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Research Article

Correlation between Different Phenotypic Traits and Nutritional Status in Murrah Buffaloes in Different Districts of Uttar Pradesh

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ABSTRACT

The objective of present study was to determine the relationship of the nutritional status of graded Murrah buffaloes with certain morphometric parameters like body weight, body surface area, and examine test day milk yield through survey in Uttar Pradesh state of India. Data on body measurements, feeding practices, and milk production of 2198 rural graded Murrah buffaloes between three to eight years of age belonging to 2019 farmers from 1587 villages were recorded in the five districts of Uttar Pradesh during the period from 2009 to 2013. Body surface area was measured by two methods viz.Measurement tape and 2D photographic image using BIOVIS PSM_L1000 software. Body condition scores, body surface area, body size, total feed intake was also recorded. Requirements and intake of dry matter, crude protein and total digestible nutrients was estimated using standard calculations based on the feeding system followed and nutrient contents of the fed feed and fodder components. The mean of body surface area, body weight, and test day milk yield were 3.40 ± 0.22 sq.mtrs, 268 ± 30.37 kg and 6.35 ± 1.01 litre respectively. District wise variation was highly significant for body surface area, body weight, and test day milk yield. The average total feed intake was 12.79 ± 0.02 kg. The means of actual intake of dry matter, crude protein and total digestible nutrients were 8.09 ± 2.17, 1.04 ± 0.34, and 5.28 ± 1.62 kg respectively against their respective expected requirement for dry matter, crude protein and total digestible nutrients content as 9.81 ± 0.91, 0.91 ± 0.10 and 4.96 ± 0.46 kg respectively. It was concluded that, graded Murrah buffaloes reared in rural areas of five districts of Uttar Pradesh were deficient in intake of dry matter and crude protein, however total digestible nutrients fed in excess than expected requirement with correlation between other different traits like body condition scores, body surface area, body size and body weight.

Keywords: *Graded Murrah buffalo, Body surface area, Nutritional status.*

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INTRODUCTION

India is emerged as the largest milk producing country with the highest livestock population in the world with annual milk production of 187.7 million ton (All India (Provisional) Annual Estimate of Milk, Egg, Meat & Wool production 2018-2019). Among the states, Uttar Pradesh is one of the major contributors of milk production in the country. Annual milk production of Uttar Pradesh is about 25.19 million tonnes which contributes 17.26 % in national milk production in the year 2014-15 (Tulika et al., 2017). Production performance of buffaloes is directly correlated with the nutrition and management practices**.** Buffaloes are resistant to diseases, environmental conditions and has capable digestive system of effectively converting poor quality feed into milk and meat with low cost of production. However, feeding of inadequate and unbalanced diet lead to drop in productivity which results in significant economic losses. Nutrition, in particular, remains the most critical constraint to increase animal productivity with the perpetual gap between demand and supply of digestible crude protein and total digestible nutrients (ILRI Report, 1995). The difference between availability and quality of feedstuffs in different seasons of various locations is one of the reasons leading to nutrient shortages or surpluses (Jarial et al., 2013). Animal feeding is based on certain standards that take into account the physiological needs for specific functions of maintenance, growth, and production.

Thus, the present study was carried out to understand the nutritional status of graded Murrah buffaloes fed under different feeding practices different districts of Uttar Pradesh and to study the effect of various nutrients influencing the body condition scores (BCS), body surface area (BSA), body size (BS).

