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Research Article

ASSOCIATION OF BLOOD PROTEIN TRANSFERRIN POLYMOROPHISM WITH SOME PHYSICAL TRAITS OF BLACK BENGAL GOAT

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ABSTRACT: The aim of this study was to determine the influences of polymorphism of transferrin on some the physical traits in Black Bengal goat. The material of this study comprised of 199 adult Black Bengal does. The least square analysis of data revealed that the overall estimate of body length, heart girth, height at wither and body weight of adult Black Bengal does were found to be 16.875 ± 0.131 inches, 25.504 ± 0.248 inches, 16.452 ± 0.152 inches and 14.306 ± 0.159 kg, respectively. The does having TfCC phenovariant performed better than other phenovariant for all physical traits except heart girth. The maximum estimate for TfCC phenovariant in this study were 17.443 ± 0.407 inch for body length, 16.782 ± 0.449 inch for height at wither and 15.202 ± 0.508 kg for body weight. The highest estimate of 26.699 ± 0.867 inch for heart girth was observed in TfBC phenovariant does. White colour variety does performed paramount compared to other three coat colour of Black Bengal goat for all physical traits. The average value observed for different physical traits in white colour variety as 17.309 ± 0.264 inch for body length, 26.351 ± 0.425 inch for heart girth, 16.959 ± 0.344 inches for height at wither and 14.736 ± 2.994 kg for body weight. White colour does having TfAC phenovariant performed most excellent for body length (18.711 ± 0.841 inches) and heart girth (30.139 ± 0.574 inches) while white colour with TfAA phenovariant showed maximum value for height at wither (18.5285 ± 1.215 inches). However, black colour with TfCC phenovariant showed maximum value for body weight (16.457 ± 0.754 kg). In this study, the relationship between the phenovariant observed in locus of transferrin, coat colour and interaction of both with all the physical traits were statistically non-significant.

Key words: Black Bengal goat, Transferrin, Polymorphism, Association, Physical trait**.**

INTRODUCTION

Search for marker genes through isolation of desirable genotypes has nowadays considered a major research area in Animal Genetics and Breeding as variation in external character is a poor index of measuring the true genetic variability. The loci which control the polymorphic protein and enzyme act as a marker for genetic investigation. Biochemical variability and its use in selection programme as genetic marker for the traits of economic interest is very much essential for early selection. Genetically controlled polymorphism studied in different animals serves an excellent tool for characterization of several protein components that may be used in association study of different economic traits. If the biochemical marker become polymorphic and exhibit any association with trait, will become imperative helpful in selecting the right one with superior genotype as the phenovariant will act as a marker. Hence, genetic improvement of a population is possible by creation of superior genotype adopting the selection procedure with the help of biochemically polymorphic proteins. Keeping in view this aspect the present investigation was undertaken to determine the association of transferrin polymorphism with some physical traits of Black Bengal goats in own native tract of West Bengal, India.

MATERIALS AND METHODS

The present study was conducted on Black Bengal goat available in four districts *viz*., Birbhum, Hooghly, North 24 Parganas and Nadia of West Bengal, India. A total of 199 apparently healthy adult does (above 12 months) were selected randomly from the village of each district under study. The goats were reared on grazing alone and no concentrate was given to them.

There are six transferrin phenovariants namely TfAA, TfAB, TfAC, TfBB, TfBC and TfCC as identified by

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Paul *et al.* (2017) were eventually used for association study with different physical traits of Black Bengal goat. Different physical traits *viz*., body length, heart girth, height at wither and body weight of adult Black Bengal does were considered in this present investigation. These data used in this investigation were collected personally from door to door of the farmer's house in different villages of the four districts under study. Body measurements like body length, heart girth and height at wither were taken with the help of a measuring tape graduated in inch as per standard method (Singh *et al*. 1979). Productive performance live body weight is also a physical character which was taken with the help of a hanging spring balance and gunny bag technique. The age of the animals was collected from the farmer's statement and finally physically verified by dentition pattern (Sastry *et al*. 1994).

The mean and the standard error of the different physical traits under the study were estimated and tests for significance were done by standard methods as described by Snedecor and Cochran (1967). To estimate the effect of transferrin phenovariant, coat colour of does and interaction of phenovariant with colour on different physical traits of adult Black Bengal does SPSS software programme were used the least mean square technique (Harvey 1966).

