occurs in the treatment with 5% golden snail. The use of golden snails can increase the palatability of feed. This is because the odor characteristics produced by golden snails are more typical and somewhat fishy are thought to be related to their high protein content (Sundari 2004; Subhan et al. 2010) This is in line with research (Sumiati et al. 2016), that the use of golden snails can increase consumption of laying ducks. The results of this study are different from those of Daud et al. (2017), which using 8-10% golden snail meal in Peking duck did not increase consumption of rations. This ration consumption is higher than the study (Darmawan et al. 2013) that feed consumption in the form of mash, the average laying age of 21-32 weeks is 7608.23 g head-1 with the same maintenance period. This difference is caused by different forms of feed, in this study using pellet shaped feed. This is confirmed by Wahju's statement (1997) that feed consumption is influenced by the form of ration, smell and color and ration palatability.

Table 2. Effect of treatment on fat consumption and consumption of rations

Parameter	Snails (%)	Cassava leafs meal (%)			
		D0	D5	D10	Average
Consumption (gr/ekor/hari)	K0	170.18±8.38	164.63±6.01	185.80±11.45	173.53±12.23a
	K5	178.73±9.23	185.52±2.99	183.30±3.05	182.52±5.90b
Average		174.5±9.17a	175.1±12.20ab	184.54±7.63b	178.02±10.40
Fat Consumption for 7 weeks (gr)	K0	487.21±24.03^{f}	62.92±2.29^{a}	273.13±16.83^{c}	274.62±184a.57a
	K5	388.85±20.08^{d}	119.08±1.92^{b}	423.03±7.03^{e}	310.32±144b.58b
Average		438.33±57.71a	91.00±30.82c	348.08±82.90b	292.47±161.88

Description: Superscripts with lowercase letters in the same row and column show significantly different ($p < 0.05$) D0K0 = control ration (without Cassava leafs meal), D0K5 = Ration contains 0% Cassava leafs meal, 5% golden snail. D5K0 = ration with Cassava leafs meal5%, golden snails 0%. D5K5 = Ration with Cassava leafs 5% meal golden snail 5%. D10K0 = Cassava leafs 10% meal, golden snails 0%. D10K5 = Cassava leafs meal 10%, golden snails

3.3. Blood Lipid Profile

Effect cassava leaf meal and golden snail to lipid profile of blood plasma was presented in table 3.

Table 3. 28 weeks old Pajajaran Ducks average blood lipid profile

Parameter	Snails (%)	Cassava leafs meal (%)			
		D0	D5	D10	Average
Triglyserida serum (mg dl^{-1})	K0	408.43±52.32	403.66±46.30	472.87±50.22	428.32±54.51
	K5	390.13±22.79	356.40±123.08	487.51±122.26	411.32±105.49
Average		399.22±37.45	380.03±87.10	480.19±83.97	419.82±81.92
Kolesterol (mg dl^{-1})	K0	159.54±22.96	164.39±44.63	159.40±3.50	161.11±225.27
	K5	135.90± 6.38	176.21±41.60	167.95±71.54	160.02±45.41

Average		147.32±19.87	170.3±39.12	163.67±45.54	160.55±35.65
HDL (mg dl^{-1})	K0	55.25±11.69	63.39±7.93	53.42±2.21	57.35±8.50
	K5	51.66±8.21	68.17±35.05	50.48±8.72	56.77±520.40
Average		53.45±9.32	65.78±22.87	51.95±5.91	57.06±15.16
LDL (mg dl^{-1})	K0	22.60±2.80	23.03±27.22	11.41±10.46	19.01±15.72
	K5	6.12±3.03	36.76±34.52	54.01±53.39	32.29±38.13
Average		14.36±9.32	29.90±28.80	32.70±41.57	25.65±29.10
MDA (mg dl^{-1})	K0	13.47±2.53	13.14±24.40	11.18±3.64	12.59±2.74
	K5	12.87±6.96	21.95±11.54	15.05±5.98	16.65±8.44
Average		13.17±4.69	17.55±8.88	13.11±4.96	14.60±6.43

D0K0 = control ration (without Cassava leafs meal), D0K5 = Ration contains 0% Cassava leafs meal, 5% golden snail.D5K0 = ration with Cassava leafs meal5%, golden snail 0%. D5K5 = Ration with Cassava leafs 5% meal golden snail 5%. D10K0 = Cassava leafs 10% meal, golden snails 0%. D10K5 = Cassava leafs meal 10%, golden snails 5%.