MATERIAL AND METHODS

A data of 2198 graded Murrah buffaloes of 3 to 8 years of age maintained by 2019 farmers spread over in 1587 villages of five districts comprising within different Agro-climatic zones viz. Allahabad and Raebareilly (Central Zone), Azamgarh and Faizabad (Eastern Plain Zone), Gorakhpur (North Eastern Pain Zone) of Uttar Pradesh were recorded through a field survey. The feeding practices followed by farmers were grouped into four categories viz. use of readymade concentrate mixture, homemade concentrate mixture, wheat bran (Chocker) along with green monocot fodder like Bajra, Berseem, Hari ghas, Sugarcane and Green dicot fodder like Arhbar, Chana, Puwal, Masur, Udid and dry fodder like Bhusa, Khali, Wheat straw etc. During the survey, the test day milk yield was recorded for individual milking animals. Also, the records of the amount of daily intake of dry matter (DM), crude protein (CP) and total digestible nutrients (TDN) were calculated on the basis of average nutritive values of the feed and fodders consumed (Ranjhan, 2001). Approximate body condition of the animals was recorded and subjectively graded as good, normal, poor while body size as large, medium, small with the help of 2 D photographic image which was taken by digital camera (with a resolution of 640 x 480 pixels). A cloth patch measuring 2 x 2 inches was fixed on body surface of animal while taking the photograph (Gokhale et al., 2015). Using photographic image and computer software BIOVIS PSM_L1000, body measures like chest girth, body length and height at withers were estimated. Farmers were grouped according to their main profession as agriculture, business, dairy, and service. Body weight estimated as per Rath et al. (2003), Body surface area (BSA) was calculated using approach suggested by Hurnik et al. (1991) and adopted by Gokhale et al. (2015). The least square analysis was carried to estimate effect of region (district), body condition, body size, farmer's profession and feeding practices on intake of nutrients like dry matter, crude protein, total digestible nutrients as well as total feed intake. The data was statistically analysed using R Package and standard statistical procedures as per Snedecor and Cocharan (1994). The data was subjected to analysis of Variance (ANOVA).

RESULTS AND DISCUSSION

Least squares mean of body weight, body condition scores (BCS), body size (BS), test day milk yield (MY) of graded Murrah buffaloes from different districts and farmer's professions are presented in Table 1.

The mean for body weight (kg) of buffaloes in different areas like Allahabad, Azamgarh, Faizabad, Gorakhpur, Raebareilly were 261.33±7.10, 277.01±6.98, 259.85±7.23, 284.11±7.55 and 257.85±7.30, respectively. Also observed that, Body Size wise (as Large, Medium and Small based on the visual and physical criteria) body weight (kg) were 272.50±7.22, 269.53±6.81 and 262.05±7.12 respectively. The overall body weight of the buffaloes was 268.03±30.37 kg. There was a significant difference ($P<0.05$) in body weights among the buffaloes of all regions with a criteria of different body size of the animals which may be because of different feeding systems followed in different regions.

The Least Square mean for body surface area (BSA) of 2198 female graded Murrah buffaloes was observed as 3.41 ± 0.10 sq. Mtrs. The estimates observed in the present investigation were similar to those reported by, Gokhale et al. (2015), less than those reported by C. Buranakarl et al. (2012) and while higher means were reported by Hurnik et al. (1991) and Napolitanoa et al. (2004). The mean for Test day milk yield (MY) of buffaloes (kg) at the area of Allahabad, Azamgarh, Faizabad, Gorakhpur, Raebareilly were 6.38±0.23, 6.89±0.23, 6.40±0.23, 6.25±0.25 and 5.85±0.24, respectively. Also, Body condition score (BCS) wise (as Good, Normal and Poor), Test Day Milk Yield (MY) of graded Murrah buffaloes (kg) were 6.16±0.23, 6.43±0.22 and 6.47±0.24 respectively. The overall Test Day Milk Yield (MY) of the buffaloes was 6.35±1.00 kg. There was a significant difference ($P<0.05$) for Milk Yield (MY) of among the buffaloes of all region's farmers. The milk estimates observed in the present investigation were in accordance with the reports of similar to those reported by, Thiruvenkadan (2014), while lower means were reported by Vidya Sagar et al. (2013) and higher estimates reported by Singh (2008).

Nutritional Status of Murrah Buffaloes:

Least square mean feed intake (kg) was observed as 12.79 ± 4.18 (Table 1). Nutrient's intake for dry matter (DM), crude protein (CP) and total digestible nutrients (TDN) and their adequacy in terms of the excess or deficit are presented in Table 2. The body weight of the buffaloes ranged between 200-700 kg in surveyed area which was similar to Singh (2008).

