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Correlations between the milk production traits in different variants of k -casein gene in Malvi, Nimari, Sahiwal and HF crossbred cattle

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Abstract
The association study was carried out in 50 HF Crossbred, 50 Sahiwal, 50 Malvi and 50 Nimari cow in the department of Animal Genetics and Breeding of College of Veterinary Science and A.H, Jabalpur. The above mention study showed that the correlation of daily milk yield (DMY) lactation length with milk yield, SNF with fat%, and density with protein and lactose was found to be highly significant for AA and AB genotypes of k- casein gene of HF crossbred but among rest traits they showed non-significant correlation. Sahiwal breed showed significant and positive correlation between daily milk yield (DMY) lactation length with milk yield, lactose, SNF, density with protein, fat and SNF whereas significantly negative correlation also noticed in the milk yield with fat%, lactation length with daily milk yield and SNF with lactation length. Malvi breed showed that the significant and positive correlation of daily milk yield (DMY) lactation length with milk yield, protein% with milk yield and daily milk yield (DMY), and protein% with lactose, SNF and density of the milk. Whereas significantly negative correlation noticed between the fat% and daily milk yield (DMY) in AB genotype of. The AA genotype of Nimari breed showed significantly positive correlation of Milk yield (MY) with daily milk yield (DMY), protein with lactose, SNF and density whereas significantly negative correlation observed in Milk yield (MY) and protein with fat% but remaining traits showed non-significant correlation with each other. In AB genotype of Nimari breed showed significantly positive correlation of Milk yield (MY) with daily milk yield (DMY), density with protein% and SNF with lactose, whereas significantly negative association observed in fat% with Milk yield (MY) and daily milk yield (DMY), lactation length with daily milk yield (DMY) and remaining traits expressed non-significant relation.

Keywords: Correlation, milk yield (MY), daily milk yield (DMY), lactation length (LL)

Introduction
Eleven genetic haplotypes of Kappa-casein (CSN3) have been identified and the most frequent being the A and B alleles [1]. Kappa-casein variants A and B differ by two amino acids substitutions. The polymorphism of kappa casein (κ-Cn) gene on bovine chromosome 6 was genotyped by using the polymerase chain restriction fragment length polymorphism. Allele A was predominantly found in the cattle population. The most frequent genotype was AA with frequency 0.57. The results from the statistical association analysis between CSN3 genotypes and milk production parameters revealed that milk protein and fat yield (kg) in standard length of lactation were not significant. casein genotypes were not significantly different in total protein and casein concentrations, but differences were found in casein composition [2, 3]. K-casein variants affected concentrations and proportion of K-casein (B>AB>A), proportion of αS1-casein (A>AB>B). κ-CN genotype was associated with the relative concentrations of κ-CN (B > E > A), αS2-CN (B > A), α-LA, and αS1-CN (A > B) and with protein percentage (B > A) [4]. The main aim of my research work was genotyping and association study of the different breeds with milk production traits.

Materials and Methods
The present research work was conducted on 200 lactating cows comprising 50 each of Malvi, Nimari, Sahiwal and HF crossbred cattle from 2016-2017. Identification number, Lactation length and Lactation yield of each animal under study were recorded. About 100 ml milk sample was collected from each of the above 200 cattle. The milk samples brought to the laboratory, maintaining cold chain and then Fat (%), Protein (%), Lactose (%), SNF (%) and milk density (Kg/L) were determined by milk analyzer, Department of Veterinary Medicine,

College of Veterinary Science and Animal Husbandry, Jabalpur.

1. Estimation of Protein (%), Fat (%), Lactose (%), SNF (%) and Milk density (Kg/L)

The Protein (%), Fat (%), Lactose (%), SNF (%) and Milk density (Kg/L) were analyzed by Milk analyzer of the Department of Veterinary Medicine, College of Veterinary Science & A.H., Jabalpur.

2. Statistical analysis

Association study of various polymorphic variants of milk protein genes for Milk yield (MY), Daily milk yield (DMY), Protein (%), Fat (%), Lactose (%), SNF (%) and Milk density (Kg/L) data were subjected to least squares analysis of variance employing following linear model:

$Yijkl = \mu + Pi + Bj + Gk + (PXB)ij + (PXG)ik + (BXG)jk + (PXBXG)ijk + eijkl$

Where, Yijkl- is the Observed value of milk yield, µ- is the population mean,

Pi -is the fixed effect of parity, Bj-is the fixed effect of breed, Gk-is fixed effect of genotypes (k = 1, 2….), (PXB)ij -is interaction effect of parity and Breed,(PXG)ik - is interaction effect of parity and genotypes,(BXG)jk- is interaction effect of Breed and genotypes,(PXBXG)ijk - is interaction effect of parity, breed and genotypes eijkl - is random error effect.

