

SERUM ALBUMIN POLYMORPHISM AND SOME ECONOMIC TRAITS SY-6a-29
IN CATTLE

Serumalbuminpolymorphismus und einige ökonomische Erbmerkmale
in Rindvieh

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INTRODUCTION

The possibility of an association between blood protein gene markers and the performance and production traits in cattle has been investigated by many workers. Some general associations have been reported for certain polymorphic systems but a clear situation has yet to emerge (Ashton *et al.* 1964; Ashton and Hewatson, 1968; Jamieson and Robertson, 1967; Larsen, 1972; Pirchner *et al.* 1972). The current status with respect to *Bos taurus* cattle has been reviewed by Spooner (1974) and Kiddy *et al.* (1975). A review of literature in zebu cattle revealed limited and sporadic information on these lines. In the present study an attempt was to find an association of serum albumin types with some economic traits in some zebu breeds and two cross-bred strains (Karan Swiss and Karan Fries).

MATERIALS AND METHODS

About eight hundred animals, which were already typed for albumin polymorphism, belonging to the various breed/genetic groups maintained in the herd of National Dairy Research Institute Karnal, were considered for this study. The two crossbred strains viz., Karan Swiss and Karan Fries constituted the animals evolved from the crossing of Sahiwal with Brown Swiss and Tharparker with Holstein exotic breeds respectively. The quantitative traits considered for the association studies were age at first calving (AFC), 305 days first lactation milk yield (FLMY) and first lactation length (LL). The statistical analyses included two methods viz., direct comparison method and the least squares analysis using the following statistical model:

$$Y_{ijk} = U + G_i + P_j + e_{ijk} \quad \text{where,}$$

$$Y_{ijk} = k^{\text{th}} \text{ observation in the } i^{\text{th}} \text{ breed/genetic group having } j^{\text{th}} \text{ albumin phenotype}$$

U = Overall mean

G_i = Effect of i^{th} breed/genetic group

P_j = Effect of j^{th} phenotype of albumin

e_{ijk} = Random error associated with k^{th} individual normally and independently distributed with mean zero and variance σ^2

The least square analysis was done on Hindustan Micro-2200 computer.

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Table-1: Direct comparisons of animals having particular albumin types with those lacking them.

Breed	Sahiwal			Karan Swiss			Karan Fries		
	AFC	FLMV	LL	AFC	FLMV	LL	AFC	FLMV	LL
No. of animals	39	38	38	250	231	222	106	110	109
Albumin Types									
BB	36.38 ±1.45 (21)	2050.00 ±109.06 (21)	377.05 ±20.02 (21)	33.27 ±1.80 (11)	2851.09 ±217.16 (11)	365.44 ±26.03 (9)	32.00 ±0.00 (1)	-	-
All others	40.94 ±2.13 (18)	2146.00 ±107.23 (17)	378.59 ±28.19 (17)	33.67 ±0.34 (239)	2668.20 ±41.87 (220)	364.85 ±6.12 (213)	30.75 ±0.49 (105)	-	-
BC	40.08 ±2.00 (13)	2122.58 ±138.47 (12)	399.33 ±38.43 (12)	33.00 ±3.00 (2)	2892.00 ±457.00 (2)	364.00 ±27.00 (2)	32.33 ±2.63 (6)	3076.00 ±180.72 (7)	368.57 ±34.94 (7)
All others	37.69 ±1.66 (26)	2079.38 ±93.34 (26)	367.77 ±16.70 (26)	33.66 ±0.33 (248)	2674.81 ±41.39 (229)	364.72 ±5.99 (220)	30.70 ±0.49 (100)	3403.92 ±65.48 (103)	360.45 ±8.85 (102)
CC	43.20 ±6.01 (5)	2202.80 ±69.38 (5)	328.30 ±13.43 (5)	-	-	-	-	-	-
All others	37.79 ±1.20 (34)	2076.39 ±84.65 (33)	387.27 ±18.55 (33)	-	-	-	-	-	-
AA	-	-	-	33.79 ±1.25 (14)	2960.93 ±204.08 (14)	362.00 ±20.91 (13)	32.50 ±0.94 (26)	3353.54 ±128.98 (26)	382.08 ±19.53 (25)
All others	-	-	-	33.65 ±0.34 (236)	2658.37 ±41.62 (217)	364.89 ±6.19 (209)	30.25 ±0.55 (80)	3392.19 ±72.13 (84)	354.69 ±9.40 (80)
AB	-	-	-	33.68 ±0.37 (210)	2630.59 ±43.46 (195)	362.26 ±6.54 (187)	30.05 ±0.56 (73)	3420.94 ±76.38 (77)	353.43 ±9.81 (77)
All others	-	-	-	33.53 ±0.76 (40)	2981.92 ±130.20 (36)	377.83 ±14.10 (35)	32.45 ±0.86 (33)	3249.58 ±109.28 (33)	379.13 ±16.82 (32)
AC	-	-	-	33.45 ±1.23 (13)	2972.22 ±188.78 (9)	409.11 ±30.51 (11)	-	-	-
All others	-	-	-	33.66 ±0.34 (237)	2664.73 ±42.01 (222)	362.40 ±6.02 (211)	-	-	-

AFC = Age at first calving in months
 FLMV = 305 days first lactation milk yield
 LL = Lactation length in days

Number in parentheses denotes number of animals.

Table-2: Least square means and their standard error for age at first calving, 305 days milk yield and first lactation length (S, KS, KF).