The average daily intake of dry matter (DM) in kg was observed as 8.09 ± 0.09 against the required 9.82 ± 0.04 with deficit of 1.73 kg for an adult buffalo which indicated that the buffaloes were fed with less dry matter than their requirement in these districts of Uttar Pradesh. The reason for the deficit in dry matter intake could be imbalanced and unorganized feeding system followed in the field level. The required dry matter intake (kg) was found significant in Azamgarh (10.31±0.07) area as compared to other regions. The required dry matter intake in Allahabad and Faizabad area was similar. The intake of dry matter was found significant in Faizabad district (9.11±0.17) as compared to other districts with lower means in Allahabad district (7.54±0.17) and highly significant to each other in five districts. The data revealed that the maximum dry matter deficiency was noticed in Gorakhpur (-2.16±0.18 kg) while it was not found in excess DM supplied though intake. In case of lactating buffaloes in all the regions dry matter intake was deficient similar to Singh (2008).

The required crude protein (CP) in kg was significantly higher in Azamgarh district (0.98±0.01) compared to other four districts. The intake of CP was significantly higher in Faizabad (1.14±0.03) district as compared to other four districts. The overall required, intake and deficit crude protein (kg) content for all districts were 1.04 ± 0.02, 0.91 ± 0.01 and -0.13 ± 0.02 respectively which indicated that there was a deficit of crude protein (CP) content through feeding. Data revealed that required total digestible nutrients (TDN) content was 4.96 ± 0.02kg in different regions with nonsignificant to each other within five

different districts whereas intake of total digestible nutrients (TDN) was 5.14 ± 0.02kg in different regions with highly significant to each other. Total digestible nutrient (TDN) content was not found significant (P>0.05) in consideration with other traits such as body condition, body size and profession of Farmer. Intake of total digestible nutrients (TDN) was found in sufficient quantity (0.18 ± 0.03) kg as per required quantity in all districts which means total digestible nutrients (TDN) fed in adequate quantity in all districts. Similar to present observations, Verma et al. (1987) and Baxi (1999) reported that milking buffaloes were deficit in dry matter (DM), crude protein (CP), whereas total digestible nutrients (TDN) availability in adequate quantity. Contrary, Raut and Amble (1969) observed that the non-descript milking buffaloes in sub-urban areas of New Delhi found to be overfed in terms of DCP and TDN. In eastern Uttar Pradesh, lactating buffaloes were fed less amount of DCP and TDN (Lal et al., 1998; Singh et al., 1998) and more amount of TDN to dry buffaloes (Singh et al., 1998). Moreover, Randhe et al. (1993) reported that DM and DCP was less while TDN was more supplied to buffaloes in Parbhani district of Maharashtra.

Table 1: Result of Body weight, BSA, Test Day Milk Yield and Total Feed Intake of Murrah Buffaloes

District	Body weight (kg)	BSA	Milk Yield (kg) (kg)	Total Feed Intake
ALLAHABAD	261 .33± 7.10^{a}	3.33 ± 0.05^{a}	6.38 ± 0.23^{a}	10.57 ± 0.97^{a}
AZAMGARH	277 .01± 6.98^{b}	3.46 ± 0.05^{b}	6.89 ± 0.23^{b}	11.23 ± 0.96^{a}
FAIZABAD	259 .85 ± 7.23^{a}	3.34 ± 0.05^{ab}	6.40 ± 0.23^{a}	15.72 ± 0.99^{b}
GORAKHPUR	284 .11 ± 7.55^{cb}	3.50 ± 0.05^{bc}	6.25 ± 0.25^{c}	13.24 ± 1.04^{cd}
RAEBAREILLY	257.85± 7.30^{a}	3.32 ± 0.05^{ab}	5.85 ± 0.24^{ad}	13.16 ± 1.00^{d}
Body Condition				
GOOD	270.57 ± 6.95	3.41 ± 0.05	6.16 ± 0.23^{a}	12.92 ± 0.95
NORMAL	265.24 ± 6.86	3.37 ± 0.04	6.43 ± 0.22^{b}	13.08 ± 0.94
POOR	268.28 ± 7.35	3.39 ± 0.05	6.47 ± 0.24^{bc}	12.36 ± 1.01
Body Size				
LARGE	272.50 ± 7.22^{a}	3.41 ± 0.05	6.38 ± 0.23	12.41 ± 0.99^{a}
MEDIUM	269.53 ± 6.81^{a}	3.40 ± 0.04	6.32 ± 0.22	13.08 ± 0.94^{a}
SMALL	262.05 ± 7.12^{b}	3.35 ± 0.05	6.36 ± 0.23	12.36 ± 1.01^{b}
Profession				
AGRICULTURE	271.44 ± 3.04	3.43 ± 0.05	6.46 ± 0.10	12.04 ± 0.41^{a}
BUSSINESS	273.98 ± 6.82	3.41 ± 0.06	6.44 ± 0.22	11.65 ± 0.94^{a}
DAIRY	273.01 ± 9.46	3.44 ± 0.06	6.46 ± 0.31	15.02 ± 1.30^{b}
LABOUR	256.31 ± 28.41	3.27 ± 0.20	5.75 ± 0.94	11.83 ± 3.91^{ac}
SERVICE	265.41 ± 5.22	3.39 ± 0.03	6.66 ± 0.17	13.40 ± 0.72^{ac}
Grand Total	268.03 ± 30.37	3.41 ± 0.10	6.35 ± 1.00	12.79 ± 4.18

