



CORRELATION BETWEEN MILK COMPOSITION TRAITS(MILK YIELD, DAILY MILK YIELD, LACTATION LENGTH, FAT, PROTEIN, LACTOSE, SNF AND DENSITY) AND DIFFERENT GENETIC VARIANTS OF α S2 CASEIN GENE IN THARPARKAR COW OF M. P., INDIA.

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ABSTRACT:

Present study revealed that the genetic variants and their association with milk production traits in Tharparkar cattle of Madhya Pradesh at β casein gene (CSN1S2) gene locus. Correlation study of MY showed that there was a positive and highly significant correlation with Daily milk yield of both AA and AB genotype of β -casein gene in Tharparkar cow. Lactation length showed significantly negative correlation with milk yield(MY) and daily milk yield (DMY) trait in AA genotypes. Fat% showed highly significant but negative correlation with milk yield and daily milk yield whereas in AB genotype Fat% showed significantly negative correlation with Lactation length of Tharparkar cow. Milk protein of AA genotype showed significantly negative correlation with Fat % whereas Significant but positive correlation noticed between milk protein of both AA and AB genotype of Tharparkar cow and milk yield. Lactose of AA and AB genotype of Malvi showed highly significant and positive correlation with milk yield and milk protein. SNF of AB genotype in Tharparkar showed Highly significant and positive correlation with lactose milk protein and Milk yield. Milk density of AB genotype of Tharparkar cow showed highly significant and positive correlation with milk protein Lactose and SNF.

Keywords: - α S2, Casein Gene, Tharparkar ,Protein Lactose and SNF.

INTRODUCTION :

This study aimed to investigate the association of different genetic variants of Tharparkar cattle with milk production traits. Genetic correlations between milk composition percentages are high and positive, averaging 0.74. However, milk yield and composition percentages are negatively correlated, -0.3 for milk yield and fat percentage (Gaunt, 1980). Thus, it is very difficult to improve milk yield and milk percentage composition simultaneously. Lactose synthesis is initiated in the Golgi apparatus and continues in the vesicles with an influx of water and ionic constituents that causes the vesicles to swell as they pass toward the cell surface. The principal biological function of lactose in milk is the regulation of water content and, thus, the regulation of osmotic content (Davies et al., 1983; Jenness, 1985). Because of this function,

lactose is the most constant constituent in milk, averaging 4.6 percent. Jerseys have the highest heritability for milk fat percentage (0.71), with other breeds ranging from 0.51 to 0.57. The small variation between ratios of one milk constituent to another, particularly fat to protein, suggests little hope for drastic changes in milk yield and milk composition (Gaunt, 1973; Wilcox, 1978). Heritabilities of solids-not-fat (SNF) to fat and protein to fat ratios are highest for Ayrshire followed by Jersey, Guernsey, Brown Swiss, and Holstein. Differences in heritabilities of breeds other than Holstein may be overestimated because of a small sample population.

MATERIAL AND METHODS :

Statistical analysis:

Calculation of Gene and genotype frequencies: Gene and genotype frequencies for different casein genes under study were estimated using

Popgene 32 (version1.32), microsoft Windows-based freeware for population genetic analysis (Yeh et al., 1999).

Association of various polymorphic variants of milk protein genes :

Association study of various polymorphic variants of milk protein genes for milk production traits data were subjected to least squares analysis of variance employing following linear model:

$$Y_{ijkl} = \mu + P_i + B_j + G_k + (PXB)_{ij} + (PXG)_{ik} + (BXG)_{jk} + (PXBXG)_{ijk} + e_{ijkl}$$

To find out the association between the polymorphic variants/ genotypes of, α_2 -casein genes with milk production traits like, Milk Yield, Daily Milk Yield, Lactation length, Milk Protein, Fat, Lactose, SNF and Milk density (Kg/L) in Tharparkar cattle by linear regression model was employed.

RESULTS AND DISCUSSION :

Daily Milk yield (DMY): DMY showed that there was a positive and highly significant correlation with milk yield of both AA and AB genotype of α_2 -casein gene in Tharparkar cow. As per some studies are suggested AA genotype as most favourable for animal selection (Alipanah et al., 2008) while others BB genotype was more associated with milk traits (Rachagani and Gupta, 2008).

Lactation length (LL): Lactation length showed negative and significant correlation with milk yield (MY) and daily milk yield (DMY) trait in AA genotypes (MY) (DMY) whereas AB genotypes showed non-significant but positive correlation with milk yield (MY) and negative correlation with daily milk yield (DMY) of Tharparkar cow.

Fat : Fat% showed highly significant negative correlation with milk yield and daily milk yield but non-significant and negative correlation with lactation length in AA genotype of Tharparkar cow. whereas in AB genotype Fat% also showed

negative correlation with both milk yield and daily milk yield trait (Tab. 02), but in AB genotype significantly negative correlation was noticed between Fat% and Lactation length of Tharparkar cow (Tab. 02). milk yield and composition percentages are negatively correlated, -0.3 for milk yield and fat percentage (Gaunt, 1980).