Based on the analysis of variance that the use of cassava leaf and golden snail meal did not have a significant effect (P> 0.05) on the lipid profile of duck blood. The mean serum triglyceride levels ranged from 390.13 mg dl-1 to 487.51 mg dl-1. The results of this study are lower than the research of Wijaya et al. (2013), namely the levels of duck triglycerides ranging from 293.33 to 753.34 mg dl-1. According to Fuller (1997), the normal standard of blood Triglyceride levels in ducks ranges from 400-500 mg dl-1.

Decreased levels of triglycerides are influenced by beta carotene in cassava leaf meal. According to Scheiber et al. (2013) beta carotene is a potential natural antioxidant. Beta carotene as an antioxidant preys on free radicals, which triggers an increase in the activity of the lipoprotein lipase enzyme. Lipoprotein lipase enzyme that is activated by Apolipoprotein C, functions to hydrolyze triglycerides into fatty acids and glycerol. The number of hydrolyzed triglycerides causes a decrease in plasma triglycerides. According to Zotte et al. (2006), omega 3 fatty acids play a role in reducing plasma triglycerides.

The amount of hydrolyzed triglycerides causes a decrease in plasma triglycerides in accordance with Zotte et al. (2006), that omega 3 fatty acids play a role in reducing triglyceride levels, which are in the snail (Pomacea canaliculata), the omega 3 content is 12.83% (Subhan et al. 2010). The use of 5% golden snail reduces Triglyceride levels by 3.96%. This is different from the study of Pal et al. (2014) which states that omega 3 fatty acids do not affect serum triglyceride levels.

The use of 10% cassava leaf meal increases serum triglyceride levels by 20.26%, this is due to an increase in feed consumption by 5.8% compared to controls (without cassava leaves). According to Fuller (1997), the normal standard of blood Triglyceride levels in ducks ranges from 400-500 mg dl-1.

Based on the analysis of the variance that the use of cassava leaf and golden snail meal did not have a significant effect (P> 0.05) on decreasing duck blood cholesterol levels, the average blood cholesterol level was presented in Table 4, the mean treatment of cholesterol levels in this study was 135.90-176.21, in the range normal according to Thrall et al. (2012) statement that bird or duck species have blood cholesterol ranging from 100-250 mg dl-1. Fuller (1997) added that normal standards of cholesterol levels in duck blood ranged from 125-200 mg dl-1.

High blood cholesterol levels are influenced by the environment and livestock genetics (Murray et al. 2000) treatment of feed ingredients can influence differences in cholesterol duck blood serum, besides that the genetic ability of ducks in synthesizing cholesterol in each type is different. The decrease in blood cholesterol levels in this study is not very visible. Treatment with 10% cassava leaves lowers blood cholesterol levels by 4.05% compared to 5% cassava leaves. This decrease is due to the presence of beta carotene in cassava leaves as a source of antioxidants. Antioxidants can inhibit the activity of the enzyme HMG-CoA reductase which is a strong catalyst in cholesterol synthesis in the intestine (Oliveira et al. 2007).

The results of analysis of variance showed that the use of 5% golden snails in the ration had no significant effect (P> 0.05) on local duck blood cholesterol, but biologically the use of 5% snails in the control ration could reduce cholesterol levels by 23.64%. This is because snails contain lots of unsaturated fatty acids

such as omega 3 acid (oleic acid) 20.37%, omega 6 acid (linoleic acid) 20.26% and omega 9 acid (linolenic acid) 12.83% (Subhan et al. 2010), according to Kinsella et al. (1990) reported that the clinical effect of omega 3 acid was lowering cholesterol due to the mechanism of the results of lipoprotein transport in the liver which is secreted into the blood.