Results and Discussion

The results of correlation analysis have been presented in table 1 to 8. As per the following table 1-2 of HF crossbred the correlation between the daily milk yield (DMY) lactation length and milk yield, SNF with fat%, and density with protein and lactose was found to be highly significant for genotypes of HF crossbred but with the rest of the traits they showed non-significant correlation.

Table 1: Correlations between the milk yield and milk composition traits for AA genotype of K- casein gene in HF Crossbreed

	MY	DMY	LL	Fat	Protein	Lactose	SNF
DMY	0.80**						
LL	0.54**	-0.07					
FAT	-0.07	-0.15	0.10				
PROTEIN	0.13	0.20	-0.03	0.21			
LACTOSE	-0.04	-0.05	0.05	0.30	0.25		
SNF	-0.24	-0.12	-0.20	0.44**	0.060	-0.04	
DENSITY	-0.08	-0.11	0.05	0.07	0.26	0.03	0.21

** (P<0.01), *(P<0.05)

Table 2: Correlations between the milk yield and milk composition traits for AB genotype of K- casein gene in HF Crossbreed

	MY	DMY	LL	Fat	Protein	Lactose	SNF
DMY	0.86**						
LL	-0.06	-0.55**					
FAT	0.10	0.13	-0.12				
PROTEIN	0.25	0.33	-0.21	-0.36			
LACTOSE	-0.19	-0.25	0.22	-0.43	0.69**		
SNF	-0.15	0.08	-0.43	0.51*	0.29	0.27	
DENSITY	0.10	0.10	-0.04	-0.43	0.75**	0.59**	0.27

** (P<0.01), *(P<0.05)

According the following table 3-4, of Sahiwal breed showed significant and positive correlation between daily milk yield (DMY) lactation length and milk yield, lactose, SNF density with protein, fat and SNF whereas positive correlation was observed due to the amount of fat being related to the amount of protein in milk, indicating that the increase in fat content will influence protein levels, although with a higher influence on Guzerá compared to Gir [5]. Significantly negative correlation also noticed in the milk yield with fat%, lactation length with daily milk yield and SNF with lactation length.

Table 3: Correlations between the milk yield and milk composition traits for AA genotype of K-casein gene in Sahiwal

	MY	DMY	LL	Fat	Protein	Lactose	SNF
DMY	0.64**						
LL	0.67**	-0.14					
FAT	-0.35*	-0.11	-0.34*				
PROTEIN	-0.16	0.00	-0.21	0.05			
LACTOSE	-0.20	-0.01	-0.24	0.15	0.99**		
SNF	-0.32	-0.05	-0.35*	0.57**	0.85**	0.99**	
DENSITY	-0.15	0.01	-0.20	-0.00	0.99**	0.99**	0.82**

** (P<0.01), *(P<0.05)

Table 4: Correlations between the milk yield and milk composition traits for AB genotype of K-casein gene in Sahiwal

	MY	DMY	LL	Fat	Protein	Lactose	SNF
DMY	0.82**						
LL	0.91**	-0.65**					
FAT	-0.60*	0.21	0.38				
PROTEIN	-0.04	0.07	-0.08	0.20			
LACTOSE	0.01	0.09	-0.06	0.27	0.99**		

SNF	0.20	0.14	0.08	0.56*	0.92**	0.95**	
DENSITY	-0.06	0.06	-0.10	0.17	0.99**	0.99**	0.91**

** (P<0.01), *(P<0.05)

Table 5-6 of Malvi breed showed that the significant and positive correlation of daily milk yield (DMY) lactation length with milk yield, protein% with milk yield and daily milk yield (DMY), and protein% with lactose, SNF and density of the milk. Same result noticed in Guzerá cattle [6]. Whereas significantly negative correlation noticed between the fat% and daily milk yield (DMY) in AB genotype of k-casein and rest traits of both table showed non-significant correlation.