Effect	No. of obs.	305 days milk yield		Age at 1st calving		1st lact. length				
		Mean	S.E.	Mean	S.E.	Mean	S.E.			
AA	39	2991.06	±258.80	54.04	36.23	±1.21	20.85	419.91	±25.50	37.92
BB	31	2663.11	±222.27	46.46	31.62	±1.04	18.31	326.67	±21.94	37.39
CC	10	3009.15	±408.74	42.95	35.85	±1.91	16.84	268.93	±40.35	47.44
AB	264	2400.64	±144.10	97.53	25.45	±0.67	42.77	379.19	±14.10	60.41
AC	12	2435.24	±120.38	17.12	32.87	±1.47	15.50	384.40	±31.09	28.01
BC	22	2099.87	±238.58	53.29	44.35	±1.11	11.73	316.76	±23.57	34.90
Sahiwal	46	2060.51	±223.26	73.48	39.68	±1.04	17.77	402.40	±22.04	37.14
Karan Swiss	223	2910.92	±139.12	71.36	27.05	±0.65	35.88	332.81	±13.73	61.60
Karan Fries	109	3075.01	±158.35	53.76	30.39	±0.75	25.76	312.69	±15.63	52.18

The least square means superscripted with similar alphabet differ significantly

RESULTS AND DISCUSSION

Direct comparison method - Table-1 shows the direct comparison of the animals having a particular albumin type with others lacking it. The breeds showing only one type of albumin phenotype have not been included in this table (Tharparkar, Red Sindhi, Holstein, Jersey, Brown Swiss and Jersey x Tharparkar). The serum albumin types in general revealed very few significant differences of the economic characters for the animals studied. Out of the total 52 comparisons made only two albumin phenotypes (Alb AA and Alb AB) showed significant differences in the performance of the animals. The animals with Alb AB type in case of Karan Fries crossbred breed/genetic group showed a lower age at first calving for about 2.4 months as compared to the animals (control) lacking this albumin phenotype. Similarly the animals having Alb AA phenotype exhibited an increase in the age at first calving by approximately 2.25 months. Singh (1972) observed an increase of approximately 8 months in the age at first calving for Alb AA phenotypic group among the Brown Swiss x Sahiwal crossbred animals. However, he failed to observe any significant difference for this trait in the Alb AB phenotypic group as observed in the present study. The effect of albumin phenotypes on the age at first calving has been reported in buffaloes by Singh *et al.* (1980).

The albumin phenotype Alb AA commonly observed in the exotic animals due to extremely high allelic frequency of Alb^A allele among these animals, seemed to have an adverse effect on age at first calving in the Karan Fries animals. However, this adverse effect was less pronounced in case of Alb AB phenotypic group where Alb^A allele was in combination with the Alb^B allele contributed from their zebu parents where it is found to be highly frequent. It may be possible that the indigenous zebu cattle contain many genotypes evolved through the course of natural selection, having in built mechanisms for adaptation to the local conditions, which are otherwise adverse to the exotic cattle.

Least Square Analysis - A least square analysis of variance for albumin phenotypic groups and breed/genetic groups with respect to the three performance traits revealed highly significant differences ($P/0.01$) for these traits among the breed/genetic groups and significant differences ($P/0.05$) among albumin phenotypes for age at first calving only. Duncan's multiple range test was applied for least square means of various albumin phenotypic groups. Table-2 gives the different comparisons of the least square means of these traits. It was observed that whereas the differences in the albumin phenotypes significantly affected age at first calving, these did not affect significantly the other two economic traits considered.

The available literature on these lines is limited especially in Indian breeds. Therefore, further studies would be needed to corroborate these findings and to draw more definite conclusions.

SUMMARY

In all about eight hundred animals belonging to three zebu and exotic breeds each and two of their crossbred genetic/breed groups were screened for serum albumin polymorphism, exhibiting the presence of three albumin alleles viz., Alb^A, Alb^B and Alb^C. An attempt was made to find an association of the albumin phenotypes with the age at first calving, 305 days first lactation length using direct comparison method and the least square analysis. Significant differences were observed for the albumin phenotypes

(Alb AA and Alb AB) with respect to age at first calving, out of fifty two direct comparisons made for the three economic traits considered. The analysis of the data by least squares method also revealed significant differences among albumin phenotypic groups only.

ZUSAMMENFASSUNG

Ingesamt etwa 800 Tiere, die je den drei Zebu und ausländischen Viehrassen zugehörten und die zwei zu ihren artgekreuzten genetischen/Rassengruppen gehörten wurden für Serumalbuminpolymorphismus untersucht, der das Vorhandensein von drei Albuminerbfaktoren nämlich Alb^A, Alb^B und Alb^O zeigte. Ein Versuch wird hier gemacht, um eine Assoziation von den Albuminphenotypen mit dem Alter bei Erstabkalbung, 305 tagigen Erstlaktationsleistung und Erstlaktationsdauer gefunden, indem eine direkte Vergleichsmethode und die Kleinstquadratanalyse verwendet wurden. Aus den 52 direkten Vergleichen gemacht für die drei berücksichtigten ökonomischen Erbmerkmale wurden bedeutende Unterschiede für die Albuminphenotypen (AlbAA und AlbAB) im Hinblick auf Alter bei Erstabkalbung. Die Analyse der Angaben durch Kleinstquadratmethode zeigte auch bedeutende Unterschiede unter phenotypischen Albumingruppen allein.

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