



Research Paper

## Fatty Acid Composition of Offal (Liver, Omasum, and Lungs) Of Pesisir Cattle

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**ABSTRACT:** This study aims to identify the fatty acid composition of offal such as the liver, omasum, and lungs at Pesisir cattle. The sample used consist of 6 males Pesisir cattle aged of 2-3 years old obtained from the Slaughterhouse in Bayang District, Pesisir Selatan Regency. The sample was dried at a temperature of 60 °C, then mashed, and the sample was extracted to take the fat. After extraction, the samples were methylated and analyzed to determine its fatty acid composition using Gas Chromatography. The results of the study found 14 types of fatty acids composition consisting of 7 saturated fatty acids (SFA), 3 monounsaturated fatty acids (MUFA), and 4 polyunsaturated fatty acids (PUFA). The saturated fatty acids consist of capric acid (C10:0), lauric acid (C12:0), myristic acid (C14:0), palmitic acid (C16:0), stearic acid (C18:0), arachidic acid (C20:0), and behenic acid (C22:0). Monounsaturated fatty acids consist of myristoleic acid (C14:1), palmitoleic acid (C16:1), and oleic acid (C18:1). Polyunsaturated fatty acids consist of linoleic acid (C18:2), linolenic acid (C18:3), arachidonic acid (C20:4), and eicosapentaenoic acid (EPA) (C20:5). The highest SFA was palmitic acid are found in omasum, with a percentage of 38.61%. The highest MUFA composition was oleic acid in the lungs, which was 30.20%. The highest percentage of PUFA was eicosapentaenoic acid (EPA) in the liver, which is 4.27%. The highest total SFA was found in the omasum, the highest total MUFA was in the lungs, and the highest total PUFA was found in the liver.

**KEYWORD:** fatty acids, liver, omasum, lungs, Pesisir cattle

Received 09 June, 2021; Revised: 21 June, 2021; Accepted 23 June, 2021 © The author(s) 2021.  
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### I. INTRODUCTION

Consumption of fat, especially saturated fatty acids (saturated fatty acids), trans unsaturated fatty acids (trans unsaturated fatty acids), and cholesterol is a factor that can increase low-density lipoprotein (LDL) in the blood and increase the risk of coronary artery constriction resulting in humans suffering from coronary heart disease [1]. This is because almost all triglycerides (90%), especially those that are saturated, can be absorbed by the body easily, while dietary cholesterol that can be absorbed by the body is only 20-50%. In the body, dietary fat intake is carried to the liver to be converted into cholesterol. To be easily distributed throughout the body, cholesterol binds to proteins to form lipoproteins. If it still contains a lot of cholesterol, then the lipoprotein bonds contain little protein so that the specific gravity is low, which is called LDL. On the way LDL leaves the liver to all body tissues, the excess cholesterol load will be easily scattered along the blood vessels. As a result, narrowing of the arteries (atherosclerosis) can occur, which can lead to strokes and heart attacks.

Pesisir cattle are one of Indonesia's local cattle which have the potential to produce meat. Although their body size is smaller than other local cattle, Pesisir cattle have the advantages of high adaptability to low-quality feed, traditional extensive rearing systems, and resistance to several diseases and parasites. Male Pesisir cattle are usually fattened to increase production yields, while female Pesisir cattle are left loose to forage for food. Pesisir cattle make a major contribution to meeting the meat needs of people in West Sumatra. In addition to beef, offal is also quite in demand by the public because, in addition to containing nutrients, offal also has a delicious taste. Offal is body parts of animals slaughtered other than carcasses, which consist of organs in the chest cavity and abdominal cavity, head, tail, legs from tarsus/carpus downwards, udder, and reproductive organs.

Offal (edible offal or also called variety meat or fancy meat) is an organ or tissue other than skeletal muscle which is common and suitable for human consumption that does not undergo further processing other

than cooling or freezing. Offal consists of the heart, tongue, liver, lungs, meat in the head, brain, thymus and/or pancreas, stomach, intestines, kidneys, and tail [2]. Some offal has high cholesterol, especially in the liver, omasum, and lungs.

## II. MATERIALS AND METHODS

This study used offal in the form of the liver, omasum, and lungs of male Pesisir cattle aged 2 to 3 years. In this study, using an analytical balance, a desiccator, an oven to dry the sample, soxhlec for fat extraction, a water bath to heat the sample in the fatty acid methylation process, and the GSMS-QP2010 SE. This research was conducted by observing fatty acids using different types of offal, namely liver, omasum, and lungs, from six heads of Pesisir cattle. Furthermore, the types of fatty acids obtained from the three offal are compared. Tests in comparing these fatty acids were carried out using a statistical general linear model (GLM) procedure.

