IDENTIFICATIONS OF CARCASS CHARACTERISTIC FOR ESTIMATING THE COMPOSITION OF BEEF CARCASS

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ABSTRACT

The research aimed to identify carcass characteristic that can be used for estimating composition of beef carcass. It was used 165 Brahman crossbred cattle in this research. Carcass characteristics were weight of a half cold carcass (WC) ranged from 96 to 151 kg, loin eye area (LEA) ranged from 22.09 to 304.8 mm^2, 12th rib fat thickness (FT12) ranged from 0.80 to 2.90 mm, meat ranged from 53.55 to 90.10 kg and carcass fat ranged from 5.54 to 39.72 kg. Result showed that a half weight cold carcass as a single indicator major may be used to predict meat weight and carcass fat with regression linear equation: Meat (kg) = 10.64 + 0.49 WC (R^2=0.728 and SE=3.58), and Fat (kg) = -21.70 + 0.36 WC** (R^2=0.582 and SE=3.65). Multiple regression to predict meat weight based on fat percentage of kidney, pelvic and heart (KPH) was Meat (kg) = 7.99 + 0.58 WC** - 4.41 KPH** (R^2=0.751 and SE=3.43).

Keywords: beef cattle, carcass characteristic, estimation.

INTRODUCTION

One of problems which high attention from people in area of meat industry is no finding in such a way for predicting carcass composition with high accuracy and without much fund. Failure for estimating carcass composition mainly on meat content in carcass can cause bias of "*under estimate*" and "*over estimate*". Under estimate can lose out cattle producer (*cattle feeder/fattener*) and advantage consumer (butcher and retailer), while over estimate has a contrast characteristic, which is disadvantage consumer and advantage producer. It should motivate situation for developing meat industry, ideally, the consumer should pay for cattle prize appropriate with meat content of the carcass.

Murphey *et al.* (1960) stated that there is a correlation between measurement of sub-cutan fat thick on the 12th rib and meat on beef carcass. This is followed by amount of research showing the correlation between fat thickness on the 10th rib or the 12th rib towards content of carcass fat (Ramsay *et al*. 1962; Brungardt and Bray 1963; Butterfield 1965; Charles 1974; Priyanto *et al*,

1997).

Researcher attention for identifying and evaluating other position of beef carcass in which measurement of carcass fat thick as well as other carcass characteristic is possible used for estimating carcass composition (Johnson dan Vidyadaran 1981; Meehan dan Taylor 1988). Their studies concluded that many position of beef carcass in which measurement of fat thick can be conducted and given accurately carcass fat prediction.

Johnson and Ball (1988), and Ball and Johnson (1989) found that there was a correlation between fat thick on the 12th rib or rump position P8 and carcass production from a few various cattle. Hopkins *et al.* (1993) reported that effect of a relationship cattle species among measurement of fat thick using the 12th rib and rump P8.

This research was carried out to determine a relationship between a variety of carcass characteristic, such as a half carcass weight, loin eye area, fat thick on the 12th rib and percentage of kidney fat, pelvic and heart in line with their combination to carcass composition, especially towards content of meat and beef carcass fat from

Australian Commercial Crossbred. Those cattle were imported from Australia and used as feeder cattle for feedlot industry in Indonesia.

MATERIALS AND METHOD

The research was conducted in PT. Celmor Perdana Indonesia which operated Slaughtering House and Laboratory of Large Ruminant, Faculty of Animal Husbandry, Bogor Agricultural University-Bogor.

It was used 165 beef carcass of *Crossbred Brahman Cattle* (CBC) with *feedlot fattening*. The used cattle have slaughtered weight 434.03 ± 40.70 kg, with average age based on permanent teeth I_1-I_4. Cattle was slaughtered with Halal and acknowledged standardized procedure.

The skin was carefully taken out, especially on position of fat thick measurement was conducted. The measurement procedure was applied following guidelines of Taylor *et al* (1992). Recording for weight of meat, bone, and fat was carried out on carcass after storage for 24 hours in *chilling room*.

