

Frequencies of the Transferrin Alleles and Genotypes in Crossbred Cattle and their Effect on Growth Traits

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RINGKASAN

Catitan mengenai berat lahir, kenaikan berat badan dan ukuran badan diperolehi dari sejumlah 149 lembu kacukan (Zebu × Temperate) di Institut Haiwan, Kluang. Dari sampel darah yang diperolehi dari haiwan tersebut, 145 daripadanya telah dianalisa untuk menguji kehadiran genotaip serum transferrin.

Kekerapan gen Tf^D didapati paling tinggi di kalangan kacukan yang mengandungi $\frac{1}{2}$ dan $\frac{1}{4}$ Zebu. Kekerapan gen Tf^A adalah rendah di kalangan kacukan $\frac{1}{2}$ Zebu manakala gen Tf^E paling tinggi di kalangan kacukan $\frac{1}{4}$ Zebu.

Pada amnya tidak terdapat perbezaan yang significant ($P < 0.05$) mengenai kesan genotaip transferrin yang berlainan (Tf^{AA} , Tf^{AD} , Tf^{AE} , Tf^{DD} dan Tf^{DE}) ke atas berat badan atau bentuk badan.

SUMMARY

Records on birth weight, body weight and body measurement traits were obtained from a total of 149 crossbred animals (Zebu × Temperate) from the Institut Haiwan, Kluang. From the blood samples collected from these animals, 145 of them were analysed for the presence of serum transferrin genotypes.

Frequency of the Tf^D gene was found to be highest in both the half bred and quarter-bred Zebus. Frequency of Tf^A and Tf^E was found to be lower and higher respectively in half-bred Zebus and the quarter-bred Zebus.

In general, there were no significant variations ($P < 0.05$) between the effects of different transferrin genotypes observed (Tf^{AA} , Tf^{AD} , Tf^{AE} , Tf^{DD} and Tf^{DE}) on any of the body weight or body conformation trait.

INTRODUCTION

Bovine transferrin or siderophilin is a beta-globulin which has the vital function of transporting iron from the plasma to receptor cells of the bone marrow and tissue storage compartments. Giblett *et al.* (1959) determined the specific function of beta-globulin in man and cattle by the use of radioactive Fe 59, which was found to combine with Fe 59 in serum samples. This complex serum glycoprotein has a molecular weight of 80,000 to 90,000. Starch gel electrophoresis technique originally introduced by Smithies (1955) and modified by Poulik (1957) facilitated the determination of the mode of inheritance of beta-globulin.

Genetic polymorphism of Transferrin locus have been reported in various breeds of cattle sampled either from the same area or from different areas. Present knowledge will reveal that the Transferrin locus has at least 7 alleles (Tf^A , Tf^B , Tf^D , Tf^E , Tf^F , Tf^{P^y} and Tf^G). Ashton (1958) reported that the frequency of Tf was much higher in *Bos indicus* than in *Bos taurus* cattle. He also reported that Tf^B and Tf^F were present only in *Bos indicus* although Gahne (1961) reported the presence of Tf^F in Swedish cattle. Presence of Tf^G and Tf^{P^y} in African, Finnish and Hungarian cattle were reported (Ashton and Lumpkin, 1965; Vasenius, 1971).

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The present paper describes the frequencies of different alleles and genotypes of Tf locus in crossbred cattle of the Institut Haiwan, Kluang. Effects of genotypes of the growth traits have also been briefly discussed.

MATERIALS AND METHODS

A total of 149 male and female temperate-LID crossbred calves kept at the Institut Haiwan, Kluang, were involved in this study.

The crossbred calves were obtained from LID cows which were inseminated with semen from temperate bulls of Australia and U.S.A. The bulls belonged to one of the following breeds: Australian Illawara Shorthorn, Brown Swiss, Charolais, Friesian, Hereford, Jersey, Santa Gertrudis and Friesian. Since the number of calves obtained from each of the parental breed groups were very small, it was decided to take all the male parents as temperate bulls. This facilitated the analysis of the data by giving a respectable number in the experiment.