The observed variables were the composition of fatty acids found in the liver, omasum, and lungs of Pesisir cattle. Determination of fatty acids by gas chromatography (GC) method [3]. Extraction and methylation of the samples are required before they are analyzed by gas chromatography. Samples were obtained at different times from the same breeder source in Bayang District, Pesisir Selatan Regency. Then the sample was taken using styrofoam and put into a cool box. After that, samples based on three different types of offal were weighed as much as 30 grams and dried in the oven at 90°C for 24 hours. The dried samples were then weighed and mashed. Samples of 0.5-0.6 grams were taken from the fat cup and put into a small bottle. Then 1 ml of 0.5 N NaOH + 0.5 ml of methanol (50%) was added. After that, it was heated in a water bath with a temperature of 80 for 20 minutes, then cooled. Then 2 ml of BF<sub>3</sub> was added and heated again in a water bath for 20 minutes. Next, 2 ml of NaCl and 1 ml of hexane were added and homogenized with a vortex, and then 0.2 µl of this mixture with a micro syringe and ready to be injected into the gas chromatograph. The data obtained were analyzed using SPSS 16.0 with the General Linear Model (GLM) method.

## III. RESULTS AND DISCUSSION

### *Saturated Fatty Acids (SFA)*

This study found seven types of saturated fatty acids (SFA) and seven types of unsaturated fatty acids (unsaturated fatty acids) in the liver, omasum, and lungs of Pesisir cattle (Tabel 1). Saturated fatty acids/SFA consist of capric acid (C10:0), lauric acid (C12:0), myristic acid (C14:0), palmitic acid (C16:0), stearic acid (C18:0), arachidic acid (C18:0), C20:0) and behenic acid (C22:0). With the total percentage of SFA contained in the liver 60.14%, omasum 77.88%, and lungs 54.84%. Based on the results in Table 1. it can be seen that the percentages of capric, lauric, myristic, and palmitic fatty acids present in the liver and lungs were significantly different from the percentages of capric, lauric, myristic, and palmitic fatty acids in omasum.

The percentage of myristic acid in the lungs of Pesisir cattle is 1.69% higher than the percentage of myristic acid are 0.6% in cow lungs and 0.6% in pig lungs [4]. In Pesisir cattle lungs, the percentage of palmitic acid was 31.98% lower than the percentage of palmitic acid in cattle lungs (34.4%) and higher than palmitic acid in pig lungs (27.1%) [4]. The highest percentage of saturated fatty acids is palmitic acid found in omasum, which is 38.61%. Palmitic acid also had the highest concentration in beef (26.75%) and goat (21.81%). This is in accordance with [5] statement regarding the main saturated fatty acids (SFA) in beef and lamb, namely myristic, palmitic and stearic.

Genetic factors can affect palmitic fatty acid content in sheep [6]. The differences in breed in sheep caused differences in the composition of myristic, palmitic, and stearic fatty acids [7]. Palmitic acid is one of the SFA that can increase serum cholesterol and low-density lipoprotein (LDL) lipoprotein levels. The percentage of stearic fatty acid of Pesisir cattle offal in the lungs (19.75%) was significantly different from the percentage of stearic acid in the liver (31.17%) and omasum (33.54%).

Stearic acid is a type of saturated fatty acid that has a high percentage of innards of Pesisir cattle after palmitic acid. In the study of [8], the highest saturated fatty acid content in buffalo liver was also found in stearic acid with a percentage of 28%. The percentage of stearic acid in the lungs of Pesisir cattle was higher than the percentage of stearic acid in the lungs of cattle (15.2%) and lower than the percentage of stearic acid in the lungs of pigs (21.1%) [4].

The arachidic fatty acids in the offal of Pesisir cattle did not show a significant difference, namely in the liver 0.31%, omasum 0.37%, and in the lungs 0.70%. This result is not much different from the percentage of arachidic acid in buffalo liver in [8] study, which was 0.3%. The percentage of behenic acid of Pesisir cattle offal in the liver (0.16%) and omasum (0.21%) showed a significant difference with behenic acid in the lungs (0.62%). Differences in saturated fatty acid composition are influenced by feed, age, and genetic factors [9].

