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Status of nutritional practices for domestic cows in rural ecology of north-western Indo-Gangetic plains

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ABSTRACT

Data congregated on 150 households from 15 ecosystems in rural area of Baghpat district of north-western Indo-Gangetic plains. The overall body weight of cows was 376.1 ± 8.8 kg and overall daily milk yield was 4.76 ± 0.08 kg. On an average, a cow requires 9.4 ± 0.09 kg dry matter daily; whereas, only 8.46 ± 0.07 kg dry matter could be supplied leaving a 10 % deficiency of dry matter, which was significantly affected by the lactation order. The daily digestible crude protein (DCP) availability to a cow were 0.47 ± 0.008 kg and 0.43 ± 0.005 kg indicating a deficiency of 0.04 kg DCP/ day/ cow. The requirement as well as availability of DCP for cows was affected significantly by lactation order. The requirement and availability of total digestible nutrients (TDN) were 4.47 ± 0.10 kg and 3.96 ± 0.05 kg/day for cows, showing a deficiency of 8.85 %. The lactation order and herd size affected significantly the requirement as well as the availability of TDN for cows.

Key words: Cows, DCP, Ecology, Herd size, Households, Indo-Gangetic plains, Nutritional practices, TDN

The cows are important for milk production and contribute approximately 43 % to the total milk production (Aneja *et al*. 2002). The daily per capita availability of milk has increased to 290 g/day during 2011-12 (LOK SABHA QUESTION NO 251 ANSWERED ON 27.08.2013) which is higher than 280 g as recommended by Nutritional Advisory Committee of ICMR. The total crossbred cows in Uttar Pradesh were 791,170 producing 1140,785 tonne of milk annually in 2011-12. Sahiwal and crossbred cows are getting popular in rural areas also because they maintain their milk yield in summer when the buffalo milk output drops to the extent of 50 %, causing an imbalance in milk availability. Thus, the crossbred cows and buffaloes are the balance wheel of the Indian dairy industry and for this reason rural milk producers have started laying emphasis on rearing crossbred cows as well.

Better breeding, nutrition and veterinary care can help to reduce inter-calving period, thus increasing the overall milk output. This would result in the production of improved cows. Considering this background, present study was aimed to assess the nutritional status of cattle.

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MATERIALS AND METHODS

The data on different characters of 224 cows were collected from the rural area of Baghpat district of western Uttar Pradesh. Cows are bred naturally as well as by artificial insemination. The animals are housed on *kutcha* as well as *pucca* floor and sheds. The cows are hand milked twice daily in the morning and evening. No weaning is being practiced and hence the calves are allowed to suckle their dams before as well as after milking.

The cows are stall fed by putting in the mangers mostly the chopped dry and green fodders available in different months of the year. The green fodders are farm grown by most of the farmers' categories except landless labourers who either purchase the green fodders or arrange from the wastelands either by cutting or scrapping the green grasses. The green and dry fodders are also purchased as and when required. The concentrates fed mostly include the grains, *choker*, mainly mustard oilcake. In most of the cases, the concentrates are purchased from the market. The concentrates are mostly fed before milking.

The sick cows are treated either by calling the expert at home or by taking them to the veterinary hospital depending on the type and severity of the health disorder. The sheds are cleaned daily to remove the dung a number of times during day hours and in morning. The cows are not washed / bathed daily but after a number of days as and when required. The block-wise selected villages along with the number of milch cows (224) are as follows: blocks Baraut (villages- Dhikana, 15, Jonmana,15, Barauli, 14, Sinauli,

16, Baoli,13); Chhaprauli (villages-Rathora 14, Silana, 13, Hewa,15, Luhara,14, Bachhor, 16), and Binauli (villages-Binauli, 17; Sirsali, 14; Jiwana, 14; Daha,15). These three blocks of the district were selected randomly for the purpose to fulfill the objectives of the study.

