CHARACTERISATION OF CARCASSES OF BRAHMAN, BRAFORD AND AFRICANDER F_1 STEERS IN DIFFERENT ENVIRONMENTS

A. Rehman[1,4], H. Hearnshaw [2], B.J. Crook[1], P.F. Arthur [3] and M. Ahmad[4]

[1]Department of Animal Science, UNE, Armidale, NSW 2351, Australia
[2]NSW Agriculture, Research Station, Grafton, NSW 2460, Australia
[3]NSW Agriculture, Research Centre, Trangie, NSW 2823, Australia
[4]Presently at Livestock Production Research Institute, Bahadurnagar, Okara, Pakistan

INTRODUCTION

Meat quality is an important issue in beef production from consumer and processing perspectives. Significant differences in most carcass attributes between genotypes and locations were demonstrated by Rehman *et al.* (1998). It is important to consider the carcass traits in a wholistic context to identify the most important variables affecting carcass quality. This paper characterises the carcasses of Brahman x Hereford (BH), Braford x Hereford (BfH) and Africander x Hereford (AfH) steers in different environments (locations) using multivariate (stepwise and canonical discriminant) analysis.

MATERIALS AND METHODS

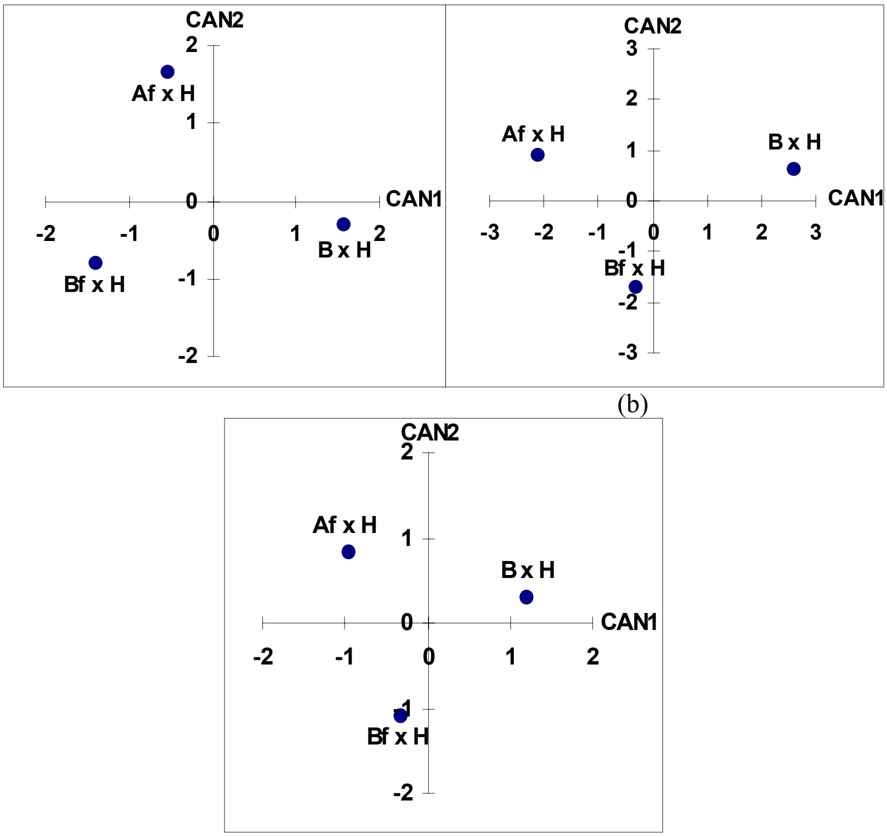
Steers used in this study were born out of Hereford cows from Brahman, Africander and Braford sires from 1977 to 1979 and were reared near Ballina (east coast subtropical, NSW, Australia) until weaning. Steers weaned in 1979 were grazed on improved, grass-clover pastures near Mallanganee ; steers weaned in 1980 were grown on temperate pastures near Nevertire and steers weaned in 1981 were grazed on unimproved, low quality, subtropical pastures near Grafton. Details on slaughtering procedure and carcass measurements have been provided by Rehman *et al.* (1998).

Statistical Analysis. A stepwise discriminant analysis was conducted to identify the variables with a major contribution to the discriminant function using carcass data on 185 steers of BH, BfH and AfH genotypes. Traits comprised hot carcass weight, eye muscle area and nine fat measures. The canonical variates (discriminant functions) obtained through the canonical discriminant procedure in SAS (1992) were used as discriminant coordinates to provide a graphical representation of the separation between the genotype means (centroids). Two discriminant functions (canonical variates) were extracted. Loadings, which are the correlations between variables (predictors) and canonical variates or discriminant functions, were used to interpret the functions.

RESULTS AND DISCUSSION

The results are described below. The locations were Grafton, Mallanganee and Nevertire.