Protein: Milk protein of AA genotype showed Significant but positive correlation with Milk yield, Daily Milk Yield but negatively correlated with Lactation length and showed significantly negative correlation with milk Fat% (Tab.1).

whereas Significant but positive correlation noticed between milk protein of AB genotype of Tharparkar cow and milk yield but non-significant value noticed in daily milk yield and lactation length. Fat % showed negative correlation with milk protein of AB genotype (Tab.1). (Gaunt, 1980) Genetic and phenotypic correlations of casein yield with milk, fat, and protein yields were large and positive. Genetic correlation of casein percent with milk yield was negative (-.76) but positive (.96) with protein percent. A variant of β -LG has been repeatedly found to be associated with higher β -LG concentration (Ng-Kwai-Hang et al., 1987; Heck et al., 2009).

Lactose: Highly significant and positive correlation noticed between lactose and milk protein whereas lactose showed non - Significant but positive correlation with Milk yield and Daily Milk Yield. Lactation length and Fat % of AA genotype of Tharparkar breed of cow showed negative correlation with Lactose.

Lactose of AB genotype of Tharparkar showed highly significant and positive correlation with milk yield and milk protein whereas its value was non - Significant but positive with daily milk yield and lactation length but negatively correlated with Fat%. As Davies et al. (2021) per Increases in SCC and TBC are negatively associated with milk lactose content. However,

lactose content was not associated with variations in fat and protein contents.

SNF: As per Tab. 01 of AA genotype of Tharparkar cow milk SNF showed non – Significant but negative correlation with Milk yield, Daily Milk Yield and milk protein whereas, Lactation length, Fat% and lactose are showed non- significant but positive correlation with SNF.

SNF of AB genotype in Tharparkar showed Highly significant and positive correlation with lactose, milk protein and Milk yield and non-significantly but positive correlated with daily milk yield and lactation length whereas Fat% showed negative correlation with SNF. Association of genotypes with certain milk production traits revealed that AB had significant ($P < 0.05$) effect on total milk yield, peak yield, yield at 300 days and SNF% as compared to AA. Deb et al.(2014).

DENSITY:

Positive correlation showed by milk density with Milk yield ,Daily Milk Yield but negative correlation noticed with Lactation length Fat and SNF in the milk of AA genotype of Tharparkar cow whereas Density of milk of Tharparkar cow showed highly significant and positive correlation with Lactose and milk protein.

Milk density of AB genotype of Tharparkar cow showed highly significant and positive correlation with milk protein Lactose and SNF but it also showed comparatively lower significant with milk yield whereas milk density showed negative but non-significant correlation with Fat %.

CONCLUSION:

1.DMY showed that there was a positive and highly significant correlation with milk yield of both AA and AB genotype of α s₂-casein gene in Tharparkar cow.

2.Lactation length showed negative and significant correlation with milk yield (MY) and daily milk yield (DMY) trait in AA genotypes.

3. AB genotypes showed non-significant but positive correlation with milk yield . Fat% showed highly significant negative correlation with milk yield and daily milk yield .

4.AB genotype Fat% also showed significantly negative correlation with Fat% and Lactation length of Tharparkar cow. Milk protein of AA genotype showed significantly negative correlation with milk Fat%.

5. Significant but positive correlation noticed between milk protein of both AA and AB genotype of Tharparkar cow milk yield.

6.Lactose of AA and AB genotype of Tharparkar showed highly significant and positive correlation with milk yield and milk protein.

7. SNF of AB genotype in Tharparkar showed Highly significant and positive correlation with lactose, milk protein and Milk yield. Milk density of AB genotype of Tharparkar cow showed highly significant and positive correlation with milk protein Lactose and SNF.

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Table 01: Correlations between the milk yield and milk composition traits for AA genotype of *cs2*-casein gene in Malvi

	MY	DMY	LL	FAT	PROTEIN	LACTOSE	SNF
DMY	0.99**						
LL	-0.17*	-0.45**					
FAT	-0.66**	-0.78**	-0.03				
PROTEIN	0.45*	0.33	-0.07	-0.5**			
LACTOSE	0.10	0.14	-0.16	-0.19	0.55**		
SNF	-0.12	-0.16	0.05	0.19	-0.09	0.34	
DENSITY	0.21	0.24	-0.23	-0.21	0.59**	0.57**	-0.16

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

Table 02: Correlations between the milk yield and milk composition traits for AB genotype of *cs2*-casein gene in Malvi

	MY	DMY	LL	FAT	PROTEIN	LACTOSE	SNF
DMY	0.87**						
LL	0.55	-0.07					
FAT	-0.57	-0.15	-0.69**				
PROTEIN	0.55*	0.46	0.34	-0.27			
LACTOSE	0.56*	0.46	0.34	-0.28	0.98**		
SNF	0.54*	0.39	0.35	-0.17	0.99**	0.91**	
DENSITY	0.53*	0.47	0.19	-0.22	0.97**	0.96**	0.98**

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