Cholesterol is broken down in the liver into bile acids and is not regenerated again to be finally excreted. The use of 10% cassava leaf meal significantly increased feed consumption and with increasing consumption, there was a tendency to increase blood cholesterol in local duck serum. Murray et al. (2000) stated that the factors that influence blood cholesterol are the speed of cholesterol synthesis in the body and the environment. Feed is one of the environmental factors that has a high contribution to fat and cholesterol metabolism.

Cholesterol precursors are obtained from feed and biosynthesis that occurs in organs such as the intestine and liver. Feed consumption contributes to cholesterol synthesis, where if high feed consumption will cause high cholesterol content in the blood. This statement by Murray et al. (2000) is reinforced by Naber (1976) who stated that cholesterol in the body is produced as much as 2/3 by the body and 1/3 of the food consumed.

Ismoyowati and Widiyastuti (2003) add that the quality and quantity of feed given to livestock greatly influences the synthesis of cholesterol in the body. Liu et al. (2010) further stated that high cholesterol was mainly due to high LDL. Cholesterol in LDL is carried by HDL to the liver. Cholesterol is converted to 7-hydrocholesterol, which then reduces the double bonds and hydroxylates into kenodeoxicolate acid and colic acid which then ente[2] the small intestine as an emulsifier to help digest fat and then excreted through the stool (Thocer 2003). The results of the study by Leance et al. (2013) showed that the intestinal capacity to absorb cholesterol from food did not show intestinal capacity to absorb the total amount of cholesterol in the lumen.

Cholesterol cannot be circulated in the bloodstream by itself because cholesterol is not soluble in blood fluids, therefore it is packaged with protein into lipoprotein. This lipprotein is a cholesterol carrier in the blood, namely LDL (Low Density Lipoprotein) and HDL (High Density Lipoprotein). The use of 5% cassava leaves decreased the mean serum LDL level by 15.83%, while the use of 10% cassava leaf meal reduced 22.79%. There is a decrease in LDL levels with the use of cassava leaf meal because cassava leaves contain flavonoids which can increase the degradation/decay of fat through an increase in metabolism in the body resulting in the burning process of fat deposits (Robinson 1995). According to Risna (2012), LDL is a lipoprotein compound that is rich in cholesterol. High fat in the body will result in an increase in LDL levels. Thus the more fat released by the body, the cholesterol in the body levels decreases (Syahruddin 2002).

The use of 5% golden snails increases the average serum LDL level by 31.26%. Thus it can be concluded that the use of 5% snails can increase LDL blood in ducks. LDL is a lipoprotein that is dangerous because it carries the most cholesterol in the blood. High LDL levels cause the deposition of cholesterol in the arteries. So thus, the use of 5% golden snail decreases blood cholesterol levels but increases LDL levels, meaning that in the blood vessels cholesterol deposition occurs.

The mean HDL levels of Pajajaran duck serum in this study ranged from 50.48 to 68.17 mg dl-1. The average treatment of D5K5 (5% cassava leaf meal, 5% snails) was higher than the other [2]atments. The research of Tugiyanti et al. (2016) shows that n[2]mal HDL levels of ducks are 59.52 mg dl-1. Based on the analysis of variance that the use of cassava meal had no significant effect (P> 0.05) on decreasing HDL levels in duck blood, but there was a tendency to increase mean HDL levels of blood with the use of 5% cassava leaf meal at 23.06%. Good synergy between cassava leaf meal and golden snails with optimal levels can increase serum HDL.

The active compound in cassava meal carotene is 7052 μg 100 g-1 has the potential as an antioxidant which can break the cholesterol formation reaction in the intestine by activating the enzyme HMG-CoA reductase that converts 3-Hydroxy, 3-Methyl, Gluteryl-CoA to mevalonic acid. Mevalonic acid is the initial compound in the process of forming cholesterol. With reduced mevalonic acid, the cholesterol produced in the liver will be reduced (Agarwal and Rao 2000), also increasing bile salts, which are the components that make up cholesterol.

