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A Hedonic Model of Lamb Carcass Attributes.

Terence C. Farrell and David L. Hopkins

Abstract

Lamb carcass value is widely reported to be a function of lean meat yield, which is the relationship between muscle, fat and bone. Five retailers and five wholesalers assessed 47 lamb carcasses from diverse genotypes and scored seven attributes. A hedonic model reveals that conformation attributes were more highly valued (16 c/kg) relative to yield characteristics (4 c/kg). Meat colour and fat distribution were significant for retailers, but less important for wholesalers. Genotype was not a strong indicator of conformation. Eye muscle area and depth were correlated with Fat C; however, these were not significant. These results indicate that carcass conformation, meat colour and fat distribution should be incorporated into carcass grading models.

Key Words

Hedonic, lamb, attributes, conformation and meat value.

Contact information

Dr Terence Farrell
11 Cynthia Crescent
Armidale, NSW, 2350 Australia
Phone: 02 6771 2093
Email: farrelltc@bigpond.com

Dr David Hopkins
NSW DPI Centre for Sheep Meat Development
PO Box 129, Cowra, NSW, 2794 Australia
Phone: 02 63 49 9722
Email: david.hopkins@dpi.nsw.gov.au

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Introduction

Differences in quality perceptions exist between buyers and sellers of meat products. The purpose of this research was to determine the relative importance of attributes of lamb carcasses to wholesalers and retailers with the view to constructing a carcass-grading scheme that would be acceptable to both market sectors.

Carcass weight and fat are the two leading predictors of lean meat yield (Hopkins, 1994). Lean meat yield has been reported to be positively related to profitability (Hopkins, Hayhurst and Horcicka, 1992). Many research programs have focused their efforts on achieving higher levels of lean meat yield including work on animal growth rates, double muscling, fat reduction and fat translocation.

Sporleder (1972) analysed consumer attitudes toward lamb cuts and found that “appearance before cooking” was the most important characteristic. Alternatively he found that the least important characteristic was “lean versus fat”. Approximately eight per cent of the consumers in Sporleder’s study claimed that they did not repeat their purchase due to the fat content of the meat. This provides some evidence that muscle or cut shape may be more important relative to fat in determining retail value.

Mullen and Wohlgenant (1991) analysed consumer preferences for lamb loin chops derived from carcasses that were 17 and 23 kilograms carcass weight with fat scores of 5 to 12 mm. Their contingent valuation approach revealed that consumers were not prepared to pay more for a loin chop with a larger eye muscle area relative to a standard loin chop from a 17-kilogram carcass.

The former Meat Research Corporation (now Meat and Livestock Australia) aimed to minimise the perception of lamb as being a fatty product. Its approach was to develop the Large Lean Lamb program. The Large Lean Lamb program had aimed to produce carcasses that were 22 kilograms in carcass weight and which had between 6-15 mm of fat at the GR site (tissue and fat depth at 110 mm from the back line over the 12th rib). Cryptorchid lambs were promoted to the domestic retail industry to achieve higher carcass weights while producing leaner carcasses. The promotion of these carcasses met some resistance from supply chain participants and it was important to identify the basis of the difference between retailer and wholesaler perceptions of the various lamb attributes. It was assumed that some of the resistance was due to the lack of suitability of Large Lean Lamb for traditional retail cuts, which would support the results of Mullen and Wohlgenant’s (1991). Trim Lamb (Lamb muscles that were denuded of subcutaneous fat and bone) was introduced to the retail market and its advantage was that it was lean and muscles from larger animals could be cut into suitable portion sizes for smaller families. Once muscles were removed from the bone for Trim Lamb their appearance changed and it was difficult to pick the difference between muscles from an animal with good conformation versus an animal with poor conformation when the carcasses had the same body weight. It was expected that the focus on boneless cuts would decrease the emphasis on conformation as a highly valued lamb carcass trait.

Good conformation was typically associated with sheep breeds such as Dorset or Suffolk or second cross lambs that were produced from Border Leicester and Merino cross ewes with a Dorset or Suffolk ram. These animals were considered meat sheep

whereas Merinos or first cross sheep were favoured for their wool (O'Halloran, 1991). The meat sheep breeds attracted higher saleyard prices relative to wool breeds. The meat breeds grew faster and were often younger (6-10 months versus 10-14 months) when slaughtered which also influenced meat and fat colour. A problem with the meat sheep breeds was that they matured early and therefore produced higher levels of fat when grown to higher weights (above 22 kilogram carcass weight). Producers quickly recognised this problem and responded by joining meat breed rams directly to Merino ewes, which enabled the lamb to grow larger without producing as much fat. Meat processors and wholesalers increased their prices for the new first cross lambs; however, prices did not rise to the same market value as second cross lambs.