A list of villages having adequate number of milch cows maintained by the farmers of different categories based on their landholding was prepared by consulting the veterinary hospitals in the block. Five villages, from this list, of each block were randomly selected forming a total of 15 villages in the district.

Finally, a list of farmers / families having milch cows was made. A total of 10 respondents / households from each selected village were selected randomly. Thus, a total of 150 households formed the basis of this investigation.

Classification of cows into various groups: The cows were classified according to the herd size groups on the basis of the number of cows (1, 2 and 3 cows) reared by the farmers, economic groups of farmers based on their landholding and the lactation number to which the cow belonged as under :

Classification	Cows	
	No. of families	No. of cows
Herd size		
One milch cow	91	91
Two milch cows	44	88
Three milch cows	15	45
Landholding size (acres)		
No land (Landless)	43	56
Marginal (0.1 – 1.0)	36	53
Small (1.1 – 2.5)	30	45
Medium (2.6 – 5.0)	26	40
Large (5.1 and above)15	30	
Lactation order		
I	–	46
II	–	57
III	–	60
IV	–	61
Total	150	224

The survey study was made through planned questionnaires by interviewing the selected 150 households of the study area comprising 15 villages of 3 blocks for whole lactation period to get available the required information.

Recording of observations

The procedures used to record the observations on different aspects were as under.

Nutrient requirement of animals: The requirement of dry matter (DM), digestible crude protein (DCP) and total digestible nutrients (TDN) were estimated. The requirement for DCP and TDN is calculated for maintenance as well as for production purpose. The maintenance requirement is calculated on live weight basis. The extra amount of DCP and TDN is required for the animals in milk and is calculated on the basis of daily milk yield and fat present in milk. The amount of DCP and TDN per kg milk produced, which is added in maintenance requirement of DCP and TDN.

Nutrients availability to animals: The amount of dry matter, DCP and TDN supplied to the animals through feeding them the various fodders (green and dry) and concentrates were calculated according to Sen and Ray (1971).

Statistical analysis of data: The data collected on different characters of cows were subjected to statistical analysis. The analysis of variance was conducted using the following mathematical model:

$$Y_{ijkl} = \mu + P_i + H_j + L_k + e_{ijkl}$$

where, Y_{ijkl}, The observations recorded on lth cow belonging to ith parity; jth herd size and kth land holding; μ, overall mean of the character; P_i, effect of i^{th} parity order (i = 1 to 4); H_j, effect of j^{th} herd size (j = 1 to 3); L_k, effect of k^{th} land holding (k = 1 to 5); e_{ijkl} , random error.

RESULTS AND DISCUSSION

Nutrient status: The nutrient status for dry matter (DM), digestible crude protein (DCP) and total digestible nutrients (TDN) was taken in terms of the requirement of nutrients for different groups of cows, the nutrients supplied through roughages (green and dry) and concentrates, and the differences between nutrient requirement and their availability (nutrient status as deficient or surplus). The results of average values are presented in Tables 2 to 5.

The nutrient requirement for cows was estimated taking into consideration the maintenance (body weight) and production level (milk yield and fat %) of the cows. The average body weight and average daily milk yield of cows have been presented in Table 2. This information was used to estimate the maintenance and production requirement of nutrients for cows of different categories.

Dry matter status – requirement and availability: The data presented in Table 2 showed that recommended allowance for dry matter / day / cow was 9.40 ± 0.09 kg. The dry matter made available to the cows through feeds and fodders was 8.46 ± 0.07. Cows did not receive the required amount of dry matter. On an average, the ration of cows was deficit for DM by 10 , thus the cows remained underfed, which definitely affected their production performance. Deficiencies of DM were reported by Badal and Dhaka (1998) for cows and Tiwary *et al.* (2007) for cattle and buffaloes. Lall *et al.* (1999, 2000) could not find any deficiency of DM in the ration of buffaloes.