Analysis of simple linear regression and double regression (Gomez dan Gomez, 1984), was applied for predicting meat component and carcass fat. The weight of a half cold carcass (WC), loin eye area (LEA), fat thickness on the 12th rib (FT12) and fat percentage of kidney, pelvic and heart (KPH) with their combination used as fixed variable. The mathematical model used is:

$$Y_{ij} = a + BX_{ij} + \varepsilon_{ij}$$

$$Y_{ij} = a + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + \varepsilon_{ij}$$

where

Y_{ij} = Weight or percentage of carcass component or commercial cutting

A_0 = Intercept

B, B_1, B_2, B_3, B_4 = Regression coefficient of variable Y_i towards X_i

X_1 = Weight a half cold carcass

X_2 = Loin eye area

X_3 = Fat thickness on the 12th rib

X_4 = Fat percentage of kidney, pelvic and heart

ε_{ij} = Error

RESULTS AND DISCUSSION

Carcass characteristic of *Crossbred Brahman Cattle* is presented in Table 1. Table 1 showed a representation of carcass characteristics (weight of a half cold carcass, loin eye area, fat thickness on the 12th rib, fat percentage of kidney, pelvic and heart, total weight of meat and total weight of carcass fat.

Determining alternative position of carcass characteristic as indicator for meat judging (*cutability yield grade*) was used WC, measurements of LEA, FT12 and percentage of KPH. The measurement of WC, width of LEA, FT12 and percentage of KPH can be shown in the Table 2 and Table 3.

Analysis of simple regression indicated that WC as single indicator (*independent variable*) was highly significant (P<0.01) related to meat weight with the accuracy level of R=72.8% and SE=3.58. Estimating fat showed highly significant with accuracy level of R=58.2% and SE 3.65.

The result indicated that weight of a half cold carcass as single indicator was dominant in predicting carcass content. It means that the more carcass weight, the more expected meat weight.

Table 1. Carcass Characteristic of Brahman Crossbred

Carcass Characteristics	Sample	Average	SD	Min	Max
Weight of a half cold carcass (kg)	165	124.78	11.8	96	151
Loin eye area (mm²)	165	262.89	24.89	22.09	304.8
Fat thickness on the 12th rib (mm)	165	1.97	0.49	0.8	2.9
Fat of Kidney, pelvic, and heart (%)	165	2.98	0.6	0.89	2.9
Meat (kg)	165	72.33	6.84	53.55	90.1
Fat (kg)	165	23.65	5.62	5.54	39.72

Table 2. Correlation between Carcass Characteristics and Meat Weight

Dependent variable	Carcass Characteristics (Independent variable)					R^2	SE
	Intercept	WC (kg)	LEA (mm^2)	FT12 (mm)	KPH (%)		
Meat (kg)	10.64	0.49**				0.73	3.58
	9.98	0.49**	0.01ns			0.73	3.59
	6.83	0.53**	0.02ns	-1.23ns		0.73	3.59
	10.73	0.51**	0.03ns	1.22ns	-2.29**	0.75	3.47
	40.78		0.30**			0.19	6.17
	45.01		0.10*	8.51**		0.48	4.96
	48.59		0.11*	11.59**	-3.44**	0.52	4.76
	53.69			9.47**		0.46	5.02
	55.72			10.85**	-2.72ns	0.47	5
	55.21				9.82**	0.22	6.07
	9.89	0.55**		0.95ns	-4.94**	0.75	3.44
	6.45	0.57**	0.03ns		-4.53**	0.75	3.44
	7.99	0.58**			-4.41**	0.75	3.43
	38.51		0.20**		7.26**	0.29	5.8
	7.92	0.53**		-1.16ns		0.73	3.57

*significant (p<0.05),   ** hightly significant (p<0.01),   ns: not significant, SE: standard error