RESULTS AND DISCUSSION

Body length

The analysis of data revealed that the overall mean body length of adult Black Bengal does was found to be 16.875 ± 0.131 inches. Phenovariant wise analysis of the data revealed that on an average body length was found to be maximum in TfCC phenovariant followed by TfBC, TfAB, TfAC, TfAA and TfBB phenovariant of transferrin protein in the studied population of female Black Bengal goat. The estimated body length of does was 17.443 ± 0.407 inch for TfCC, 17.109 ± 0.416 inch for TfBC, 16.958 ± 0.218 inch for TfAB, 16.655 ± 0.418 inch for TfAC, 16.633 ± 0.270 inch for TfAA and 16.453 ± 0.335 inch for TfBB phenovariant of transferrin. Statistical analysis failed to show any significant effect of transferrin phenovariant on this physical trait.

It was observed that mean body length of adult female Black Bengal goat was found to be maximum for white (17.309 ± 0.264 inch) followed by black (16.849 ± 0.195 inch), brown (16.707 ± 0.277) and black and white (16.634 ± 0.41 inch) coat colour variety, respectively. Though there was noticeable variation existed in body length of different colour varieties of Black Bengal does but statistical analysis failed to show any significant effect of coat colour on this trait.

The mean body length was found to be maximum in white colour variety having TfAC phenovariant (18.711 ± 0.841 inches) and minimum was found to be in combination of black and white colour having TfAA phenovariant (14.675 ± 0.788 inches) in adult Black Bengal does. In this research endeavor the body length ranged from 16.150 ± 0.580 for TfBB to 18.071 ± 0.641 for TfCC phenovariant among the black colour variety goat. It was varied from 14.675 ±0.788 for TfAA to 17.900 ±0.400 for TfBC phenovariant among the black and white colour variety goat. The respective estimates were from 15.640 ±0.857 for TfAC to 17.900 ±0.100 for TfCC phenovariant in the brown colour variety goat. In white colour variety goat, it was varied from 16.100±1.100 for TfCC to 18.711±0.841 for TfAC phenovariant of transferrin.

Heart girth

The overall average heart girth of adult Black Bengal does was found to be 25.504 ± 0.248 inches (Table 1). The average heart girth was recorded maximum in goats having TfBC type followed by goats having TfBB, TfAA, TfAB, TfAC and TfCC types, respectively. The estimated value of heart girth was observed as 26.699 ± 0.867 inch for TfBC, 25.698 ± 0.493 inch for TfBB, 25.533 ± 0.464 inch for TfAA, 25.453 ± 0.419 inch for TfAB, 25.114 ± 0.791 inch for TfAC and 24.532 ± 0.972 inch for TfCC phenovariant of transferrin of Black Bengal does. Though the heart girth varied from d 24.532 ± 0.972 inch to 26.699 ± 0.867 inch but this much variation is not significant statistically.

To estimate the effect of coat colour on heart girth, it was observed that the heart girth of adult female Black Bengal goat was found to be maximum in white colour variety (26.351 ± 0.425 inch) followed by black (25.3023 ± 0.369 inch), brown (25.2228 ± 0.599 inch) and black and white (25.143 ± 0.708 inch) colour variety. But analysis of variance showed that coat colour had no significant effect on heart girth of Black Bengal does in the study.

The present study was also envisaged to estimate the effect of interaction of phenovariant and coat colour on heart girth of Black Bengal does. It was observed from statistical analysis of data that the heart girth ranged from 24.175±1.039 inch for TfBB to 26.229±1.552 inch for TfCC phenovariant among the black colour variety. In black and white colour variety of Black Bengal does, it was varied from 23.050 ±1.422 inch for TfAA to 29.000 ±1.200 inch for TfBC phenovariant of transferrin. The trait of heart girth was varied from 23.640 ±2.268 inch for TfAC to 27.167±1.083 inch for TfBB phenovariant among the brown colour variety. The respective estimate was varied from 22.400±0.400 inch for TfCC to 30.139±0.574 inch for TfAC phenovariant among the white colour variety of Black Bengal does under study. From the result, it was observed that the mean heart girth was maximum due to combined effect of white colour and TfAC phenovariant (30.1399 ± 0.574 inches) and lowest value come under the group with white colour and TfCC phenovariant (22.40 ± 0.40 inches) in this investigation. However, estimate of heart girth of Black Bengal does did not differ significantly through this interaction effect of transferrin phenovariant and coat colour of this goat breed.

