

THE CHOLESTEROL PROPERTIES OF INDONESIAN RUMINANT BY-PRODUCT

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Abstract. The research determined the cholesterol properties of Indonesian Ruminant By-Products of the Ongole Crossbreed Cattle (OCC) and the Kacang Goat (KG) that intensively rearing system in Lamongan District, Indonesia. The research materials were red offal (RO) consist of liver, kidney, heart, tongue, trachea, lung, and spleen), white offal (WO) consist of rumen, reticulum, omasum, abomasum, duodenum, jejunum, ileum, and colon), and dark offal (DO) was head skin of male and female OCC and KG. The research method was using laboratory analysis with random purposive sampling. The data were analyzed using quantitative descriptively. The results showed the mean of male cholesterol OCC was RO of 100.513 ± 11.314 , WO of 97.586 ± 31.078 , DO was 70.423 mg/100 g. The mean of female cholesterol OCC was RO of 95.573 ± 43.193 , WO of 116.197 ± 9.707 , and DO was 21.127 mg/100 g. The mean of female cholesterol KG was RO of 109.658 ± 26.925 , WO of 119.718 ± 8.131 , and DO was 77.465 mg/100 g. The mean of male cholesterol KG was RO of 235.374 ± 130.960 , WO of 194.558 ± 94.837 , and DO was 57.143 mg/100 g. The cholesterol content of Indonesian ruminant by-product of OCC and KG was relatively low and could be processed into the development livestock product.

Keywords: Cholesterol, By Product, Ongole, Kacang, Ruminant

BACKGROUND

Indonesia has diverse genetic resources, especially in endogenous livestock such as cattle and goat. The Ongole Crossbreed Cattle (OCC) and Kacang Goat which are endogenous animals that have existed for a long time. In 2016 the population of OCC was 1.6 million heads, KG was 1.96 million heads [1]. Local ruminants are livestock breeds that are widely developed in Asian countries such as Indonesia and Malaysia. Local ruminants have the characteristics including small body, short ears, high back and horns in both males and

females. The biological productivity of local livestock is 10-30% lower than that of European cattle [2]. Local livestock commodities from ruminants that are commonly bred in Indonesia include: Ongole Crossbreed Cattle [3], Kacang Goat [4]. Local ruminant livestock in Indonesia are genetically different from European and other imported cattle, and maintenance management is carried out based on the local wisdom of the Indonesian breeder community. This has the potential to cause differences in the macro and micro quality of the local livestock products, both the main products such as meat, milk and eggs as well as other by-products.

The exploration of the main yields of local livestock, especially on ruminants, OCC and KG have been previously studied and published by researchers [5] [6], but have not on the by-products. The process of converting livestock to meat in abattoirs usually generates a lot of by-products which can be further utilized by humans as food or reprocessed as secondary by-products for both agricultural and industrial uses [7]. The yield of these by-products has been reported to account for about 10% to 15% of the value of the live animal in developed countries, although animal by-products account for about two-third of the animal after slaughter [8].

Basically, animal by-products include all parts of a live animal that are not part of the dressed carcass such as liver, heart, rumen contents, kidney, blood, fats, spleen and meat trimmings. In this sense, the production of these animal by-products can be grouped into non-carcass meat (EBPs) and non-meat products (IEBPs). The description and classification of animal by-products differ from country to country and according to different usages in the meat industry. They can be classified as EBPs and IEBP or organ and non-organ by-products [9]. They are also sometimes classified based on muscular structure, shape and colour [10]. Non carcass part divided into two groups, Edible part and Non Edible part. Regardless of this, the edible offal can be sub-grouped into white offal, dark offal and red offal [11]. The red edible offal consist of liver, kidney, hearth, tongue, trachea, lung, and spleen, the white edible offal consists of stomach, intestine and gizzard, and the dark edible offal consist of head, neck, trotter, and shank. All of the part of the edible offal could be for human consumption [12]

The consumption of EBPs across the world is gradually increasing due to the discovery of their importance as a source of nutrients for human benefit. They are widely used in traditional culinary in Europe, South America, North America, Asia, Africa and Australia [13,14]. In Africa, all parts of EBPs are processed and commonly used as human food [14]. In South Africa, EDP delicacies are enjoyed and accepted as one of the traditional norms shared collectively between white South Africans (especially Afrikaners) and black South Africans [15]. A study conducted in Somalia revealed that EBPs are culturally acceptable and consumed by people of all ages [16]. EBPs are usually eaten after frying, grilling, boiling or braising with vegetables and other ingredients. In some cultures, liver meat is processed and consumed in different forms such as liver pâté, foie gras and liver sausages [17–18]. This is due to the richness of animal liver in protein, fat, iron, copper and vitamins which are important for normal development in humans.