A large study was initiated to investigate the production and processing differences between various breeds of lambs to determine which breeds would be more suitable to produce larger leaner carcasses and to investigate their meat quality under the same environmental conditions (Fogarty, Hopkins and van de Ven, 2000). The following data are the output from that study.

Methods

Five independent meat retailers were invited to assess carcasses and other lamb attributes due to their experience with boneless lamb products. Five lamb wholesalers, four from Sydney and one from Canberra, also participated and these wholesalers supplied approximately one third of Sydney's independent butcher shops (Hopkins, 1995a). The retail group sold a range of product that was considered higher value and its stores were located in suburbs with a greater proportion of high-income families.

Carcass Description

The carcasses were a mix of 16 ewes and 31 cryptorchids from six genotypes. The aim was to value a diversity of lambs with differing weights and fat scores, conformations and fat distributions. The retailers and wholesalers were asked to score the lambs for fat distribution, fat level, meat colour, conformation of the hind legs, loin and forequarter, and overall conformation. The scoring range was 1 to 5 with 1 equal to very good, 2 good, 3 acceptable, 4 poor and 5 very poor (Hopkins, 1995a). The retailers were asked to value the carcass in cents per kilogram at their buying price and wholesalers were asked to value the carcasses at their selling price. Both groups also assessed conformation using the EUROP system (de Boer, 1992) where E was excellent conformation, U good, R average, O poor, and P was very poor conformation.

Additional carcass information was collected including yield (defined by Hopkins and Fogarty, 1998), weight, GR (tissue depth over 12th rib 110 mm from back line), Fat C (tissue depth over 12th rib 50 mm from back line), eye muscle depth (height of longissimus dorsi at 12th rib), width (width of longissimus dorsi at 12th rib) and area (cross section measure of longissimus dorsi at 12th rib), genotype, muscle weight (trimmed weight of primals in grams), fat weight (weight in grams of the fat trimmed from primals) and bone to muscle ratio. The variables Fat C, genotype, and bone to muscle ratio were dropped from further analysis due to their lack of correlation with the nominated values or other variables. The fact that genotype was not correlated

with other variables was surprising given the market premiums that were available for second cross animals. Eye muscle length, depth and area were highly correlated with each other but they did not correlate highly with the remaining variables and were removed from further analysis. The EUROP score was also poorly correlated with the remaining variables and it was also excluded.

Variable Correlations

The correlation matrix for the variables analysed in the model is shown in Appendix 1. A correlation of 0.6 was set as the cut-off level and each of the attributes has at least one correlation of 0.6 or above. The correlation between fat level and distribution was 0.76, which indicates that these two variables were similar. Fat distribution was also correlated with conformation of the loin (0.72) and forequarter (0.66), which indicated that these were the regions that the assessors used to examine fat distribution. It was interesting that the conformation of the hind was not used to the same extent as the forequarter. Meat colour was primarily assessed from the hind (0.61) and this may be due to the absence of subcutaneous fat. The correlation between carcass weight and fat score was 0.60, which indicated that as weight increased so did the fat score. As expected the carcass weight and muscle weight were highly correlated (0.88). GR was not highly correlated with fat level, fat distribution or expected yield and it was surprising that this information was not used more in the assessment process. The correlation between GR and fat weight was 0.59, which indicates that GR was not a fully robust indicator of total fat. Considering that the GR is a measure of tissue depth, which includes both fat and muscle, then an alternate site might need to be identified to improve predictability. Nonetheless GR (0.59) was superior to Fat C (0.29) as a predictor of overall fat weight.

The nominated carcass values provided by the wholesalers and retailers were adjusted to prices for Thursday 18th January 2007 to analyse current attribute value (NLRS 2007).

The means and standard deviations for the variables that were used in the analysis are shown in Table 1.