Table 2: Nutritional Status of Animals: The Nutrient Intake, requirement and Deficit/Excess (kg)

Parameters	DM (kg)				CP (kg)			TDN (kg)		
District	**No. of Animals**	**Required**	**Intake**	**Excess-Deficit**	**Required**	**Intake**	**Excess-Deficit**	**Required**	**Intake**	**Excess-Deficit**
ALLAHABAD	518	9.63±0.06^{a}	7.54±0.17^{a}	-2.09±0.18^{a}	0.86±0.02^{a}	0.91±0.01^{a}	-0.03 ± 0.08^{a}	4.92±0.03^{a}	4.52±0.10^{a}	-0.39±0.11^{a}
AZAMGARH	623	10.31±0.07^{b}	8.28±0.19^{b}	-2.03±0.21^{a}	1.05±0.03^{b}	0.98±0.01^{b}	0.07±0.03^{b}	5.25±0.03^{b}	5.35±0.14^{b}	0.09±0.15^{b}
FAIZABAD	464	9.64±0.07^{a}	9.11±0.17^{c}	-0.52±0.18^{b}	1.14±0.03^{c}	0.92±0.01^{a}	0.21±0.03^{c}	4.95±0.03^{a}	5.81±0.14^{c}	0.86±0.14^{c}
GORAKHPUR	224	10.03±0.13^{c}	7.86±0.15^{a}	-2.16±0.18^{a}	0.97±0.02^{bd}	0.92±0.01^{a}	0.05±0.02^{d}	5.01±0.04^{a}	5.01±0.11^{b}	0.06±0.12^{bcd}
RAEBAREILLY	369	9.27±0.08^{d}	7.74±0.15^{a}	-1.53±0.18^{a}	0.95±0.02^{ad}	0.86±0.01^{c}	0.09±0.03^{e}	4.72±0.03^{c}	4.98±0.13^{e}	0.25±0.14^{e}
Body Condition	**No.of Animals**	**Required**	**Intake**	**Excess-Deficit**	**Required**	**Intake**	**Excess-Deficit**	**Required**	**Intake**	**Excess-Deficit**
GOOD	763	9.74 ± 0.21	8.08 ± 0.49	-1.65 ± 0.54	1.02±0.07	0.90±0.02	0.12±0.08	4.90±0.10	5.24±0.37	0.34±0.38
NORMAL	1050	9.80 ± 0.20	8.31± 0.49	-1.48 ± 0.53	1.05±0.08	0.93±0.02	0.13±0.08	4.97±0.10	4.97±0.36	0.38±0.38
POOR	385	9.89 ± 0.22	7.86 ± 0.52	-2.02 ± 0.56	1.04±0.08	0.93±0.02	0.11±0.08	5.01±0.11	5.65±0.38	0.20±0.41
Body Size	**No.of Animals**	**Required**	**Intake**	**Excess-Deficit**	**Required**	**Intake**	**Excess-Deficit**	**Required**	**Intake**	**Excess-Deficit**
LARGE	524	9.91 ± 0.21^{a}	7.94 ±0.51^{a}	-1.96 ± 0.55^{a}	1.03±0.08	0.92±0.02	0.11±0.09^{a}	4.99±0.11	5.21±0.38^{a}	0.21±0.40^{a}
MEDIUM	1174	9.82 ± 0.20^{a}	7.69 ± 0.48^{a}	-2.13 ± 0.52^{a}	0.98±0.07	0.91±0.02	0.06±0.08^{a}	4.96±0.10	4.97±0.36^{a}	0.03±0.38^{a}
SMALL	500	9.69 ± 0.21^{b}	8.63 ± 0.50^{b}	-1.06 ± 0.55^{b}	1.11±0.08^{b}	0.91±0.03	0.19±0.08^{b}	4.93±0.10	5.65±0.38^{b}	0.71±0.39^{b}
Proffession	**No.of Animals**	**Required**	**Intake**	**Excess-Deficit**	**Required**	**Intake**	**Excess-Deficit**	**Required**	**Intake**	**Excess-Deficit**
AGRICULTURE	1908	9.96 ± 0.09	7.61 ±0.21	-2.34 ± 0.23	0.94±0.03	0.93±0.01	0.01±0.03	5.03±0.04	4.85±0.16	-0.18±0.17