The dry matter requirement for the cows belonging to different lactations varied from 8.00 ± 0.17 kg for heifer calvers to 10.00 ± 0.19 kg for older cows of fourth lactation. Statistically these differences in dry matter requirement were significant. It was further observed that the dry matter availability was less than required allowances and this was true for cows of all the lactations. The dry matter was more

Table 2. Average body weight (kg) and average daily milk yield (kg)

Effects	Cow	Effect	Cow
Lactation order		Lactation order	
I	320.0 ± 16.04 (46)	I	3.77 ± 0.14 (46)
II	381.2 ± 17.67 (57)	II	4.80 ± 0.16 (57)
III	390.1 ± 17.64 (60)	III	5.20 ± 0.16 (60)
IV	400.0 ± 17.41 (61)	VI	5.05 ± 0.17 (61)
Herd size		Herd size	
One	378.4 ± 13.48 (91)	One	4.73 ± 0.13 (91)
Two	376.8 ± 13.65 (88)	Two	5.16 ± 0.15 (88)
Three	370.2 ± 19.32 (45)	Three	4.06 ± 0.16 (45)
Land size		Land size	
Landless	372.0 ± 16.90 (56)	Landless	4.42 ± 0.16 (56)
Marginal	376.2 ± 17.64 (53)	Marginal	4.95 ± 0.18 (53)
Small	378.1 ± 20.03 (45)	Small	5.07 ± 0.21 (45)
Medium	380.2 ± 20.45 (40)	Medium	4.76 ± 0.20 (40)
Large	375.3 ± 22.24 (30)	Large	4.60 ± 0.22 (30)
Overall	376.1 ± 8.8 (224)	Overall	4.76 ± 0.08 (224)

Figures in parenthesis are the number of animals.

Table 3. Average DM requirement, availability (kg/day) and status for cows

Effects	No. of observations	Requirement (kg/day/animal)	Availability	Status (% short)
Lactation order				
I	46	8.00 ± 0.17	6.90 ± 0.82	13.75
II	57	9.53 ± 0.15	8.53 ± 0.14	10.49
III	60	9.75 ± 0.16	8.85 ± 0.15	9.23
IV	61	10.00 ± 0.19	9.20 ± 0.17	8.00
Herd size				
One	91	9.46 ± 0.13	8.56 ± 0.11	10.57
Two	88	9.42 ± 0.10	8.54 ± 0.12	9.34
Three	45	9.25 ± 0.20	8.10 ± 0.17	12.43
Land size				
Landless	56	9.30 ± 0.18	8.40 ± 0.15	9.67
Marginal	53	9.40 ± 0.18	8.50 ± 0.14	9.57
Small	45	9.45 ± 0.21	8.55 ± 0.15	9.52
Medium	40	9.50 ± 0.20	8.70 ± 0.17	8.42
Large	30	9.38 ± 0.21	8.58 ± 0.22	8.52
Overall	224	9.40 ± 0.09	8.46 ± 0.07	10.00

deficient for younger cows as compared to older cows. The analysis of variance has indicated that the availability of dry matter was significantly affected by lactation order.

It was evident from the data of Table 3 that the dry matter requirement and its availability through feeds and fodders remained unaffected due to herd size. This was because of lesser number of animals kept by the farmers and hence there was equal distribution of feeds and fodder to all the cows whether farmers kept 2 or 3 cows. However, the supply of dry matter was insufficient to the cows irrespective of herd size.

The dry matter requirement of cows kept by different categories of farmers ranged from 9.30 ± 0.18 kg for those kept by landless farmers to 9.50 ± 0.20 kg for the cows maintained by medium size farmers. The range in availability of dry matter for the cows kept by different groups of farmers was also very less (8.40 ± 0.15 kg to 8.70 ± 0.17 kg). It was further observed that dry matter availability remained short / deficient than recommended level and this was true for the cows kept by different groups of farmers. However, statistical analysis of data revealed that the differences in dry matter requirement as well as in availability were not significant due to landholding size.

