

Determination of Level Protein Intake to Control Fat and Protein in Carcass of Fattened Lambs

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Submission date: 03-Sep-2018 04:00PM (UTC+0700)

Submission ID: 996271137

File name: PROCEEDING_ANI_NUE_Thailand_sutaryo1.pdf (552.61K)

Word count: 2215

Character count: 11185



Session 9-Orchid ballroom I

ANN-01-0061

Determination of Level Protein Intake to Control Fat and Protein in Carcass of Fattened Lambs

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Abstract

Twenty four thin tailed lambs aged approximately 3 months old with an average body weight of 14.19 ± 2.41 kg (CV 16.98%) were used in this study to determine the level of dietary protein (percent protein intake per body weight; CPI in %BW) required to achieve a low fat content (less than 5%) in lamb meat preferred by consumer. The lamb were fed the diets containing 14, 16 and 18% crude protein (CP) and 60 and 70% total digestible nutrients (TDN). The lambs were slaughtered after 3 months raising under the feeding treatments which reached average slaughter weight 24.48 ± 3.45 kg. The carcass was weighed to obtain carcass weight, and was then separated into meat, fat and bone. The longissimus dorsi (LD) and Biceps femoris (BF) were used to determine the fat and protein content of carcass by proximate analysis. The data of level CPI (in %BW) was then correlated to fat and protein in carcass, and was analyzed to determine the level protein intake required to control carcass fat. The results showed that the level of CPI (in %BW) were significantly correlated ($P < 0.05$) with carcass fat, meat fat and carcass protein, being 0.11, 0.40 and 0.63 respectively. This study found that level of protein intake per body weight (CPI in %BW) for lamb should be less than 0.7%BW to obtain a consumer preferred low fat content (less than 5%) in lamb meat.

Keywords: lambs, percent protein intake per body weight, carcass fat, meat fat, meat protein



Introduction

In recent years, consumer realized that the high proportion of lipid consumption of meat give some effects on human health such as coronary heart disease, cancer and arthritis. Along with the increasing public awareness to healthy living, consumption of low meat fat increased (Scollan et al., 2006 ; World Cancer Research Fund/American Institute for Cancer Research, 2007 ; Bezerra et al., 2016) and the quality of meat can be identified through its flavor and tenderness (Jaworska et al., 2016 ; Malva et al., 2016 ; Zinder et al., 2017). Intramuscular fat (IMF) is being a factor to determine juiciness and flavour of meat (Lambe et al., 2017). Savel ad Cross (1998) claimed that a minimum level of IMF in meat lambs that can be accepted by consumer is 3%. Lambe et al. (2017) reported a preferred level of IMF of lamb meat is less than 5%.

In the postnatal period, adipose cells in the body of lamb is still carrying out to the hyperplasia process, adipose tissue develops its size of cell (hypertrophy) and increases the amount of cell (hyperplasia) (Hood and Allen, 1973). The increasing of adipose cells occurs as long as the live of lamb and fat accumulation in the meat of lambs will continue (Wangko and Wangko, 2010). Protein is one of nutrient contents that can affect fat proportion in meat. The excess of amino acids from protein would be utilized for fat synthesis in the carcass of lambs and being low quality carcass (Ponnampalam et al., 2003). Therefore, it is necessary to determine the level protein intake to get best quality of meat lambs.

Materials and Methods

Twenty four thin tailed lambs were used with an average body weight of 14.19 kg \pm 2.41 (CV 16.98%) aged \pm 3 months. The diets contained 14, 16 and 18% of crude protein (CP) and 60 and 70% of total digestible nutrients (TDN). The feed ingredients consisted of rice brand, cassava peel, sugarane top, cassava flour, soybean meal, fish meal, molasses and minerals. The feed and water were given ad libitum. The lambs were reared for 3 months and slaughtered. Lambs were fasted 6 hour prior to be slaughtered. The carcass of lambs was aging at 18°C for 10 hours, then was weight to determine carcass weight. Then carcass was separated between meat, fat and bone to obtained the percentage of carcass fat. The longissimus dorsi (LD) and Biceps femoris (BF) were used to determine the proximate composition (fat and protein).



The data was obtained and analyzed using correlation analysis. The relationship between the two variables was evaluated using the magnitude of the correlation value described by Steel and Torrie (1960).

Results and Discussion

Percent protein intake per body weight, carcass fat (%), fat of meat (%) and protein of meat (%) are presented in the Table 1. The dietary protein intake was 0.46 – 0.99 % per body weight and 0.67% as an average. The carcass fat (%) was around 1.41 - 33.96 % and 16.51% as an average. Fat of meat (%) was around 2.41 – 8.88 % and 4.22 % as an average. Protein of meat (%) was around 12.25 – 20.02% and 16.864% as an average).

Table 1 Protein intake per body weight (%), carcass fat (%), meat fat (%) and meat protein (%) of lambs.