By-products are considered as food ingredients that are not healthy for humans, even though they still have the potential to contain micronutrients in the form of bioactive peptides to be explored and developed into functional products. One of the bioactive compounds of by-product can describe by the knowing of the by-product cholesterol content. The research about the cholesterol properties of Indonesian Ruminant By-Product had not explored so it needed for

exploration of cholesterol of OCC and KG and can be the basic of the explore for the functional properties of the by-product especially OCC and KG.

METHOD

The research method was using laboratory analysis with random purposive sampling. The research materials were edible by-product part consists of Liver, Kidney, Hearth, tongue, trachea, lung, and spleen, ruminant stomach (rumen, reticulum, omasum, abomasum), intestine and head skin of OCC and KG. the research conducted on June – July 2022. The OCC was 2-4 years old and the KG was 1-2 years old, each sample used 2 tails of female and male of OCC and KG that intensively rearing. Every livestock were keeping in the farm, feeding twice of day, and drinking *adlibitum*. The data were analyzed using quantitative descriptively. The cholesterol content method were using Dr. david sleighton and modification by [19]

RESULTS AND DISCUSSION

The results of this research were by-product cholesterol contents of Indonesian ruminant could describe on the *Table 1*.

Table 1. The Edible By-Product Cholesterol Contents of KG and OCC (mg/100g)

Edible Offal Part	KG		OCC	
	Female	Male	Female	Male
Red Offal				
Liver	119.78	440.816	126.761	98.592
Kidney	105.634	228.571	56.338	91.549
Hearth	70.423	187.755	133.803	105.634
Tongue	119.78	Unidentified	84.507	84.507
Trachea	140.845	114.286	126.761	97.959
Lung	77.465	106.122	21.127	119.718
Spleen	133.803	334.694	119.718	105.634
Mean	109.658	235.374	95.573	100.513
Sd	26.926	130.960	43.193	11.314
White Offal				
Rumen	119.718	97.959	112.676	84.507
Reticulum	126.761	97.959	Unidentified	112.676
Omasum	105.634	155.102	98.592	112.676
Abomasum	126.761	334.694	119.718	84.507
Duodenum	122.676	Unidentified	126.761	105.634
Jejunum	126.761	261.224	119.718	140.485
Colon	119.718	220.408	119.718	42.254
Mean	119.718	194.558	116.197	97.586
Sd	8.132	94.837	9.707	31.079
Dark Offal				
Head Skin	77.465	57.143	21.127	70.423

The cholesterol content of liver KG was the higher male than female and the cholesterol content of liver OCC was the higher on the female than male cattle. The results of the study of liver cholesterol of female KG were 119, 718 mg/100gr, this value was higher than the cholesterol of Alpine goats and Anglo Nubian goats studied by [20] which had cholesterol levels of 214.2 mg/100g.

The Cholesterol Content of Kidney

The cholesterol content of kidney KG was the higher male than female and the cholesterol content of kidney OCC was the higher on the male than female cattle. Based on the results of research on kidney cholesterol of female KG were 105.634 mg/100gr, this value was lower than goat kidney cholesterol studied by Park [20] which had a cholesterol level of Alpine goats and Anglo Nubian goats 276.7 mg/100 g. The difference was due to the type of goat used and the feed given. Increasing of goat cholesterol levels was followed by increase in blood urea nitrogen (BUN) levels and creatinen was a very sensitive parameter to describe kidney function [21]

The Cholesterol Content of Heart

The cholesterol content of heart KG was the higher male than female and the cholesterol content of heart OCC was the higher on the female than male cattle. The heart was a part of the animal's body which was composed of epithelial tissue, muscle tissue, connective tissue, and nerves which contain a lot of blood. The heart was a place to pump blood. When there was too much cholesterol in the blood, it builds up on the walls of the arteries of the heart. Cholesterol levels in the heart, not as much as in the liver and kidneys. Based on the research results of heart cholesterol of female KG were 70.423 mg/100gr, this value was lower than goat heart cholesterol studied by Park [20] which had a cholesterol level of 167.5 mg/100 gr. The research results of heart cholesterol of female KG were 133.803 mg/100gr, this value was lower than catle heart cholesterol studied by Ejike and Emmanuel [21] which had a cholesterol level of 178.5 mg/100 gr. The cardiovascular system in the heart facilitated the process of transporting various substances to and from the body's cells. This system consists of a driving organ called the heart, and a channel system consisting of arteries that drained blood from the heart, and veins that drained blood to the heart which results in differences in cholesterol values [22]