Table 1 Means and standard deviations for the retained variables

Description	Variable	Mean	Std. Dev.
Fat Distribution	FD	2.64	1.07
Fat Level	FL	2.81	1.12
Meat Colour	MC	2.61	0.93
Conformation Hind	CH	2.53	1.11
Conformation Loin	CL	2.74	1.10
Conformation Forequarter	CF	2.71	1.02
Predicted Yield	Y	2.90	1.08
Carcass Weight ^a	CWT	25.40	2.75
Fat Score ^b	GR	14.04	2.73
Muscle Weight ^c	MWT	2626.58	291.50
Fat Weight ^d	FWT	735.48	128.25

a measured in kilograms for hot standard carcass weight;

b fat depth in mm over the 12th rib;

c yield of trimmed, boneless primals in grams

d fat weight from trimmed primals in grams

Model

Multicollinearity arises between variables when they exhibit high degrees of correlation. This is a common problem in data sets that include biological variables, such as muscle, bone and fat percentages that accumulate in predictable proportions. When a model is estimated with correlated variables, the result is that predictors of the explanatory variables become inefficient; however, they remain unbiased in large samples (Mittlehammer, 1996). One method to minimise this problem is to use factor analysis in which highly correlated variables are transformed into new variables called factors. The use of factor analysis is appropriate for this research due to the relatively small sample size. A factor analysis relies on an orthogonal transformation of the correlated variables so that composites of new variables are formed. The resulting factors have zero means and a standard deviation of one but, more importantly, the correlation between the new variables (factors) approaches zero. The factors can then be used in regression equations as explanatory variables, which improves modelling efficiency.

Eigen Values

Eigen values show the proportion of total variation that is explained by each factor. These are shown in Table 2. The first three factors account for approximately 80 per cent of the total variation. The last 8 factors account for the remaining 19.52 per cent of the variation. A Likelihood Ratio Test (Chi-Square, 55df, 5136) rejects the null hypothesis of no common factors with a probability of >0.0001 . This result enables us to conclude that more than one factor is appropriate for this data set. Both Akaike's Information Criterion (Akaike, 1981) and Schwarz's Bayesian Criterion (Schwarz, 1978) were minimised at 7.415 and 39.228 respectively at the five-factor level, which indicates that the upper number of factors was five. When five factors were used the last two factors were trivial. Hence, the N-Factor criterion (SAS, 2006) was used to select three factors to include in the subsequent hedonic regression.

Table 2 Eigen values

Factors	Eigenvalue	Difference	Proportion	Cumulative
1	5.309131	2.465759	0.4826	0.4826
2	2.843373	2.142814	0.2585	0.7411
3	0.700558	0.175473	0.0637	0.8048
4	0.525085	0.091888	0.0477	0.8526
5	0.433198	0.035521	0.0394	0.8919
6	0.397677	0.157912	0.0362	0.9281
7	0.239765	0.028288	0.0218	0.9499
8	0.211477	0.052885	0.0192	0.9691
9	0.158593	0.009026	0.0144	0.9835
10	0.149567	0.117991	0.0136	0.9971
11	0.031576		0.0029	1.0000

Factor Scores

The variable scores for the first three factors are shown in Table 3. From that table the variables for fat distribution (FD), fat level (FL), meat colour (MC), conformation of the hind (CH), loin (CL), and forequarter (CF), plus the predicted yield score, each load highly on factor 1. The main contributors to factor 2 are fat score (GR) and fat weight (FWT). The third factor is dominated by carcass weight (CWT) and muscle weight (MWT). From these results we form the opinion that fat distribution and level, conformation, and meat colour represent one discreet dimension and collectively these may be termed appearance variables. GR fat score and fat weight have loaded on the second factor and these are important fat content predictors. Similarly carcass weight and muscle weight are lean meat content predictors that determine retail yield.

Table 3 Factor scores by variable

Variable	Description	Factor 1	Factor 2	Factor 3
FD	Fat Distribution	0.8798	0.0535	0.0234
FL	Fat Level	0.8395	0.1948	-0.0287
MC	Meat Colour	0.7971	-0.0048	-0.0554
CH	Conformation Hind	0.8495	-0.0535	-0.0155
CL	Conformation Loin	0.9197	0.0007	0.0384
CF	Conformation Forequarter	0.8918	0.0236	0.0550
Y	Predicted Yield	0.8936	0.0147	0.0128
CWT	Carcass Weight	0.0337	0.5737	0.7944
GR	GR Fat Score	0.0356	0.8152	0.2694
MWT	Muscle Weight	-0.0210	0.2436	0.9615
FWT	Fat Weight	0.0414	0.8960	0.1871