Parameter	Range	Average	Standar Deviation
Protein intake / BW (%)	0.462 – 0.992	0.677	0.137
Carcass Fat (%)	1.413 – 33.964	16.516	6.597
Meat Fat (%)	2.410 – 8.880	4.225	1.436
Meat Protein (%)	12.250 – 20.020	16.864	2.682

Francisco et al. (2015) found that carcass fat of lamb was 20,9% with protein intake 0,7% per BW. Based on fat class and conformation (Speedy, 1980), lambs in this study is included as class 2 of fat. It was due to its carcass weight was around 14.18 kg (fat 16.71%, muscle 62.21% and bone 18.51%). The meat fat of lambs in this study was higher than those of previous study that taken by Francisco et al. (2015), the meat fat of lambs were 2%. According to Purbowati et al. (2010) the protein of lamb meat were 18,32% which is higher than this study. The growth of animals starts from nerves growth, bone growth, muscle growth and fat growth (Owens et al., 1993). Savel and Cross (1998) claimed that a minimum level of IMF in meat lambs that can be accepted by consumer is 3%. According to Lambe et al (2017), a preferred level of IMF of meat lamb is less than 5%. Protein content of meat is about 16 – 22% and the largest component was 75 – 80% of dry matter (Lawrie, 1995).

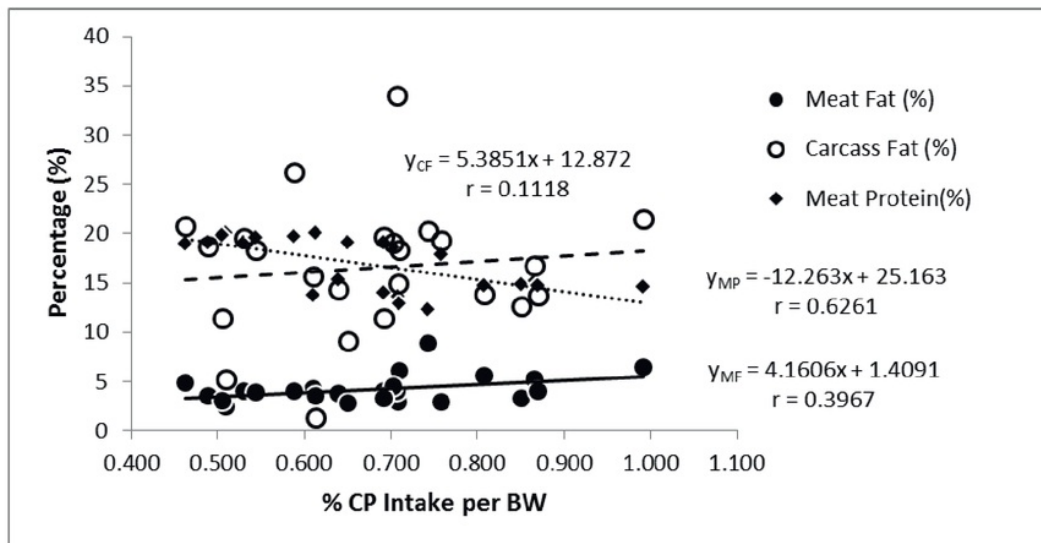


Figure 1 Correlation between % CP intake per BW to carcass fat (CF), meat fat (MF) and meat protein (MP); %meat fat (●), %carcass fat (○), %meat protein (◆)

The result showed that protein intake per body weight (%) was linearly correlated with carcass fat (%), meat fat (%) and meat protein (%) ($P < 0.05$). Protein intake per body weight (%) has weak correlation with carcass fat (%) ($r = 0.1118$) and has medium correlation with meat fat (%) ($r = 0.3967$). However, protein intake per body weight (%) has strong correlation with meat protein (%) ($r = 0.6261$). Figure 1 showed that every increasing of protein intake per body weight (%) increases the carcass fat (%) and meat fat (%) but decreases the meat protein (%). It is due to the muscle has maximum capacity to receive protein intake. Therefore, the excessive protein intake would be used to grow fat in form of adipose cells by hyperplasia process. Muscle tissue in lambs grows as cell enlargement process (hypertrophy) but adipose cells in the body of lambs is still carrying out to be hyperplasia process where is adipose tissue develops size of cell (hypertrophy) and increases of the amount of cell (hyperplasia) during growth period. (Hood and Allen, 1973). The excess of amino acids from protein would be utilized for fat synthesis in the carcass of lambs and being low quality carcass (Ponnampalam et al., 2003).



If lamb with average body weight \pm 25 kg consumed 3.5% dry matter intake/BW it can be calculated that lamb consumed 0.875 kg DMI. From this research it is known that the best protein intake to get low fat of meat is 0.7%/BW. Then, protein consumed by lamb with the average body weight \pm 25 kg is 175 g. Therefore, protein content on diet that should be given to the lamb to get low fat meat is less than 20% .

Conclusions

Based on this study, it can be concluded that protein intake per body weight of lamb to achieve low fat meat (<5%) which is preferred by consumer as healthy meat is 0.7%. Then, it can be suggested that protein content on diet for lamb should be given less than 20%.

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Acknowledgements

The authors would like to thank you to the Domba Cemara Team of Faculty of Animal and Agricultural Sciences, Diponegoro University, for their support and help in this study.

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