Unsaturated Fatty Acid (UFA)

Unsaturated fatty acids (UFA) are distinguished based on the number of double bonds, namely unsaturated fatty acids with single, double bonds (monounsaturated fatty acids / MUFA) and unsaturated fatty acids with multiple double bonds (polyunsaturated fatty acids/PUFA) [6]. The composition of unsaturated fatty acids is influenced by factors of age, species, animal body weight, sex, animal condition, and feed [10].

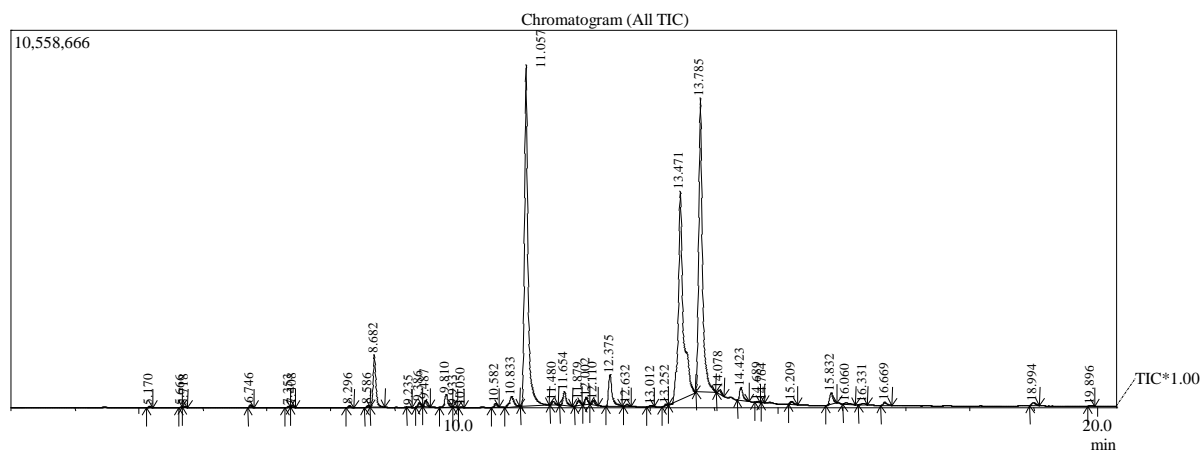
**Table 1.** Offal Fatty Acids (Liver, Omasum, and Lung) composition of Pesisir Cattle.

No	Fatty Acid	Offal		
		Liver (%)	Omasum (%)	Lungs (%)
1	<i>Saturated fatty acid (SFA)</i>			
	Capric C10:0	0,01 <sup>a</sup>	0,10 <sup>b</sup>	0,01 <sup>a</sup>
	Lauric C12:0	0,09 <sup>a</sup>	0,18 <sup>b</sup>	0,09 <sup>a</sup>
	Myristic C14:0	1,11 <sup>a</sup>	4,87 <sup>b</sup>	1,69 <sup>a</sup>
	Palmitic C16:0	27,29 <sup>a</sup>	38,61 <sup>b</sup>	31,98 <sup>a</sup>
	Stearic C18:0	31,17 <sup>b</sup>	33,54 <sup>b</sup>	19,75 <sup>a</sup>
	Arachidic C20:0	0,31	0,37	0,70
	Behenic C22:0	0,16 <sup>a</sup>	0,21 <sup>a</sup>	0,62 <sup>b</sup>
	SFA Total	60,14	77,88	54,84
2	<i>Mono Unsaturated fatty acid (MUFA)</i>			
	Myristoleic C14:1	0,00 <sup>a</sup>	0,11 <sup>b</sup>	0,04 <sup>a</sup>
	Palmitoleic C16:1	2,26 <sup>b</sup>	1,62 <sup>a</sup>	2,58 <sup>b</sup>
	Oleic C18:1	23,11 <sup>ab</sup>	17,43 <sup>a</sup>	30,20 <sup>b</sup>
	MUFA Total	25,37	19,16	32,82
3	<i>Poly Unsaturated fatty acid (PUFA)</i>			
	Linoleic C18:2	0,89	0,17	0,22
	Linolenic C18:3	2,34 <sup>b</sup>	0,10 <sup>a</sup>	0,73 <sup>a</sup>
	Arachidonic C20:4	3,92 <sup>b</sup>	0,51 <sup>a</sup>	3,85 <sup>b</sup>
	EPA C20:5	4,27 <sup>b</sup>	0,68 <sup>a</sup>	1,66 <sup>a</sup>
	PUFA Total	11,42	1,47	6,47
4	Unknown	3,11	1,69	5,93