Table 3. Correlation between Carcass Characteristics and Fat Weight

Dependent Variable	Carcass characteristics (Independent variable)					R^2	SE
	Intercept	WC (kg)	LEA (mm^2)	FT12 (mm)	KPH (%)		
Fat (kg)	-21.7	0.36**				0.58	3.65
	-21.1	0.37**	-0.01ns			0.58	3.66
	-19.08	0.34**	-0.01ns	0.79ns		0.58	3.66
	-20.61	0.35**	-0.02ns	-0.18ns	0.90ns	0.59	3.66
	2.07		0.20**			0.13	5.26
	5.6		0.04ns	7.08**		0.43	4.27
	5.48		0.04ns	6.98**	0.12ns	0.43	4.29
	8.97			7.46**		0.43	4.27
	6.48			5.76**	3.33*	0.44	4.23
	6.22				10.00**	0.34	4.6
	-20.79	0.33**		-0.13ns	2.01ns	0.59	3.64
	-19.52	0.33**	-0.02ns		2.02ns	0.59	3.64
	-20.53	0.33**			1.94ns	0.59	3.63
	-0.72		0.08*		8.94**	0.35	4.55
	-19.99	0.34**		0.73ns		0.58	3.65

* significant (P<0.05,   ** hightly significant (P<0.01),   ns: not significant, SE: standard error

The result of this research was in agreement to the report of Crouse and Dikeman (1976), Johnson and Davis (1983), and Priyanto *et al.* (1997) in which the carcass weight was indicator for predicting weight of total meat and fat. The same statement also reported by Abraham *et al.* (1968); Epley *et al.*(1970); Abraham *et al.* (1980); Miller *et al.* (1988) and Reiling *et al.* (1992).

The second alternative should be concerned as indicator was the fat thickness on the 12th rib resulting from highly significant correlation (P<0.01) with content of meat and fat (accuracy level of R=46.4% and SE=5.02 for meat, R=42.6% and SE=4.27 for fat). This research was in agreement to the research of Priyanto (1993) and Taylor *et al.* (1996) in which fat thickness on the 12th rib as an alternative indicator, excluding thick of sub-cutan fat rump P8.

An indicator is called accurate when it shows high coefficient and small error standard in predicting a dependent variable. This research created the best simple linear regression:

Meat (kg) = 10.64** + 0.49 WC**
              R=72.8% SE=3.58
Fat (kg) = -21.7** + 0.36 WC**
              R=58.2% SE=3.65

The equation of simple linear regression involving TLR12 as independent variable was:

Meat (kg) = 53.69** + 9.47 FT12**
              R=46.4% SE=5.02
Fat (kg) = 8.97** + 7.46 FT12**
              R=42.6% SE=4.27

Analysis of multiple regression showed that combination of weight of a half cold carcass with fat percentage kidney, pelvic, heart indicated highly significant correlation (P<0.01) and was able to increase accurate prediction of meat yield. The obtained accuracy was R^2=75.1% and SE=3.43. There was no significant correlation (P>0.05) for fat.

This results showed that weight of a half cold carcass and fat percentage of kidney, pelvic, and heart could be combined for predicting weight of meat. The obtained multiple regression for this combination was:

Meat (kg) = 7.99 + 0.58 WC** - 4.41 KPH**
              R^2=75.1 SE=3.43

The important thing to be concerned in using the linear regression or multiple regression was avoiding bias (*under estimated* or *over estimated*). Therefore, it is beneficial to get information of cattle with its feed background. The use of the regression model will be more accurate when applied on the Crossbred Brahman Cattle (CBC) which is come from fattening with *grain feed*. The bias in implementing the regression model on different feed background has been proven by Priyanto (1993).

CONCLUSION

The use of weight of a half cold carcass as single indicator is more possible for predicting total weight of meat and fat carcass components with better accuracy level. The regression model was:

Meat (kg) = 10.64 + 0.49 WC**
Fat (kg) = -21.7 + 0.36 WC**

Analysis of multiple regression of combination among weight of a half cold carcass with fat percentage of kidney, pelvic, and heart caused the better accuracy as showed by equation:

Meat (kg) = 7.99 + 0.58 WC** - 4.41 KPH**

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