Grafton. The important variables identified through the stepwise discriminant procedure were hot carcass weight, eye muscle area, fat depth at sirloin, 12/13th ribs, 8/9th ribs and 5/6th ribs site (1). Two significant canonical variates (discriminant functions) were obtained accounting for 65.0% and 35.0% variation, respectively. The genotype means for the two corresponding discriminant coordinates (variates) showed that the first coordinate (CAN1) gave greatest separation between BH and BfH steers, with BfH having lower CAN1 compared to BH. The second coordinate (CAN2) gave greatest separation of AfH from the other two genotypes (Figure 1a). Loadings, as given in Table 1 indicated that CAN1 separated BH from BfH on the basis of higher hot carcass weight, larger eye muscle area and higher fat. On the other hand, larger eye muscle area contributed most to CAN2, separating AfH from BH and BfH. Thus, the first canonical variate reflected size, whereas the second canonical variate reflected eye muscle area given size.



(a) (b) (c)

Figure 1. Canonical discriminant variate (CAN1 and CAN2) showing the means for the three genotypes at Grafton (a), Mallanganee (b) and Nevertire (c)

Mallanganee. The stepwise discriminant procedure identified hot carcass weight, eye muscle area, fat at sirloin, round, 8/9th ribs, silverside, rump and topside as significant predictors. Two canonical variates were obtained describing 74.2% and 25.8% variation, respectively. As shown in Figure 1b, the first canonical variate gave maximal separation of AfH steers from BH steers, with BH having higher CAN1. The second canonical variate separated BfH from the other two genotypes. Loadings are presented in Table 1. These show the best predictors distinguishing AfH from BH steers to be higher hot carcass weight and higher fat of the BH genotype, whereas, the smaller eye muscle area of BfH (with some contribution from lower hot carcass weight) distinguished BfH from other two genotypes.

Nevertire. Hot carcass weight, eye muscle area, fat at round, sirloin, silverside and 5/6th ribs (site 2) were identified as significant predictors. Two significant canonical variates accounted for 55.5% and 44.5% variation, respectively. The first coordinate provided greatest separation between AfH and BH steers, while the second coordinate separated BfH from the other two genotypes, but more so from AfH (Figure 1c). On the basis of loadings (Table 1), high hot carcass weight and high fat along with some contribution from eye muscle area discriminated BH from AfH steers. The balance of eye muscle area and fat at round distinguished BfH genotype from the other two. On the basis of discriminant functions, BH steers were characterised by high hot carcass weight, large eye muscle area and high fat ; AfH steers were characterised by relatively lower hot carcass, fat and eye muscle area ; and BfH steers were characterised by small eye muscle area, low hot carcass weight and high fat at this location.

Table 1. Loadings of individual carcass traits within canonical variates for genotypes at Grafton, Mallanganee and Nevertire

Variables	Grafton		Mallanganee		Nevertire	
	CAN1	CAN2	CAN1	CAN2	CAN1	CAN2
Hot carcass weight	0.707	-0.102	0.544	0.421	0.798	-0.034
Eye muscle area	0.528	0.421	-0.036	0.726	0.489	0.451
Fat at sirloin	0.554	0.206	0.379	0.350	0.320	0.336
Fat at 12/13th ribs	0.526	-0.001	-	-	-	-
Fat at 8/9th ribs	0.107	0.294	-0.074	0.333	-	-
Fat at 5/6th ribs site (1)	0.159	0.209	-	-	-	-
Fat at round	-	-	0.291	-0.098	0.328	-0.442
Fat at silverside	-	-	0.515	0.078	0.526	0.005
Fat at topside	-	-	0.132	-0.029	-	-
Fat at rump	-	-	0.399	0.097	-	-
Fat at 5/6th ribs site (2)	-	-	-	-	0.337	-0.263

Multivariate analyses of covariance are highly effective for determining the appropriate statistical models, providing joint assessments of effects. Johnston *et al.* (1992) used canonical variate analysis to identify the fat depth sites contributing most to difference between the straightbred Hereford and Devon cattle. Multivariate analyses were used by Perry *et al.* (1998) to discriminate between Brahman sired and *Bos taurus* sired steers on the basis of fatty acids.

Two canonical variates were obtained. The first separated the Brahman- from the *Bos taurus*-sired steers while the second separated the purebred Herefords from the three crossbreds (Brahman x Hereford, Friesian x Hereford and Simmental x Hereford).

In the present study, the first canonical variate generally constituted a measure of size while second canonical variate was a function of eye muscle area and fat distribution among the depots. At Mallanganee and Nevertire, the first canonical variate distinguished AfH from BH and the second canonical variate separated BfH from the other 2 genotypes. At Grafton, however, the first canonical variate separated BH from BfH and the second canonical variate separated AfH from the other two genotypes. It is interesting to note that at Mallanganee and Grafton, BfH steers were characterised by relatively low hot carcass weight, small eye muscle area and low fat depth, while at Nevertire were characterised similarly for the first two traits but with higher fat depth. The high fat of BfH steers at Nevertire reflected the better quality of nutrition compared to the other two locations. AfH steers were characterised by relatively low hot carcass weight, large eye muscle area and low fat depth at Grafton and Mallanganee, whereas at Nevertire were characterised similarly for hot carcass weight but with smaller eye muscle area and relatively lower fat depth. In contrast, BH steers were characterised by relatively higher hot carcass weight, eye muscle area and fat depth at all the three locations. These results show that carcass characteristics of the three genotypes were dependent on the environment.

CONCLUSION

Overall, discriminant analysis revealed that genotype differences in carcass size, and relative balance of fat depots and eye muscle area were dependent on the environment. The environment influenced the degree to which the three genotypes could be adequately distinguished on the basis of carcass components.

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