BUSSINESS	83	10.01 ± 0.20	7.78 ±0.48	-2.22 ± 0.52	0.94±0.07	0.93±0.02	0.01±0.08	5.04±0.10	4.76±0.36	-0.28±0.38
DAIRY	40	9.99 ± 0.28	8.57 ±0.67	-1.41 ± 0.73	1.00±0.10	0.93±0.03	0.06±0.11	5.04±0.14	5.19±0.50	0.14±0.52
LABOUR	4	9.13 ± 0.85	7.88 ±2.02	-1.25 ± 2.19	1.22±0.32	0.84±0.10	0.38±0.33	4.61±0.43	6.00±1.44	1.37±1.59
SERVICE	163	9.96 ± 0.15	8.59 ±0.37	-1.35 ± 0.40	0.90±0.05	0.94±0.01	0.14±0.06	5.07±0.07	5.59±0.28	0.51±0.29
Grand Total	**2198**	**9.82 ± 0.04**	**8.09 ±0.09**	**-1.73 ± 0.09**	**1.04 ± 0.02**	0.91 ± 0.01	**-0.13 ± 0.02**	**4.96 ± 0.02**	**5.14 ± 0.02**	**0.18 ± 0.03**

Dissimilar superscripts indicates significant (P<0.01) differences of means

CONCLUSION

The study concluded that there was highly significant variation for different traits in graded Murrah buffaloes like body weight (BW), body size (BSA) and test day milk yield (MY) within five different districts of Uttar Pradesh. It was also concluded that based on different traits like body condition score (BCS), body size (BS) like large, medium and small, graded Murrah buffaloes from all rural areas of five districts were deficient in dry matter (DM) and crude protein (CP) intake. However total digestible nutrients (TDN) intake was found with adequate within five different districts of Uttar Pradesh. Graded Murrah buffaloes from all surveyed area exhibited a deficiency of important nutrients like dry matter (DM), crude protein (CP) except total digestible nutrients (TDN) intake. It is indicating that based on the correlation between other different phenotypic traits like body condition scores (BCS), body surface area (BSA), body size (BS), body weight, there were different nutritional status of graded Murrah buffaloes in five districts of Uttar Pradesh by following different feeding systems. In view of the scarcity of green fodder and high cost of concentrates as well as imbalanced feeding, use of unconventional feeds in balanced diet with supplementation of mineral mixture might be beneficial to improve the nutritional status of the graded Murrah buffaloes in surveyed five districts of Uttar Pradesh. There is further scope for improvement in production of graded Murrah Buffaloes by feeding the balanced diet as per recommended feeding standards in India.

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