Hedonic Model

Hedonic models are used to estimate values for attributes of products. Waugh (1928) first applied the model to value attributes of vegetables. Other researchers such as Rosen (1974) and Ladd and Suvannunt (1976) further refined the technique. The hedonic function is similar to the utility function where its first derivative provides the demand function and as such the general form of the function should in theory be non-linear. Non-linear hedonic models have been used to estimate carcass characteristics for beef in Japan (Lin and Mori 1991; Wahl, Shi and Mittlehammer, 1995). McConnell and Strand (2000) recently applied a linear hedonic model to value attributes of tuna fish. Farrell, McCluskey, Busboom and Wahl (2005) used factor analysis in conjunction with a log-linear hedonic model to estimate sensory attributes for retail beef cuts. In general the form of the hedonic equation is as follows,

$$P = f(Z_i) + e_i \quad (1)$$

where the price P is a vector of unit prices and Z_i is a matrix of i uncorrelated attribute variables and e_i are the standard error terms.

The model used by Farrell *et al* (2005) modifies the typical model by adding factor scores to the equation,

$$\text{Log Price} = f(F_i, Z_i) + e_i \quad (2)$$

where F_i is a matrix of independent factor scores, Z_i are other independent variables and e_i are the error terms.

The model used for this analysis has the following form,

$$\text{Log Price} = a + b_1F1 + b_2F2 + b_3F3 + e_i \quad (3)$$

where the cents per kilogram price nominated by the retailer or wholesaler is equal to the sum of the three factor vectors (F1, F2, F3) derived above and their coefficients b_i , plus the intercept a and the error terms e_i . The results of this regression are shown in Table 4.

Table 4 Regression results for the hedonic equation

Variable	DF	Parameter Estimate	Standard Error	t-value	Pr > t
Intercept	1	5.75714	0.00503	1143.64	<.0001
Factor 1	1	-0.05134	0.00588	-8.73	<.0001
Factor 2	1	-0.00637	0.00503	-1.27	0.2055
Factor 3	1	-0.01252	0.005	-2.51	0.0125

The signs on the parameter estimates were expected to be negative for factors 1 and 2 and indeterminate for factor 3. That is, for factor 1 we would expect prices to increase when the fat distribution, conformation and meat colour scores decrease (1=very good, 5= very poor). Similarly the price should increase as the amount of fat decreases. The issue with lean muscle weight (factor 3) was that we expected prices to rise with carcass weight to some level slightly above twenty kilograms; however, we expected price to fall at some higher weight level. The average carcass weight for these animals was 26 kilograms and this produced an overall negative price response.

The F-value for this regression was 28.33 with a <0.0001 probability of being greater than the F-value. Similarly the t-values were significant for factor 1 and factor 3 at the 98 per cent level. The t-value for factor 2 was not significant at the 90 per cent level.

Price Elasticities

Price elasticities were calculated from the coefficients for each factor in the hedonic equation. They show the change in price that would result from a one per cent change in the variable of interest (often referred to as price flexibilities). The elasticity equation for a log-liner function where the variables had a zero mean was,

$$\eta_{p_i} = (\text{Exponential } b_i) - 1 \quad (4)$$

The price elasticities for the three factors are shown in Table 5.

Table 5 Price elasticities for the three factors

Factor	Elasticity	Hedonic Value c/kg
Factor 1	-0.05004	-16.0142
Factor 2	-0.00635	-2.03192
Factor 3	-0.01244	-3.98142

The results in Table 5 reveal that visual attributes (factor 1) are four times more important than yield attributes (factor 3). The hedonic value for factor 1 indicates that a one per cent decrease in the conformation score, fat distribution score or colour score would result in an additional sixteen cents per kilogram. Similarly a one per cent decrease in carcass weight from the mean of 26 kilograms would result in a four-cent per kilogram rise in carcass value as shown by the hedonic value for factor 3. The hedonic value on factor 2 indicates that a one per cent reduction in the amount of GR fat and fat weight would increase price by two cents per kilogram.

Difference between Retailers and Wholesalers

An F-test of equal means for scores provided by retailers and wholesalers shows that their respective scores were significantly different. The data from individuals were separated into groups of retailers or wholesalers. The hedonic model results for both groups are shown in Table 6. The parameter estimates for factor 1 for each group were significant at the 99 per cent level. The t-value for factors 2 and 3 for the retailers were significant at the 95 and 99 per cent levels respectively. Alternatively the t-values for factors 2 and 3 for the wholesaler group were not significant at the 90 per cent level. The model is a better fit for the retailer group relative to the wholesaler group as reflected by the model F-values. The important difference is that the retailers place more emphases on the yield characteristics relative to wholesalers who primarily focus on appearance characteristics.