Hasanudin et al. (2014) stated that HDL has a positive correlation with LDL and both are strongly influenced by cholesterol levels in the blood. High and low levels of HDL in the blood are related to cholesterol levels and the synthesis of steroid compounds in bile salts (Murray et al. 2003) as well as cholesterol in the blood circulation, thus the levels of HDL, LDL and Triglycerides are also reduced.

The administration of 5% golden snail increased blood HDL by 7.01% in the D5K5 treatment. HDL is a lipoprotein that transports cholesterol less than LDL, HDL can remove excess cholesterol in the arteries and return to the liver for processing or disposal. This high density lipoprotein can prevent cholesterol from settling in the arteries and protect blood vessels from the asteroid cancer process, low HDL levels can increase

the risk of coronary heart disease. Thus the use of 5% snail can reduce the risk of cholesterol deposition in this Pajajaran duck.

Analysis of variance showed that the treatment did not significantly affect the MDA value of blood (Table 4). The use of cassava leaf meal in rations as much as 10% without snails (D10K0) was able to reduce the mean serum MDA level by 17%. Beta carotene found in rations containing cassava leaf meal effectively protects multiple chain fatty acids (omega 3 and omega 6) from the oxidation process so that omega 3 can work well and reduce the MDA value.

The use of 5% golden snails increases serum MDA levels by 24.38% compared to controls. This is because the golden snail is given in a fresh form without processing. According to Budiari et al. (2016) boiling process in making golden snail meal can prevent the negative effects of antinutrients.

3.4. Meat Profile

The results of the variance analysis showed that the use of cassava leaf and golden snail meal significantly ($p < 0.05$) reduced the cholesterol of 28 weeks old Pajajaran duck meat. The D5K0 treatment was significantly lower than the D10K0 treatment, but not significantly with the treatment of D0K0, D0K5, D5K5. The average treatment with the use of cassava leaf meal was real ($p < 0.05$) lower than without and 10% cassava leaf meal.

Table 4. Results of meat fat and cholesterol analysis

Parameter	Snails (%)	Cassava leafs meal (%)			
		D0	D5	D10	Average
Meat Cholesterol (mg 100g-1)	K0	104.7±26.15^{ab}	71.86±14.27^{b}	120.03±12.30^{a}	97.45±26.45
	K5	92.13±7.52ab	106.41±15.50ab	72.49±11.32b	90.40±18.00
Average		96.39±17.78	89.13±23.14	96.26±28.10	93.93±22.25
Meat Fat (%)	K0	27.04±4.06	21.95±2.60	22.98±2.96	23.99±3.66
	K5	23.35±4.13	23.18±6.36	21.13±5.03	22.55±4.67
Average		25.19±4.18	22.56±4.4	22.05±3.82	23.27±4.14

Description: Superscripts with lowercase letters in the same row and column show significantly different ($p < 0.05$)

D0K0 = control ration (without Cassava leafs meal), D0K5 = Ration contains 0% Cassava leafs meal, 5% golden snail. D5K0= ration with Cassava leafs meal5%, golden snail 0%. D5K5 = Ration with Cassava leafs 5% meal golden snail 5%. D10K0= Cassava leafs 10% meal, squared 0%. D10K5 = Cassava leafs 10% meal, golden snails 5%.

3.5. Ducks Eggs Lipid Profile

The results of the variance analysis showed that there were no significant interactions ($P < 0.05$) between supplementation of Cassava leafs meal and golden snail in rations containing lemuru fish oil to the lipid profile of eggs (triglyserida, cholesterol, HDL and LDL) and MDA 28 weeks old Pajajaran duck.

