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Nutritional status of animals in peri-urban dairy complexes in Punjab, India

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ABSTRACT

The study was taken up to assess the nutritional status of dairy animals in peri-urban dairy complexes in Punjab, India. About 24 to 29 dairy houses were selected randomly from each of Ludhiana (LDC), Amritsar (ADC), Jalandhar (JDC), Ferozepur (FDC) and Hoshiarpur (HDC) peri-urban dairy complexes. Buffaloes predominated in almost all peri-urban dairies, except in FDC. The animals of FDC had the lowest (P<0.05) and that of LDC had the highest body weight (478 vs. 572 kg). The milk yield of the animals of LDC was highest (P<0.05), while that of ADC was the lowest (9.65 vs. 5.96 kg/animal/day). The space allocated per adult cattle unit was highest in JDC and lowest in LDC, which was only 42 to 55% of the recommended area of 11.25 m^2/adult cattle unit.

Wheat bran was the most common feedstuffs used in the rations of lactating animals. Non-conventional feed resources like pulses chunni, brewery and starch industry waste played a significant role in peri-urban dairy production system. The CP and EE content in the diet of animals was less than the recommended level to the extent of 28 and 30%, 17 and 32%, 22 and 38%, 13 and 26%, 12 and 4% respectively in JDC, ADC, FDC, LDC and HDC. The NDF content in complete feed was 114 to 144% higher than the recommend level of >28%. The milk urea nitrogen (MUN) was lowest (P<0.05) in animals of FDC (8.1mg/dl) and highest in animals of HDC (20.8mg/dl). About 24, 14, 64, 83 and 50% of the dairy houses of JDC, ADC, FDC, LDC and HDC, respectively, offered DM less than the requirement. The daily consumption of nutrients was over and above the requirements in JDC, ADC and HDC, but less (P<0.05) than the requirement in LDC (22% DM, 18%CP, 15%DCP and 21%TDN) and FDC (5%DM, 8%CP, 11%DCP and 7%TDN). Only 3.6% of the dairy houses of FDC and 25% of the dairy houses of LDC offered mineral mixture to their animals, while mineral mixture was not offered at all in JDC, ADC and HDC. It was concluded that CP and EE content in the diet of the animals was less than the recommended levels in all the peri-urban dairy complexes in Punjab, but the daily consumption of nutrients was less than the requirements, only in LDC and FDC. The farmers need to be motivated to feed nutritionally balanced diet.

Key words: Dairy animals, Nutritional status, Peri urban dairies

In Punjab, 34% of the human population lives in urban area (Anonymous 2007). An ever increasing migration of human population from rural to urban areas has led to increased demand of food, especially milk and milk products in urban area. To meet the demand, seven peri-urban dairy units two each in Jalandhar and Ludhiana and one each in Amritsar, Ferozepur and Hoshiarpur district has been established. In most of these dairy complexes, animals are mainly offered wheat straw and compounded feed, supplemented with or without green fodder. But optimum productive and reproductive efficiency of livestock could be achieved only if the animals receive the required quantity of feed providing all nutrients in proper proportion (NRC 2001) and required management in terms of good health and comfortable environment (Noguera and Abreu 1993, Venkatasubramaniam and Fuizele 1996). But, no information is available regarding nutritional status of animals in the peri-urban dairy units in Punjab. This study was therefore taken up to assess the nutritional status of animals, so that the productive and reproductive performance of dairy animals could be improved by advocating the use of balanced feeding, depending upon the physiological status of dairy animals.

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MATERIALS AND METHODS

For assessing the nutritional status of dairy animals in peri-urban dairy complexes in Punjab, India, about 24 to 29 dairy houses were selected randomly from each of Ludhiana, Amritsar, Jalandhar, Ferozepur and Hoshiarpur peri-urban dairy complexes. Information about livestock holdings and feeding practices was collected by filling up a comprehensive questionnaire. The different categories of animals kept by

the farmers were converted into adult cattle units, i.e. adult lactating buffalo/cow, bullock or adult male buffalo as 1 unit, heifer as 0.75 units and calves as 0.35 units. The heart girth and body length of animals were measured to calculate body weight of animals by using Shaeffered formula (Sastry *et al*. 1994).

