Regression Models for Estimating Fat Carcass Percentage Using Chest Measurement in Thin Tailed Lambs

by Sutaryo Sutaryo

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Farah Nabila, Pradhipta Hersandika, Ari Prima, Vita Restitrisnani, Nadlirotun Luthfi, Endang Purbowati, Sutaryo, and Agung Purnomoadi*

Department of Animal Science, Faculty of Animal and Agricultural Sciences, Diponegoro University, Semarang, Indonesia 50275
**Corresponding email: agung194@yahoo.com*

Abstract

This study was conducted to evaluate the possibility of using chest measurement for subcutaneous, intermuscular, and total fat percentage in Thin Tailed Lambs. Twenty one heads of three months old male thin tailed lambs with initial body weight (BW) 14.57 ± 2.19 kg were raised up to 3 months fattening period. Chest girth (CG), chest depth (CD), and chest width (CW) were measured before slaughtered. The fat of the carcass was separated into subcutaneous, intermuscular, and total fat, then weighed. The data was analyzed by linear regression to determine the correlation and equation between chest measurement and fat carcass percentage, then was evaluated by t-test, standard error (SE) and the differences were measured to predict the accuracy of the equation. The results showed that the correlation between CG, CW and CG/CD in intermuscular and total fat percentage was positive and significant ($P<0.05$) with correlation value moderate to high ($r= 0.510 - 0.664$), while subcutaneous were not significant. SE of each variable showed a low value (0.002-0.020) that indicate the prediction is close to the actual fat percentage value. The lowest differences between prediction and actual value could be found in CG regression equation in total fat (2.368%), while the highest value was 8.918% in intermuscular fat in CW/CG regression. Based on the results of this study, it can be concluded that CG regression is the best equation for estimating intermuscular, and total fat percentage using chest measurement in Thin Tailed Lambs.

Keywords: chest measurement, fat percentage, regression, lambs

Introduction

Fat is one of factor that determine carcass grading qualification in animals. Fat carcass consist of subcutaneous, intermuscular and intramuscular. The minimum requirement for either extractable fat in order to achieve acceptable consumer satisfaction for grilling red meat at 5% for sheepmeat (Hopkins et al., 2006). There are some methods to predict the fat before slaughtering the lambs. The ultrasound scanning is one of the methods that can be used for estimating fat carcass percentage of live animals (Grill et al., 2015).

Body Condition Score (BCS) have been used as reflection of animal's fat reserve. However, BCS is a subjective means of assessing an animal's lean body mess and body fat (Summers et al., 2012). Therefore there is a need to have an accurate and objective measurement for estimating fat while the animal is still alive. Body measurement can be used to predict body weight and carcass characteristics (Agamy et al., 2015). Chest girth is one of variable that have been used to predict body weight. Agamy et al. (2015) reported that chest girth had the highest correlation with body weight in Barki Lambs. The fat thickness of lambs can also indicated in chest depth. This study was conducted to evaluate the possibility of using chest measurement for subcutaneous, intermuscular, and total fat percentage in Thin Tailed Lambs.

Materials and Methods

Twenty one heads of male thin tailed lambs (± 3 months old) with initial body weight (BW) 14.57 ± 2.19 kg (CV= 15.03%) were used in this study. They were fattened by fed the complete feed contained three levels of crude protein (CP; 14, 16 and 18%) and two levels of total digestible nutrients (TDN; 60, 70%) that composed of rice bran, cassava meal, sugar cane top, cassava peel, soybean meal, fish meal, molasses and mineral and was given in pelleted form. All lambs were housed in individual pen and given freely access to feed and water throughout the experimental period.

Parameters measured were CG (cm), CW (cm), CD (cm), CG/CD, CW/CD, CW/CG, subcutaneous, intermuscular, and total fat percentage of carcass weight. Those measurements were taken before slaughtered that used tape measures and elaborate calipers. All lambs were slaughtered randomly after 3 months of feeding. Lambs were fasted for 6 hours before slaughtered. The slaughter method was done follow Islamic methods. The carcass was kept in a cold room at 18°C for 10 hours. The fat of carcass were separated into subcutaneous, intermuscular, and total fat (comprises of subcutaneous and intermuscular), then were weighed.

The relationship between body measurements and fat carcass percentage were analyzed by correlation regression analysis. The strength of correlation coefficient was evaluated by the value described by Steel and Torrie (1960), while the accuracy of the equation of regression was evaluated by t-test, standard error (SE) and the differences between predicted value and actual value. The accuracy was also determined if the difference value was low and statistically significant.

Results and Discussion

The correlation between chest measurement and fat carcass percentage are presented in Figure 1. The percentage of subcutaneous fat in CG, CW, CD, CG/CD, and CW/CD has a positive correlation value (0.163, 0.074, 0.135, 0.076, and 0.017, respectively) while in CW/CG was negative (-0.019). The negative correlation in CW/CG is caused by the growth of subcutaneous fat might be maximum, so it will decrease the growth rate. Owens et al. (1993) reported that fat deposition is starting from intermuscular, subcutaneous and intramuscular. Intermuscular and total fat percentage showed a positive correlation in all chest measurements. The correlation between CG in intermuscular and total fat percentage showed a strong correlation value, being 0.582 and 0.664, respectively, while, in CG/CD showed a medium correlation value, being 0.510 and 0.533, respectively. The bigger chest measurement value will give the more fat carcass percentage. This result agreed to the report of Abd-Alla (2014) that total fat stores weight of carcass were positively correlated with chest girth in Barki Lambs.