Height at withers

The overall mean height at withers in adult Black Bengal does (above 12 months of age) was estimated in this study to be 16.452 ± 0.152 inches. Research result also depicted that the average height at withers was maximum in TfCC phenovariant followed by TfBC, TfAA, TfAB, TfAC and TfBB phenovariant of transferrin in Black Bengal does under study. The average height at wither of Black Bengal does belonging to different phenovariant were found to be 16.782 ± 0.449 inch for TfCC, 16.775 ± 0.423 inch for TfBC, 16.699 ± 0.344 inch for TfAA, 16.454 ± 0.271 inch for TfAB, 16.203 ± 0.444 inch for TfAC and 15.804 ± 0.348 inch for TfBB phenovariant of transferrrin. Statistical analysis of data revealed that the variation of height at wither existed among does belonging to different phenovariant of transferrin was not statistically significant in studied population of Black Bengal goat.

The data were further subjected to analysis to find out the effect of coat colour on height at wither trait of Black Bengal does. From the analysis result, it was observed that the height at withers of adult female Bengal goat was recorded to be maximum in white colour variety (16.959 ± 0.344 inches) followed by black (16.428 ± 0.226 inches), black and white (16.266 ± 0.402 inches) and brown (16.158 ± 0.294 inches) respectively. Analysis of variance failed to show any significant variation existed among the different colour varieties of studied Black Bengal does.

Interaction effect of phenovariant and coat colour of Black Bengal does on height at wither in this study revealed that this trait ranged from 15.600±0.554 for TfBB to 17.629±0.643 for TfCC phenovariant among the black colour variety. It was varied from 14.750±0.250 for TfBB to 17.750 ±0.250 for TfBC phenovariant among the black and white colour variety. Among the brown colour varieties of Black Bengal does, this trait varied from 15.779±0.507 for TfAB to 17.500±0.500 for TfCC phenovariant. The respective estimate was varied from 15.000±1.000 for TfCC to 18.529±1.215 for TfAA phenovariant among the white colour variety. From the present result, it was observed that the mean height at withers was found maximum for the Black Bengal does with white colour and TfAA phenovariant (18.5285 ± 1.215 inches) and minimum was found in combination of black and white colour and TfBB phenotype (14.75 ± 0.25 inches). However, there was no significant relationship of height at wither trait with any combination of colour and transferrin phenovariant in this present research work.

Body weight

In this investigation the overall mean body weight of adult Black Bengal does was estimated as 14.306 ± 0.159 kg. It was also observed that average body weight was exposed maximum by animals having TfCC type which followed by TfAB, TfBC, TfAA, TfAC and TfBB respectively. The respective estimates were observed as 15.202 ± 0.508 kg for TfCC phenovariant, 14.598 ± 0.267 kg for TfAB phenovariant, 14.528 ± 0.476 kg for TfBC phenovariant, 14.524 ± 0.332 kg for TfAA phenovariant, 13.651 ± 0.479 kg for TfAC phenovariant, 13.333 ± 0.429 kg for TfBB phenovariant of transferring. Statistical analysis failed to show any significant effect of different phenovariant of transferrin on body weight of Black Bengal does under study.

From the result it was observed that the mean adult body weight of white variety was found to be maximum (14.736 ± 2.994 kg) followed by black (14.704 ± 0.244 kg), brown (14.363 ± 0.322 kg) and black and white (13.422 ± 0.447 kg), respectively (Table 1). Though the body weight ranged from 13.422 ± 0.447 kg to 14.736 ± 2.994 kg among the different color varieties of Black Bengal does but statistical analysis of data showed that the body weight of different colour varieties of Black Bengal does did not differ significantly in the present investigation.

To estimate the interaction effect of phenovariant and coat colour of Black Bengal does, the data were subjected to further analysis in the present investigation. Analysis data revealed that the body weight ranged from 13.625±0.580 for TfBB to 16.457±0.754 for TfCC phenovariant among the black colour variety. It was varied from 11.000±1.000 for TfBB to 15.250 ±0.750 for TfCC phenovariant among the black and white colour variety. Among the brown colour variety, it was varied from 13.600±0.927 for TfAC to 15.600±0.600 for TfCC phenovariant. The respective estimates were varied from 13.500±0.500 for TfCC to 15.425±0.616 for TfBC

Table 1. Least square means with standard errors of physical traits showing the effect of Transferrin types, colour and their interaction in adult Black Bengal female goat.