Table 6 Hedonic equation results by retail and whole groups

Retailers		Parameter Standard					
Variable	DF	Estimate	Error	t-value	Pr > t	F-value	Pr >F
Intercept	1	5.78858	0.00482	1200.31	<.0001	69.44	<0.0001
Factor 1	1	-0.07854	0.00574	-13.69	<.0001		
Factor 2	1	-0.00948	0.0048	-1.98	0.0493		
Factor 3	1	-0.01688	0.00479	-3.53	0.0005		
Wholesalers		Parameter Standard					
Variable	DF	Estimate	Error	t-value	Pr > t	F-value	Pr >F
Intercept	1	5.73083	0.00764	750.42	<.0001	5.95	0.0006
Factor 1	1	-0.03531	0.00885	-3.99	<.0001		
Factor 2	1	-0.00858	0.00765	-1.12	0.2632		
Factor 3	1	-0.00435	0.0076	-0.57	0.5677		

Table 7 shows the hedonic valuations for both the retailer and wholesaler groups for each of the three factors. The largest difference is in the appearance variables where retailers would pay 14.3 cents per kilogram more than wholesalers for a one per cent improvement in fat distribution, conformation and meat colour. The difference for factor 2 was only half a cent per kilogram; however, this factor was not significant for the wholesaler group. The hedonic value for factor 3 for the retailer group indicates

that they would pay up to 5.5 cents per kilogram for lighter carcasses. The t-value was not significant for the wholesaler group for factor 3.

Table 7 Difference in price elasticity and hedonic values by group

	Price	Hedonic		Price	Hedonic	
Retailers	Elasticity	Value	Wholesalers	Elasticity	Value	Difference in Value
Factor 1	-0.0755	-24.9265	Factor 1	-0.0347	-10.5469	14.3796
Factor 2	-0.0094	-3.1136	Factor 2	-0.0085	-2.5972	0.5165
Factor 3	-0.0167	-5.5236	Factor 3	-0.0043	-1.3195	4.2041

The average price nominated by the retailers over the 47 lamb carcasses was 333 cents per kilogram relative to 304 cents per kilogram for wholesalers. This difference could reflect the margin accounting for transport and wholesaler services. However wholesalers were charging approximately 10-12 cents per kilogram rather than 29 cents. Another potential source of difference may be that the retailers were primarily butchers renowned for their higher quality product whereas the wholesalers had a more diversified clientele. Hence when each group considered their prices they may have been thinking of their own average client rather than an industry average client.

The important conclusion to be drawn from this research is that retailers place up to four times as much emphasis on appearance attributes relative to wholesalers and retailers value fat and lean ratios more highly than wholesalers.

Wahl, Shi and Mittelhammer (1995) found that aggregate yield and quality grade indices were statistically insignificant in a hedonic price equation for Japanese Wagyu beef carcasses that were auctioned in Japan. They did not examine conformation as an explanatory variable; however, it appears that yield was not as important to wholesalers as it was to retailers.

The EUROP grading system did not correlate highly with other grading type variables nor any of those analysed in this research. This may have been due to the inexperience of the participants in using the EUROP system as it has not been used commercially in Australia.

Drennan, Keane and Nolan (2006) report a correlation of 0.82 between mechanical conformation scores and carcass value, and a correlation of 0.79 between visual conformation scores and carcass value (data were obtained on a 15 point EUROP scoring system for carcasses from 134 two year old steers). Their results support the above conclusion that conformation is an important determinant of carcass value and it should be included in a carcass grading system.

Meat purchasing behaviour governs the messages that are transmitted to retailers regarding meat products offered for sale. Erickson, Wahl, Jussaume and Shi (1998) report findings by Menkhaus *et al* (1993) which list cholesterol, calorie content, artificial ingredients, convenience, store display, and cost as variables that have an impact on consumer perception of meat quality. It is important to put issues of muscle shape and therefore carcass conformation into perspective against these other attributes or services to identify the value of muscle shape to consumers to ensure that retailers are interpreting the signals of their consumers correctly (Thonney, Perry, Armbruster, Beermann and Fox, 1991).

The meat industry has achieved Freebairn's (1973) goal where retailers can phone a wholesaler to order carcasses by quality grade. However there is still some difference between retailers and wholesalers in terms of their valuation of conformation and a wide gap between their perceptions of the value and cost of fat. This study indicates that development of a standard conformation scoring system should be the first priority when developing an automated grading scheme for carcasses.