Approximately 10 c.c. of blood was collected from each calf by puncturing the jugular vein with a syringe into clean glass tubes. These tubes were labelled and left in a slanting position inside an ice-cooled insulated box. The serum was decanted into another clean glass tube about twenty-four hours later and was immediately frozen by putting the tubes inside packs of dry ice. The frozen serum was transported back to the laboratory and stored at -10°C until required for electrophoretic analysis.

The starch gel electrophoresis of the serum samples was conducted according to the method originally introduced by Smithies (1955) and modified by Osterhoff and Van Heerden (1964). This system of separation of the various blood proteins by their differences in electrical charges and molecular size was adopted because of the high resolution of Transferrin variants. Preparation of gel for staining of Transferrin and the actual staining of Transferrin followed the procedure described by Ashton (1958).

RESULTS AND DISCUSSION

In the electrophoretic analysis of Transferrin analysis, five genotypes were identified. Fig. 1 shows that these correspond to the position of the genotypes Tf^{AA} , Tf^{AD} , Tf^{AE} , Tf^{DD} and Tf^{DE} , as observed by Ashton (1958). Tf^{AA} homozygotes migrated faster than the Tf^{DD} homozygotes. The heterozygote genotypes had

intermediate mobilities resulting in the appearance of the four bands seen in the Tf^{AD} and Tf^{DE} genotypes and the five bands in the Tf^{AE} genotypes. There was no Tf^{EE} homozygotes present in this study.

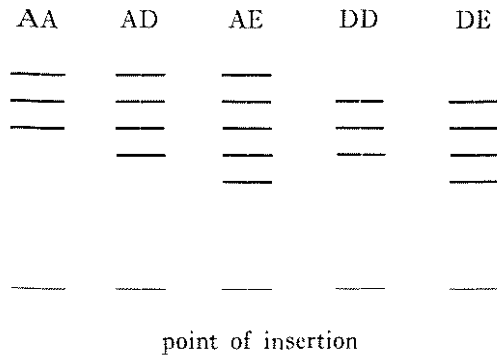


Figure 1. Transferrin genotypes of calves.

Of the 149 blood samples collected for this study, only 144 could be properly analyzed for the presence of Transferrin genotypes in the animals from which the samples were collected. Five samples could not be analyzed either due to lack of enough serum for two repeated electrophoretic runs, or contamination of serum samples with too much red cells. Table 1 shows the frequency of the genes A, D and E and the genotypes in the crossbred animals.

The increase in frequency of gene Tf^{A} in the quarter-bred Zebu's suggests that the temperate breeds have higher frequency of Tf^{A} compared to Zebus. Gahne (1961) also observed this. Conversely there was a decrease in the frequency of the gene Tf^{E} in the quarter-bred Zebu. This would confirm earlier findings of Ashton (1959) that the Tf^{E} is much higher in *Bos indicus* than in *Bos taurus*. Rare variant forms such as Tf^{B} and Tf^{F} were not found in any of the animals examined.

Correlation of transferrin with growth traits

Data on birth weight, and body weight, withers height, heart girth, body length, loin area, hip width, round and rump width of the animals at 6 months and 12 months were collected. Effects of the different transferrin genotypes on each of the traits were tested in the pooled data for difference by using a t-test. At $P = 0.05$, no significant differences were observed for birth weight and other traits at 12 months except for the effect of different transferrin genotype on round at 12 months. Tf^{AA} calves had significantly higher round (mean 65.5 ± 3.44 cm) than that

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TABLE 1

Frequency of genes and genotypes in crossbred cattle of Institut Haiwan, Kluang

Crossbred Groups	No.	Frequency of gene			Frequency of genotypes				
		TfA	TfD	TfE	TfAA	TfAD	TfAE	TfDD	TfDE
1/2 Zebu × 1/2 Temperate	121	.13	.66	.21	.02	.16	.07	.40	.35
1/4 Zebu × 3/4 Temperate	23	.25	.625	.125	.21	.05	.05	.43	.26

of Tf^{AD} calves (56.0 ± 1.19 cm) ($P < 0.05$) but they were not significantly different from calves with Tf^{AE}, Tf^{DD} and Tf^{DE} genotype. In view of the small number of animals involved in this study, the present results can neither agree nor confirm with the results of Osterhoff and Neethling (1969) who reported animals with Tf^{AA} genotypes had the greatest daily gain while those of Tf^{DE} and Tf^{EE} had the lowest.

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