	Body length (inch)	Heart girth (inch)	Height at withers (inch)	Body weight (Kg)
Overall (199)	16.875 ± 0.131	25.504 ± 0.248	16.452 ± 0.125	14.306 ± 0.159
Phenovariants				
TfAA (42)	16.633 ± 0.270	25.533 ± 0.464	16.699 ± 0.344	14.524 ± 0.332
TfAB (69)	16.958 ± 0.218	25.453 ± 0.419	16.454 ± 0.271	14.598 ± 0.267
TfAC (27)	16.655 ± 0.418	25.114 ± 0.791	16.203 ± 0.444	13.651 ± 0.479
TfBB (21)	16.453 ± 0.335	25.698 ± 0.493	15.804 ± 0.348	13.333 ± 0.429
TfBC (27)	17.109 ± 0.416	26.699 ± 0.867	16.775 ± 0.423	14.528 ± 0.476
TfCC (13)	17.443 ± 0.407	24.532 ± 0.972	16.782 ± 0.449	15.202 ± 0.508
Coat colour				
Black (103)	16.849 ± 0.195	25.302 ± 0.369	16.428 ± 0.226	14.704 ± 0.294
Black and White (18)	16.635 ± 0.410	25.143 ± 0.708	16.266 ± 0.402	13.422 ± 0.014
Brown (38)	16.707 ± 0.277	25.223 ± 0.599	16.158 ± 0.294	14.363 ± 0.322
White (40)	17.309 ± 0.264	26.351 ± 0.425	16.959 ± 0.344	14.736 ± 0.299
Interaction black colour				
BLAA (23)	17.135 ± 0.376	25.909 ± 0.686	16.730 ± 0.430	15.296 ± 0.492
BLAB (33)	16.639 ± 0.305	24.564 ± 0.605	16.412 ± 0.445	14.103 ± 0.398
BLAC (17)	16.447 ± 0.567	25.365 ± 1.012	16.071 ± 0.593	14.306 ± 0.700
BLBB (8)	16.150 ± 0.580	24.175 ± 1.039	15.600 ± 0.554	13.625 ± 0.580
BLBC (15)	16.653 ± 0.635	25.573 ± 1.247	16.126 ± 0.626	14.440 ± 0.715
BLCC (7)	18.071 ± 0.641	26.229 ± 1.552	17.629 ± 0.643	16.457 ± 0.754
Black and white colour				
BWAA (4)	14.675 ± 0.788	23.050 ± 1.422	15.175 ± 0.911	12.800 ± 0.840
BWAB (5)	17.400 ± 0.476	25.760 ± 1.373	16.920 ± 0.555	14.480 ± 0.880
BWAC (3)	16.633 ± 1.449	23.400 ± 1.789	16.000 ± 1.607	12.500 ± 0.288
BWBB (2)	15.500 ± 0.500	25.000 ± 0.500	14.750 ± 0.250	11.000 ± 1.000
BWBC (2)	17.900 ± 0.400	29.000 ± 1.200	17.750 ± 0.250	14.500 ± 1.300
BWCC (2)	17.700 ± 0.100	24.650 ± 2.350	17.000 ± 0.500	15.250 ± 0.750
Brown colour				
BRAA (8)	17.250 ± 0.389	26.188 ± 1.048	16.363 ± 0.327	15.000 ± 0.534
BRAB (14)	16.521 ± 0.478	25.143 ± 0.898	15.779 ± 0.507	14.393 ± 0.555
BRAC (5)	15.640 ± 0.857	23.640 ± 2.268	15.340 ± 1.002	13.600 ± 0.927
BRBB (3)	16.800 ± 0.850	27.167 ± 1.083	16.067 ± 1.105	13.833 ± 1.013
BRBC (6)	16.133 ± 0.940	24.350 ± 2.160	15.900 ± 1.047	13.750 ± 1.116
BRCC (2)	17.900 ± 0.100	24.850 ± 2.350	17.500 ± 0.500	15.600 ± 0.600
White color				
WHAA (7)	17.471 ± 0.580	26.986 ± 0.373	18.529 ± 1.215	15.000 ± 0.715
WHAB (17)	17.271 ± 0.512	26.347 ± 0.890	16.706 ± 0.528	15.418 ± 0.533
WHAC (2)	18.711 ± 0.841	30.139 ± 0.574	18.090 ± 0.506	14.319 ± 0.404
WHBB (8)	17.363 ± 0.512	26.450 ± 0.267	16.800 ± 0.550	14.875 ± 0.673
WHBC (4)	17.750 ± 0.322	27.875 ± 0.829	17.325 ± 0.286	15.425 ± 0.616
WHCC (2)	16.100 ± 1.100	22.400 ± 0.400	15.000 ± 1.000	13.500 ± 0.500

*Figures in parenthesis indicate the number of observations.

phenovariant among the white colour variety of Black Bengal does. Hence, the mean body weight was maximum in combined effect of black colour and TfCC phenovariant (16.457 ± 0.754 kgs) and minimum in black and white colour with TfBB phenovariant (11.000 ± 1.000 kgs). However, analysis of variance showed that there was no significant variation ($p<0.01$, and 0.05) in the body weight due to such interaction effect in Black Bengal does.