Table 5: Correlations between the milk yield and milk composition traits for AA genotype of K- casein gene in Malvi

	MY	DMY	LL	Fat	Protein	Lactose	SNF
DMY	0.90**						
LL	0.89**	0.61**					
FAT	-0.14	-0.13	-0.10				
PROTEIN	0.29**	0.30**	0.22	0.31			
LACTOSE	0.27	0.28	0.20	0.40	0.99**		
SNF	0.12	0.21	0.13	0.21	0.77	0.87	
DENSITY	0.12	0.12	0.10	0.67**	0.89**	0.92**	

** (P<0.01), *(P<0.05)

Table 6: Correlations between the milk yield and milk composition traits for AB genotype of K- casein gene in Malvi

	MY	DMY	LL	Fat	Protein	Lactose	SNF
DMY	0.93**						
LL	0.78**	0.49**					
FAT	-0.32	-0.42*	-0.00				
PROTEIN	-0.12	-0.10	-0.07	-0.18			
LACTOSE	-0.09	-0.06	-0.06	-0.12	0.99**		
SNF	0.12	0.18	0.00	0.28	0.76**	0.82**	
DENSITY	-0.14	-0.12	-0.07	-0.22	0.99**	0.99**	0.73**

** (P<0.01), *(P<0.05)

The AA genotype of Nimari breed in table 07showed significantly positive correlation of Milk yield (MY) with daily milk yield (DMY), protein with lactose, SNF and density whereas significantly negative correlation observed in Milk yield (MY) and protein with fat% but remaining traits showed non-significant correlation with each other but In contrary to above finding negative correlation between Lactose and Fat% is noticed in Guzerá cattle [6]. In AB genotype of Nimari breed in table 08 showed significantly positive correlation of Milk yield (MY) with daily milk yield (DMY), density with protein% and SNF with lactose, whereas significantly negative association observed in fat% with Milk yield (MY) and daily milk yield (DMY), lactation length with daily milk yield (DMY) and remaining traits expressed non-significant relation

Table 7: Correlations between the milk yield and milk composition traits for AA genotype of K- casein gene in Nimari

	MY	DMY	LL	Fat	Protein	Lactose	SNF
DMY	0.79**						
LL	0.32	-0.33					
FAT	-0.48*	-0.38	-0.11				
PROTEIN	0.49*	0.36	0.18	-0.46*			
LACTOSE	0.27	0.09	0.24	-0.30	0.90**		
SNF	0.22	0.03	0.26	-0.09	0.76**	0.83**	
DENSITY	0.23	0.08	0.22	-0.26	0.86**	0.92**	0.84**

** (P<0.01), *(P<0.05)

Table 8: Correlations between the milk yield and milk composition traits for AB genotype of K- casein gene in Nimari

	MY	DMY	LL	Fat	Protein	Lactose	SNF
DMY	0.89**						
LL	-0.18	-0.60**					
FAT	-0.50**	-0.37*	-0.12				
PROTEIN	0.07	0.09	-0.05	-0.32			
LACTOSE	-0.02	0.02	-0.14	0.05	0.09		
SNF	0.03	0.02	-0.01	0.21	0.05	0.37*	
DENSITY	-0.22	-0.06	-0.30	0.09	0.47**	0.28	-0.11

** (P<0.01), *(P<0.05

Conclusion

As per above result the correlation of daily milk yield (DMY) lactation length with milk yield, SNF with fat%, and density with protein and lactose was found to be highly significant for AA and AB genotypes of k- casein gene of HF crossbred. Sahiwal breed showed significant and positive correlation between daily milk yield (DMY) and lactation length with milk yield, lactose, SNF and density with protein, fat and SNF

whereas significantly negative correlation also noticed in the milk yield with fat%, lactation length with daily milk yield and SNF with lactation length. Malvi breed showed that the significant and positive correlation of daily milk yield (DMY) and lactation length with milk yield. Protein% with milk yield and daily milk yield (DMY), lactose, SNF and density of the milk. Significantly negative correlation noticed between the fat% and daily milk yield (DMY) in AB genotype of k-casein. The AA genotype of Nimari breed in table 07showed significantly positive correlation of Milk yield (MY) with daily milk yield (DMY), protein with lactose, SNF and density whereas significantly negative correlation observed in Milk yield (MY) and protein with fat% but remaining traits showed non-significant correlation with each other. In AB genotype of Nimari breed showed significantly positive correlation of Milk yield (MY) with daily milk yield (DMY), density with protein% and SNF with lactose, whereas significantly negative association observed in fat% with Milk yield (MY) and daily milk yield (DMY), lactation length with daily milk yield (DMY).

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