Digestible crude protein (DCP) status – requirement and availability: The data on the requirement and availability of DCP are presented in Table 4. Cows require, on an average, 0.47 ± 0.008 kg DCP; whereas, the amount of DCP made available through feeds and fodders given to the cows was 0.43 ± 0.005 kg (Table 4), which indicated a deficiency of 0.04 kg DCP / day / cow. This, deficiency indicated that

Table 4. Average DCP requirement, its availability (kg/day) and status for cows

Effects	No. of Observations	Requirement (kg/day/animal)	Availability	Status (% short)
Lactation order				
I	52	0.69 ± 0.02	0.63 ± 0.016	8.69
II	73	0.74 ± 0.02	0.69 ± 0.014	6.75
III	75	0.83 ± 0.03	0.77 ± 0.016	7.23
IV	50	0.83 ± 0.03	0.77 ± 0.020	7.23
Herd size				
One	77	0.76 ± 0.02	0.73 ± 0.015	3.95
Two	92	0.78 ± 0.01	0.72 ± 0.014	7.70
Three	81	0.77 ± 0.02	0.70 ± 0.014	9.10
Land size				
Landless	45	0.73 ± 0.03	0.64 ± 0.017	12.33
Marginal	41	0.77 ± 0.03	0.71 ± 0.021	7.79
Small	55	0.77 ± 0.02	0.72 ± 0.017	6.50
Medium	56	0.79 ± 0.03	0.75 ± 0.019	5.06
Large	53	0.80 ± 0.03	0.76 ± 0.019	5.00
Overall	250	0.77 ± 0.015	0.71 ± 0.008	7.80

Table 5. Average TDN requirement, availability (kg/day) and status of cows

Effects	No. of Observations	Requirement (kg/day/animal)	Availability	Status (% short)
Lactation order				
I	46	3.76 ± 0.17	3.26 ± 0.09	13.29
II	57	4.18 ± 0.19	3.58 ± 0.10	14.35
III	60	4.78 ± 0.20	4.38 ± 0.12	8.37
IV	61	4.83 ± 0.17	4.43 ± 0.12	8.28
Herd size				
One	91	4.52 ± 0.16	4.32 ± 0.95	4.42
Two	88	4.52 ± 0.17	4.02 ± 0.00	11.06
Three	45	4.22 ± 0.16	3.62 ± 0.10	14.20
Land size				
Landless	56	4.40 ± 0.19	3.90 ± 0.112	11.36
Marginal	53	4.40 ± 0.18	3.80 ± 0.115	13.63
Small	45	4.64 ± 0.20	4.14 ± 0.129	10.77
Medium	40	4.60 ± 0.20	4.20 ± 0.14	8.70
Large	30	4.53 ± 0.20	4.13 ± 0.16	8.83
Overall	224	4.47 ± 0.10	3.96 ± 0.05	8.85

the cows were underfed either due to lack of knowledge of the farmers to meet DCP requirement as no specific feeding schedule is prepared by the farmers or there may be inadequate availability of feeds and fodders with the farmers. Similar results of deficiency of DCP in the ration were reported by Badal and Dhaka (1998) for local and crossbred cows; Mohan and Methews (2004) and Tiwary *et al.* (2007) for cattle and buffaloes; Badal and Dhaka (1998), Lall *et al.* (2000). The DCP requirement of cows in the first lactation was 0.39 ± 0.015 kg / day / cow, which increased to 0.48 ± 0.017 kg for second calvers and 0.51 ± 0.017 kg for those belonged to third and fourth parity of lactation. On subjecting the data to statistical analysis, it was found that requirement of DCP for first calvers was significantly less than cows of subsequent parity of lactation (Table 7). The availability of DCP for cows belonging to first parity was also less than the cows of subsequent lactations and the variability was statistically significant. Further, it was observed that cows of all the lactations remained deficient for DCP.