Further Research

Further research on conformation values needs to be conducted to determine the average value at the wholesale and retail levels. This should include research with supermarkets and food service establishments. If conformation is as important to retailers as this research suggests then it is vital to assess which aspects of conformation are important to consumers. This would require research on the acceptability of muscles with different shapes and sizes. The research would need to be conducted on traditional products as well as boneless products.

The results presented in this paper apply to Australian domestic retailers. No research has been identified that attempts to quantify the value of conformation for lamb exporters.

In the event that conformation is confirmed to be an important descriptor of lamb then a study would need to be conducted to identify a mechanism other than geno type, eye muscle area, or Fat C to assess live animals for the attribute prior to slaughter. Saleyard operators may need to fund that research on behalf of their selling agents, as there are several devices to score carcasses for this trait for over-the-hook trading.

The correlation between lean meat yield and GR needs to be researched further. Hopkins (1994) produced regressions between carcass weight, GR and loin depth for Poll Dorset, Suffolk and Wiltshire Horn lambs with corresponding mean weights of 16.2, 14.7 and 15.7 kilograms with 11.1, 9.6, 11.9 mm respectively at the GR site. These regressions produced R-Squares of between 0.84 – 0.92. This result indicates that for low carcass weights GR and loin depth are good indicators of lean meat yield. The data reported in this study produced poor correlations (0.59) between GR and fat weight when the carcass weights increased to a mean of 26 kilograms.

Conclusion

This research supports earlier conclusions by Hopkins (1995a) who has shown that lamb conformation was an important attribute for retailers and wholesalers. Retailers in this study valued a one per cent improvement in conformation at 25 cents per kilogram (c/kg) whereas wholesalers valued it at 10.5 c/kg. The difference of 15 c/kg may be explained in part by the quality demanded by the members of the retail group who served higher quality markets relative to the average clients served by the wholesaler group. Nonetheless there was a significant gap between the two groups and the conformation trait was four times the price level of the next most important trait, which was lean meat yield.

Carcass weight and lean muscle weight were important to retailers who valued the trait at 5.5 c/kg relative to the wholesalers who nominated 1.3 c/kg for a one unit

change in value. The least significant trait was the combination of GR and fat weight where retailers valued this trait at 3.1 c/kg, versus 2.6 c/kg for wholesalers, for a one per cent change in the fat levels. The trait was not significant for the wholesaler group, as they did not link it back to carcass values.

The value of muscle and cut shape need to be validated at the consumer-retailer interface to ensure that retailers are correctly interpreting consumer signals that they prefer cuts derived from animals with better conformation. That research would need to be undertaken with an average group of retailers and supermarket companies using both traditional cuts and boneless cuts to confirm the values estimated above.

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Appendix 1. Correlation matrix for input variables.

Description		FD	FL	MC	CH	CL	CF	Y	CWT	GR	MWT	FWT
Fat Distribution	FD	1	0.7671	0.48225	0.56395	0.72333	0.66821	0.67988	0.09212	0.09581	0.03672	0.09778
Fat Level	FL	0.7671	1	0.51403	0.45404	0.6571	0.61592	0.68048	0.14098	0.16849	0.03655	0.19869
Meat Colour	MC	0.48225	0.51403	1	0.61343	0.56701	0.48951	0.53828	0.01312	-0.00418	-0.05891	0.07026
Conformation Hind	CH	0.56395	0.45404	0.61343	1	0.71048	0.65791	0.64436	0.00168	0.01241	-0.05864	0.03361
Conformation Loin	CL	0.72333	0.6571	0.56701	0.71048	1	0.78544	0.75218	0.06963	0.07343	0.01716	0.0736
Conformation Forequarter	CF	0.66821	0.61592	0.48951	0.65791	0.78544	1	0.72695	0.10741	0.07742	0.03447	0.11951
Predicted Yield	Y	0.67988	0.68048	0.53828	0.64436	0.75218	0.72695	1	0.05601	0.04748	0.00533	0.09031
Carcass Weight	CWT	0.09212	0.14098	0.01312	0.00168	0.06963	0.10741	0.05601	1	0.60782	0.88294	0.70566
Fat Score	GR	0.09581	0.16849	-0.00418	0.01241	0.07343	0.07742	0.04748	0.60782	1	0.47035	0.59221
Muscle Weight	MWT	0.03672	0.03655	-0.05891	-0.05864	0.01716	0.03447	0.00533	0.88294	0.47035	1	0.37441
Fat Weight	FWT	0.09778	0.19869	0.07026	0.03361	0.0736	0.11951	0.09031	0.70566	0.59221	0.37441	1