Note: Different superscripts in the same row are significantly different (P ≤0.05)

Monounsaturated Fatty Acid (MUFA)

In this study, monounsaturated fatty acids/MUFA in offal were myristoleic acid (C14:1), palmitoleic acid (C16:1), and oleic acid (C18:1). The total percentage of MUFA in the liver was 25.37%, omasum was 19.16%, and lung was 32.82%. The myristoleic acid of Pesisir offal in the liver (0.00%) and lungs (0.04%) was significantly different from that of omasum (0.11). In the palmitoleic acid of Pesisir cattle offal, there was a significant difference between omasum (1.62%) with liver (2.26%) and lungs (2.58%). Meanwhile, the percentage of oleic acid of Pesisir cattle offal in the liver (23.11%) was not significantly different from that of omasum (17.43%) and not significantly different from that of the lungs (30.20%). In [4] study, the percentage of palmitoleic acid in bovine lungs was 1.0%, and the percentage of palmitoleic acid in pig lungs was 2.3% higher. The percentage of oleic acid in the lungs of Pesisir cattle is 30.20% lower than the percentage of oleic acid in the lungs of cows (37.3%) and pork lungs (34.2%) in Okano and Akino's (1979) study. The oleic acid was the most dominant fatty acid in beef carcasses [11].



**Figure 1.** Chromatogram of Fatty Acid in Liver of Pesisir Cattle

Poly Unsaturated Fatty Acid (PUFA)

Poly Unsaturated Fatty Acid/PUFA of Pesisir cattle offal consists of linoleic acid (C18:2), linolenic acid (C18:3), arachidonic acid (C20:4) and eicosapentaenoic acid (EPA) (C20:5). The total percentage of polyunsaturated fatty acids (PUFA) in Pesisir cattle offal is 11.42% in the liver, 1.47% in the omasum, and 6.47% in the lungs. There was no significant difference in the linoleic fatty acids of Pesisir cattle offal in the form of the liver (0.89%), omasum (0.17%), and lungs (0.22%). The percentage of linoleic acid in the lungs of Pesisir cattle is 0.22% lower than the percentage of linoleic acid in the lungs of cattle (2.5%) and pork lungs (6.5%)[4]. Linoleic acid has benefits in maintaining health, especially for children who are in their infancy. The percentage of linolenic acid in the omasum (0.10%) and lungs (0.73%) was significantly different from the liver (2.34%).