The dry matter requirement of cows kept in different herd size varied from 0.45 ± 0.02 kg for those kept in a herd of 3 cows to 0.49 ± 0.015 kg for those kept in a herd of 2 cows. However, these differences were not statistically significant. The amount of DCP made available varied from 0.40 ± 0.011 kg for cows of 3 animals to 0.44 ± 0.08 kg for

those kept single or in a group of 2 cows, but this variability was not statistically significant. It was also found that in cows remained deficient for their DCP requirement either they are kept singly or in-group of 2 or 3 animals.

The perusal of data presented in Table 4 further indicated that requirement of DCP for cows maintained by the farmers of different landholdings was 0.44 ± 0.016 kg for the cows kept by landless labourers and it was less than the cows kept by other categories of farmers. Statistically, these differences were not found significant. On the other hand, the availability of DCP through feeds and fodders was significantly influenced by landholdings of the farmers. The cows kept by landless labourers received significantly lesser amount of DCP compared to other categories. However, the cows of all the categories of farmers received less DCP than their requirement.

TDN status – requirement and availability: The results on TDN requirement and availability are presented in Table 5 for cows. The TDN requirement for cows was 4.47 ± 0.10 kg whereas, the availability of TDN for cows was 3.96 ± 0.05 kg. Further, there was a deficit of TDN in the ration of cows. Therefore, the cows could not receive due care of the farmers regarding the feeding of balanced ration. This was due to the allotment of less land to grow fodder crops and to grow more the cash crops as well as the higher cost of green fodders and the concentrates, which are the major sources of supplying the DCP and TDN. Our results corroborated the findings of Badal and Dhaka (1998) for local and crossbred cows, Mohan and Methews (2004) and Tiwary *et al.* (2007) for cattle, who reported deficiency of TDN.

The TDN requirement of cows in the first lactation was lower than in subsequent lactations. This was due to low body weight and low milk production of first calvers. On subjecting the data to statistical analysis, it was found that lactation number had significant effect on TDN requirement of cows; whereas, the availability of TDN was not significantly affected by lactation number. The TDN availability was inadequate than required amount for the cows of all the lactations.

The TDN requirement (Table 5) was low for the cows maintained in herd size of 3 animals and this difference was statistically significant. Similarly, the TDN availability for the cows in herd size of 3 cows was significantly low than other groups of cows as well as these cows were more deficient in TDN. Thus, herd size has significantly affected the requirement and availability of TDN for cows.

The perusal of data presented in Table 5 further showed that size of landholding has no significant effect on requirement and availability of TDN. The TDN requirement as well as availability was less for the cows maintained by landless and marginal farmers than other categories of farmers. It was also further observed that the cows reared by any category of farmers could not get the required amount of TDN.

The overall average body weight of cows was 376.1 ± 8.8 kg. On an average, a cow required 9.4 ± 0.09 kg dry matters daily; whereas, only 8.46 ± 0.07 kg dry matters could be supplied and thus there was deficiency of dry matter to the extent of 10 % of the requirement. The average digestible crude protein (DCP) and its availability to a cow daily were 0.47 ± 0.008 kg and 0.43 ± 0.005 kg indicating a deficiency of 8.51 %. The lactation order affected significantly the requirement as well as availability of DCP for cows. The requirement and availability of total digestible nutrients (TDN) were observed as 4.47 ± 0.10 kg and 3.96 ± 0.05 kg / day for cows with a deficiency of 8.85 %. The lactation order and herd size affected significantly the requirement as well as the availability of TDN for cows. The cows are light eaters. The ration fed to the cows was deficient and hence efforts should be made to make suitable arrangements to supply adequate amount of feeds and fodders for cows to increase their productivity. The farmers faced certain problems particularly inadequate supply of feeds and fodders. Efforts should be made to overcome these problems through Government or NGO's.

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