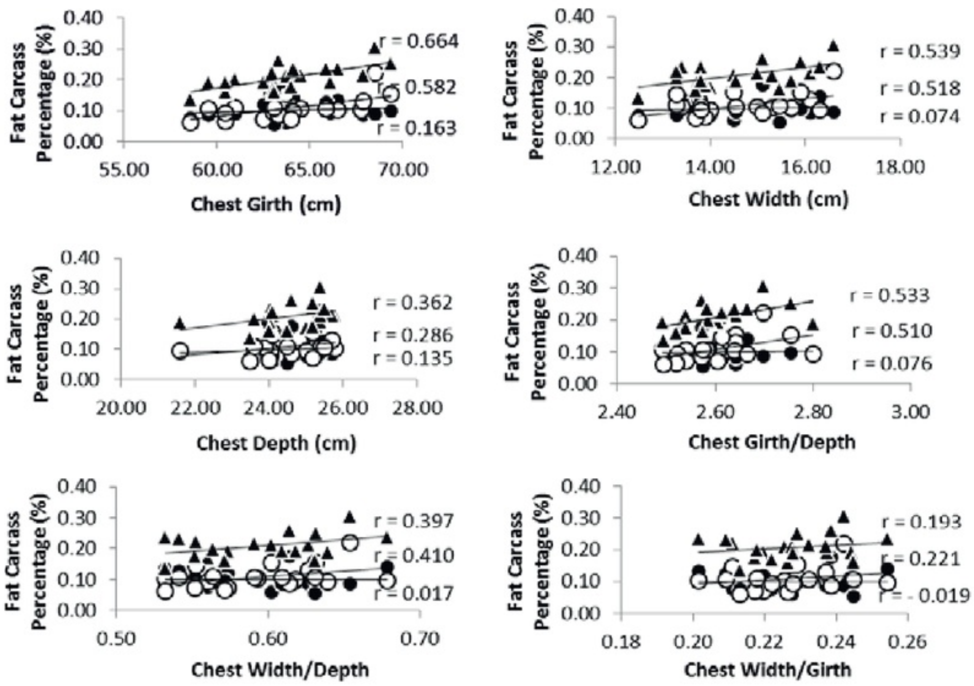

Figure 1. The correlation between chest measurements and fat carcass percentage; % subcutaneous (●); % intermuscular (○) and % total fat (▲).

Table 1 shows the equation regression of chest measurement and fat carcass percentage. The table showed the correlation of intermuscular and total fat in CG, CW and CG/CD were statistically significant (P<0.05), while subcutaneous fat was not significant (P>0.05). The growth of subcutaneous fat might be stable, so it's statistically not significant with chest measurements. Fat deposition is starting from intermuscular, subcutaneous and intramuscular (Owens et al., 1993). Chest girth were reported to have the highest correlation with body weight in Barki Lambs (Agamy et al., 2015). The SE of both variables showed a low value (from 0.002 to 0.020) and have a small differences of the actual value (0.368 - 7.520%). These result means either intermuscular or total fat regression equation in CG and CG/CD can be used. The CG regression is the best indicator of overall value, because it has the lowest differences and strong correlation in intermuscular and total fat percentage. The results of this study are in agreement with Nigm et al. (1995) who concluded that heart girth (or chest girth) was the best single measurement for predicting different carcass traits of Merino sheep.

Conclusion

This study concluded that chest girth (CG) has a strong correlation to intermuscular and total fat carcass percentage, so that the regression equation using CG has a good accuracy to estimate intermuscular and total fat carcass percentage in thin tailed lambs as shown by the low differences between the predicted and actual value.

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Table 1 The equation regression of chest measurement and fat carcass percentage.

No	Variable	Equation	r	SE	Diff. of predicted to actual value cm	Diff. of predicted to actual value %
1.	CG					
	Subcutaneous	y = 0.0015x + 0.0011	0.163^{ns}	0.005	-0.002	5.178
	Intermuscular	y = 0.007x - 0.3405	0.582^{*}	0.018	-0.001	4.943
	Total Fat	y = 0.0085x - 0.3394	0.664^{*}	0.020	-0.003	0.368
2.	CW					
	Subcutaneous	y = 0.0018x + 0.0727	0.074^{ns}	0.002	-0.000	7.433
	Intermuscular	y = 0.0164x - 0.1303	0.518^{*}	0.017	0.000	6.958
	Total Fat	y = 0.0182x - 0.0577	0.539^{*}	0.018	0.000	2.420
3.	CD					
	Subcutaneous	y = 0.0038x + 0.0048	0.135^{ns}	0.004	-0.001	6.414
	Intermuscular	y = 0.0103x - 0.1445	0.286^{ns}	0.010	0.000	8.795
	Total Fat	y = 0.0141x - 0.1397	0.362^{ns}	0.013	-0.001	2.520
4.	CG/CD					
	Subcutaneous	y = 0.027x + 0.0287	0.076^{ns}	0.002	-0.000	7.520
	Intermuscular	y = 0.2319x - 0.496	0.510^{*}	0.016	0.000	6.719
	Total Fat	y = 0.2589x - 0.4673	0.533^{*}	0.018	0.000	2.315
5.	CW/CD					
	Subcutaneous	y = 0.0116x + 0.0922	0.017^{ns}	0.001	0.000	7.626
	Intermuscular	y = 0.3581x - 0.1042	0.410^{ns}	0.014	0.000	7.675
	Total Fat	y = 0.3698x - 0.012	0.397^{ns}	0.014	0.000	2.850
6.	CW/CG					
	Subcutaneous	y = -0.0405x + 0.1083	-0.019^{ns}	0.001	0.000	7.598
	Intermuscular	y = 0.5976x - 0.0278	0.221^{ns}	0.008	0.000	8.918
	Total Fat	y = 0.557x + 0.0805	0.193^{ns}	0.008	-0.000	3.211

CG: Chest Girth, CD: Chest Depth, CW: Chest Width

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