Table 5. 28 weeks old Pajajaran Ducks average eggs lipid profile

Parameter	Snails (%)	Cassava leafs meal (%)			
		D0	D5	D10	Average
Eggs Triglyserida (mg dl^{-1})	K0	6.25±3.48	4.45±0.79	3.04±0.96	4.50±2.35
	K5	4.84±0.71	4.83±0.43	4.88±0.84	4.84±0.58
Average		5.53±2.37	4.52±0.84	3.95±1.29	4.67±1.67

Cholesterol (mg g^{-1})	K0	3.78±2.96	1.47±0.48	1.13±0.02	2.10±1.93
	K5	1.57±0.55	1.62±0.39	1.43±0.29	1.53±0.37
Average		2.63±2.23	1.54±0.39	1.28±0.24	1.81±1.38
HDL (mg dl^{-1})	K0	0.34±0.04	0.35±0.03	0.35±0.01	0.34±0.02
	K5	0.35±0.01	0.34±0.02	0.34±0.01	0.34±0.01
Average		0.34±0.02	0.34±0.02	0.34±0.01	0.34±0.01
LDL (mg dl^{-1})	K0	2.12±2.29	0.23±0.37	0.18±0.19	0.83±1.50
	K5	0.44±0.36	0.48±0.18	0.11±0.13	0.30±0.25
Average		1.44±1.87	0.32±0.30	0.13±0.14	0.60±1.14
MDA	K0	27.92±20.83	8.97±5.35	6.26±2.46	14.38±14.89
	K5	8.22±2.21	9.99±3.50	9.06±2.29	9.06±2.47
Average		18.07±17.09	9.4±4.07	7.66±2.62	11.72±10.71

The variance test results on MDA levels were not significant ($P>0.05$) affecting the MDA levels of eggs. However, from the Averagoes the use of 5% golden snails in the ration was able to reduce the MDA levels of eggs 37.03%. The use of 5% Cassava leafs meal in the ration is able to reduce the MDA level of eggs by 47.98% and the use of 10% Cassava leafs meal can reduce egg MDA levels by 57.60%. Decrease in MDA levels of eggs shows that the final product obtained in this study is eggs that are high in antioxidants. Antioxidants from eggs can be seen from levels of Malondialdehyde (MDA) or markers of free radical indicators (Akdemir and Sahin 2009).

3.6. Pajajaran Ducks Egg Fat

The variance test results show that 10% Cassava leafs meal were significant ($P<0.05$) reduce egg fat content by 7.62%. Average fat content in duck eggs ranges from 28.63% -32.88%. Suhermiyati (2003) states that fat in the body of chickens and eggs is influenced by feed fat consumption. In the use of 10% Cassava leafs meal level there was an increase in feed fat consumption. The egg fat has decreased means that the body effectively decomposes feed fat.

Table 6. Average Eggs Fat

Parameter	Snails (%)	Cassava leafs meal (%)			
		D0	D5	D10	Average
Eggs Fat (%)	K0	32.28±0.19	29.79±2.47	30.26±1.10	30.78±1.77
	K5	31.45±0.34	32.24±0.73	28.63±1.71	30.77±1.89
Average		31.87±0.51a	31.02±2.11ab	29.44±1.56b	30.77±1.78

Description: Superscripts with lowercase letters in the same row and column show significantly different ($p<0.05$)

D0K0 = control ration (without Cassava leafs meal), D0K5 = Ration containing 0% Cassava leafs meal, 5% golden snail. D5K0 = ration with Cassava leafs meal5%, golden snails 0%. D5K5 = Ration with Cassava leafs 5% meal golden snail 5%. D10K0 = Cassava leafs 10% meal, golden snails 0%. D10K5 = Cassava leafs meal 10%, golden snails 5%.

4. CONCLUSION

The use of cassava leaf meal can reduce fat consumption and cholesterol level of meat and reduce the fat content of eggs. The use of a combination of cassava leaf meal and golden snail increases feed consumption. The use of golden snail can reduce MDA levels of eggs. The use of a combination of cassava leaf meal and golden snail is able to improve blood, meat and egg lipid profiles although statistically not significantly different.

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LIPID METABOLISM OF PAJAJARAN DUCKS FED POMACEA CANALICULATA AND MANIHOT ESCULENTA CRANZT LEAF MEAL IN RATIONS CONTAINING SARDINELLA OIL LEMURU

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