The Cholesterol Content of Tongue

The cholesterol content of tongue KG was just the female KG that identified and the cholesterol content of tongue OCC was the same on the female and male cattle. Based on the results of the study, cholesterol of female KG tongue was 119.718 mg/100gr and the tongue OCC cholesterol were 84.507 mg/100 gr. According to the Department of Agriculture (USDA), the content of beef tongue about 87.78 mg/100gr.

The Cholesterol Content of Trachea

The cholesterol content of trachea KG was the higher female than male and the cholesterol content of trachea OCC was the higher on the female and male cattle.

The Cholesterol Content of Lung

The cholesterol content of lung KG was the higher on the male than female and the cholesterol content of lung OCC was the higher on male than female cattle. Based on the results of the cholesterol content of the lungs female KG were 77.465/100gr. This value was

lower than the sheep cholesterol described by Park [20] which had a cholesterol level of 213.0 mg/100gr on sheep. Histological structure of the bronchioles of lungs was composed of a thin and elastic lamina propria, surrounded by loosely twisted smooth muscle bands, the lumen was lined with simple ciliated columnar epithelium, in the bronchioles no hyaline cartilage was found as in the bronchi [23] .

The Cholesterol Content of Spleen

The cholesterol content of spleen KG was the higher on male than female and the cholesterol content of spleen OCC was higher on the female and male cattle. Based on the results of the cholesterol content of the spleen organ of KG were 133.803mg/100gr. This value was lower than sheep cholesterol described by Park [20] which had a cholesterol level of 250.0.mg/100gr on sheep. The spleen is in charge of removing unnecessary materials from the blood such as blood cells damaged [24]

The Cholesterol Content of Rumen

The cholesterol content of rumen KG was the higher female than male and the cholesterol content of rumen OCC was the higher on the female and male cattle. The rumen was a part of the animal's body which consists of four tunics, namely the tunica mucosa, tunica submucosa, tunica muscularis and tunica serosa. The tunica mucosa consists of an epithelial lamina and a lamina propria. The epithelial lamina was characterized by projections of elongated and short fungiform filiform papillae that were lined with stratified squamous epithelium. The lamina muscularis mucosa was not present in the tunica mucosa, so the lamina propria was fused with the tunica submucosa. The tunica muscularis rumen consists of two muscle layers, namely the circular muscle layer and the longitudinal muscle layer and the connective tissue between the two muscle layers. The tunica serosa has loose connective tissue, fatty tissue and blood vessels which in that section contains a lot of cholesterol worth [24].

The Cholesterol Content of Reticulum

The cholesterol content of reticulum KG was the higher female than male and the cholesterol content of rumen OCC was unidentified on the female and male cattle was 112.676 mg/100g.

The Cholesterol Content of Omasum

The cholesterol content of omasum KG was the higher on the male than female and the cholesterol content of omasum OCC was higher on the male than female cattle.

The Cholesterol Content of Abomasum

The cholesterol content of abomasum KG was the higher on male than female and the cholesterol content of abomasum OCC was higher on the female than male cattle.

The Cholesterol Content of Duodenum

The cholesterol content of Duodenum KG was just identified on the female goat of 126.676 mg/100g, and the cholesterol content of duodenum OCC was higher on the female and male cattle.

The Cholesterol Content of Jejunum

The cholesterol content of jejunum KG was the higher male than female and the cholesterol content of jejunum OCC was the higher on the male than female cattle.

The Cholesterol Content of Colon

The cholesterol content of colon KG was the higher male than female goat and the cholesterol content of colon OCC was higher on the female than male cattle.

The Cholesterol Content of Head Skin

The cholesterol content of head skin KG was the higher male than female goat and the cholesterol content of head skin OCC was higher on the female than male cattle.

CONCLUSIONS

Based on the research got the diversity cholesterol content between female and male of Indonesian ruminant, especially on Kacang Goat and Ongole Crossbreed Cattle. The edible offal of Kacang goat and Ongole Crossbreed Cattle was relatively low and could be processed into the development livestock product and safe for human consumption. It was one of pre elementary research so it still need more research about the bioactive compound of edible offal to explore the functional properties of edible offal especially on Kacang Goat and Ongole Crossbreed Cattle.

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