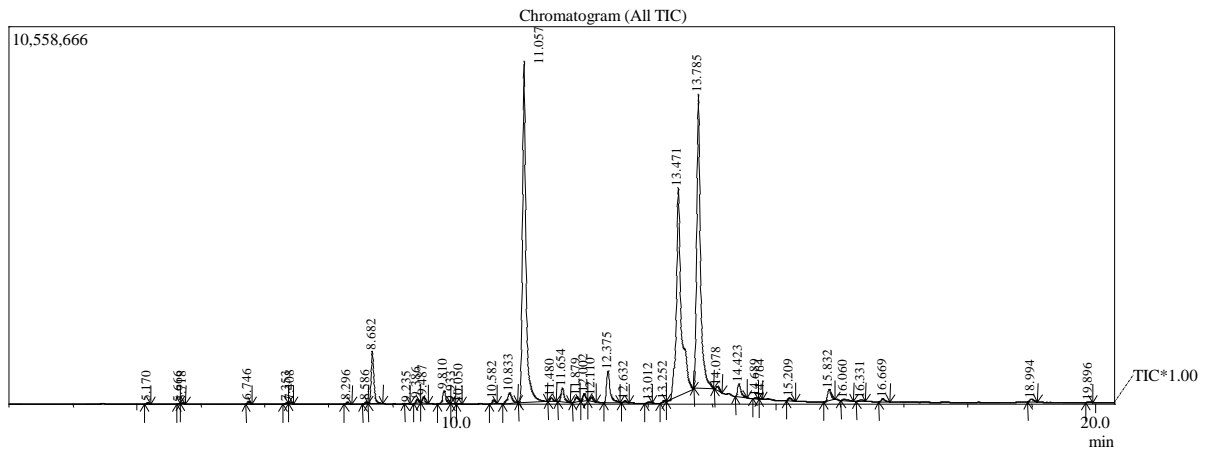


Figure 2. Chromatogram of Fatty Acid composition of Omasum of Pesisir Cattle

The cattle liver has 2.5% linolenic acid and 0.5% and 3.8% in pork and lamb liver [12]. The percentage of linolenic acid in cow lungs was 2.4%, and in pig, lungs were 0.8% [4]. Linolenic acid plays an important role in helping brain function, as well as brain growth and development. Arachidonic acid in the omasum (0.51%) was significantly different from the liver (3.92%) and lungs (3.85%). The percentage of arachidonic acid in the lungs of Pesisir cattle was higher than the percentage of arachidonic acid in the lungs of cattle (2.7%) and lungs of pigs (3.4%)[4]. Arachidonic acid is abundant in the brain, liver, egg yolks, and vegetable oils derived from seeds.

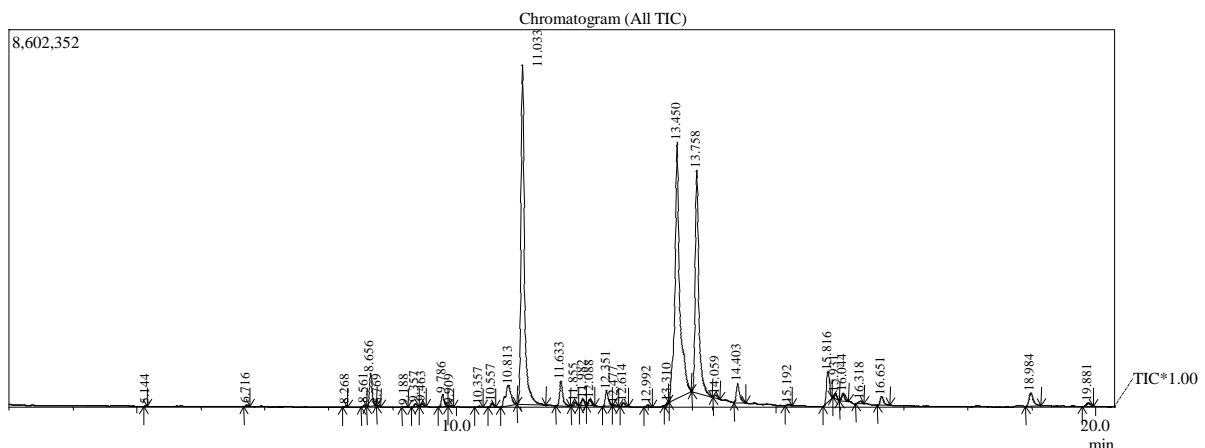


Figure 3. Chromatogram of Fatty Acid composition of Lungs of Pesisir Cattle

Eicosapentaenoic acid (EPA) in the omasum (0.68%) and lungs (1.66%) was significantly different from the liver (4.27%). The highest percentage of polyunsaturated fatty acids in Pesisir cattle offal is eicosapentaenoic acid, which is found in the liver, which is 4.27%. Eicosapentaenoic acid (EPA) is a derivative of Omega-3 fatty acids, which are widely found in fish oil and fish products. Eicosapentaenoic acid (EPA) serves to prevent the hardening of the arteries, reduce stimulation of blood clotting and increase intelligence in toddlers. The percentage of unidentified compounds in Pesisir cattle offal contained in the liver (3.11%), omasum (1.69%), and lungs (5.93%).

#### IV. CONCLUSION

There is a difference in the percentage of fatty acid of offal (liver, omasum, and lungs) of Pesisir cattle. The highest saturated fatty acid (SFA) was in the omasum with a percentage of 77.88%, the highest monounsaturated fatty acid (MUFA) was of the lungs which is 32.82 % and the highest polyunsaturated fatty acid (PUFA) was found in the liver with a percentage of 11.42%. The highest SFA was palmitic acid in the omasum, which was 38.61%. The highest MUFA was oleic acid, with a percentage of 30.20% in the lungs and the highest PUFA was eicosapentaenoic acid (EPA) in the liver which was 4.27%. It can be concluded that the highest percentage is saturated fatty acid (SFA in offal were the type of palmitic acid.

#### ACKNOWLEDGMENT

Thank you so much to the Head of Biotechnology Laboratory, Faculty of Animal Science, Andalas University, who support for the analyse of samples.

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