The estimate of adult body length of Black Bengal does of 16.875 ± 0.131 inches as observed in the present finding was comparable with the available literature. Estimated results from the present study almost coincide with earlier report on Black Bengal (43.11 ± 0.57, 42.15 ± 0.55 cm) goats (Rao *et al*. 2002). Higher values of body length were reported in Black Bengal (50.7 ± 0.67 cm) and Assam Hill (61.48 ± 0.57 cm) goats (Singh *et al*. 1979; Khargharia *et al*. 2015). However, Mukherjee *et al*. (1979) recorded 51.3 ± 0.37 cm of mean body length (20.1inch approx) in brown type female Black Bengal goat. Similar type of findings was also reported by Acharya (1982) in female Black Bengal goat irrespective of colour variety. The present study revealed a slightly lower body length as compared to the reported earlier findings.

The overall average heart girth of adult Black Bengal does was found to be 25.504 ± 0.248 inches. The result of heart girth in the present study was almost in accordance with the finding of Acharya (1982) who observed approximately 63.2 ± 0.16 cm heart girth in female Black Bengal goat irrespective of cololur variety. Khargharia *et al*. (2015) estimated the average heart girth as 71.93 ± 0.99 cm in randomly selected 67 female Assam Hill goats (2 to 4 years of age) of Northeast India. Mukherjee *et al*. (1979) recorded heart girth to be 63.9 ± 0.2 cm for 1 to 3 years of age in brown type Black Bengal goat.

The overall mean height at withers in adult Black Bengal does was estimated in this study to be 16.452 ± 0.152 inches. The research result of height at wither found in the present investigation was comparable with earlier research work. Mukherjee *et al*. (1979) who recorded height at withers as 55.2 ± 0.38 cm for brown type Black Bengal goat irrespective of sex and Acharya (1982) also found also higher height at withers of 55.4 ± 0.18 cm and 49.3 ± 0.24 respectively in Black Bengal and Assam type Bengal goats. Khargharia et al. (2015) also recorded the height at wither of the female Assam Hill goat of Northeast India (2 to 4 years of age) as 54.57 ± 0.57 cm. Higher values of height at withers were reported in Black Bengal (49.44 ± 2.15 cm), Ganjam (79.03 ± 0.11 cm) goats (Paul *et al*. 2011, Rao *et al*. 2009). Our estimated result from the present study almost lower values of height at wither than with the earlier reports on Black Bengal.

In this investigation the overall mean body weight of adult Black Bengal does was estimated as 14.306 ± 0.159 kg. The research finding for body weight in this study may be compared with the earlier research work available in the literature. The estimate of overall adult body weight of the present investigation contrary the findings of Acharya (1982) who reported 12.08 ± 0.10 kg body weight in 12 months irrespective of sex in Black Bengal goat. Anon (1989) found adult female weight of Black Bengal goat between 8.4 to 13.5 kg. Acharya (1982) reported mean body weight was 14.49 kg for brown colour variety and 13.35 kg for white colour variety irrespective of sex at 12 months of age in Bengal goat which were in accordance with present finding. Khargharia *et al*. (2015) reported the average body weight was 24.86 ± 0.80 kg of 2 to 4 years of age of Assam Hill goat of Northeast India. Naderi *et al*. (2008) recorded mean weight at 1st kidding was 15.41 ±1.35 kg of Black Bengal goat reared in the semi-intensive system. Paul *et al*. (2011) reported the body weight of Black Bengal does at 12^{th} month of age as 12.40±0.41 kg. The mean body weight of Black Bengal and Jamnapari does was 14.65±2.84 kg and 30.4±9.08 kg, respectively under semi-intensive system in Bangladesh as reported by Miah *et al*. (2016). The result of this investigation recorded lower body weight for all colour varieties of Black Bengal goat, might be due to that these findings are from the farmers door and the earlier reports are based on farm records or sample size.

CONCLUSION

Research finding of this investigation depicted that Black Bengal does having TfCC phenovariant perform better for all physical trait except height at withers. For this trait, does having TfBC phenovariant performed better. Hence, the TfCC and TfBC in Black Bengal does are acted mostly for adaptation on this ecological and environmental condition of West Bengal and these phenovariants can be used for marker assisted selection in breeding programme. By using of these markers, the productive performance of Black Bengal goats may be increased at satisfactory level. Even so, detailed works on large number samples in native goat of in Black Bengal is required in order to obtain a more definite conclusion.

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