The feed and fodder samples (249), on the spot milk and urine samples (552) were collected from at least 2 lactating animals selected at random from each house-hold. The samples of different feedstuffs were dried in a hot air over at 80°C and ground to pass through 1 mm sieve and analyzed for CP, EE (AOAC 1995) and NDF content (Robertson and Van Soest 1981). The milk samples were preserved with sodium azide tablet. The milk samples were centrifuged at 2800 g for 15 min at 4°C to separate the fat layer. The defatted milk was de-proteinized by equal volumes of 3% TCA. Samples were mixed and centrifuged at 21 000 g for 20 min at 4°C. The supernatant was used for the estimation of urea. The urine sample (10 ml) stored in a vial containing 0.5 ml of 20% H_2SO_4 was analyzed for allantoin (Young and Conway 1942), uric acid (Trivedi *et a1*. 1978) and creatinine (Folin and Wu 1919). Purines absorbed were calculated from the daily urinary PD excreted (IAEA 1997). The data were analyzed by simple ANOVA (Snedecor and Cochran 1994) by using the software package SPSS version 12 (SPSS 1996) and differences in mean were assessed by using Tukey's b.

RESULTS AND DISCUSSION

The LDC had the highest number of adult cattle units (ACUs) followed by JDC and ADC (Table 1), while the FDC had the lowest number of ACU. The lactating animals as percent of ACU were highest in JDC followed LDC, ADC and lowest in FDC. Buffaloes predominated in all peri-urban complexes and the relative proportion of cattle and buffaloes varied between 43 : 57 (FDC) and 17 : 83 (JDC). The body measurement revealed that the animals in FDC had lowest ($P<0.05$) body weight as compared to animals in other dairy complexes. The animals of LDC had excellent health as indicated by highest body weight (572 kg).The animals of LDC followed by HDC had the highest ($P<0.05$) milk yield as compared to the lowest in ADC, which was statistically comparable with that of animals in JDC and FDC. The milk

Table 1. Livestock inventory, body weight and milk production in peri urban dairy complexes

Parameters	JDC (n=29)	ADC (n=28)	FDC (n=28)	LDC (n=24)	HDC (n=25)
		Livestock inventory			
ACU's/dairy house	98.2	94.5	20.6	136.3	42.0
Lactating animals/dairy house	85.0	69.3	10.9	115.3	24.4
Lactating animals,% ACUs	86.6	73.3	52.6	84.6	58.2
Area allocated/ACU, m^2	6.5	6.1	5.9	5.1	5.2
Area less than recommended,%	42.22	45.60	47.02	54.76	53.69
		Species wise distribution			
Cattle	17.2	28.6	42.9	25.0	26.9
Buffalo	82.8	71.4	57.1	75.0	73.1
Cattle: Buffalo	1: 4.8	1: 2.5	1: 1.3	1: 3.0	1: 2.7
		Body weight, milk yield and MUN			
Body weight, kg	544.9^{ab}	553.2^{b}	478.1^{a}	571.8^{b}	537.5^{ab}
Milk yield, kg/d	6.5^{a}	5.9^{a}	6.7^{a}	9.7^{b}	8.3^{b}
MUN, mg/dl	12.8^{ab}	13.7^{b}	8.1^{a}	19.6^{c}	20.8^{c}

JDC, Jalandhar dairy complex; ADC, Amritsar dairy complex; FDC, Ferozepur dairy complex; LDC, Ludhiana dairy complex; HDC, Hoshiarpur dairy complex; ACU, Adult cattle unit; MUN, Milk urea nitrogen.

Figures with different superscripts in a row differ significantly, $P<0.05$.

Table 2. Urinary excretion of purine derivatives (mM/dl) and microbial protein synthesis in animals

Parameters	JDC	ADC	FDC	LDC	HDC	PSE
Allantoin	51.1^{a}	102.8^{b}	59.3^{ab}	74.7^{ab}	77.2^{ab}	5.36
Uric acid	0.79	2.23	1.47	0.93	1.40	0.22
Purine derivatives (PD)	51.9^{a}	105.1^{b}	61.2^{ab}	75.6^{ab}	75.6^{ab}	5.4
Creatinine	145.6^{b}	151.9^{b}	97.2^{a}	167.5^{b}	188.7^{b}	6.12
Purines absorbed, g	189.9^{a}	412.7^{b}	170.8^{a}	306.9^{ab}	405.5^{b}	24.71
Microbial-N, g	138.1^{a}	300.1^{b}	124.1^{a}	223.1^{ab}	294.8^{b}	17.96
Allantoin,% of PD	98.1	97.5	95.1	98.4	94.5	0.85
Uric acid,% of PD	1.9	2.5	4.9	1.6	5.5	3.79

$P<0.05$; Figures with different superscripts in a row differ significantly; Abbreviations are explained in Table 1.

Table 3. Chemical composition of feed stuffs, % DM basis

Feed stuffs	Total ash	OM	CP	EE	NDF
Home madeconcentrate	8.0(2.0–16.0)	92.0(84.0–98.0)	17.0(4.6–20.3)	3.78(2.3–9.7)	38.7(25–61)
Commercial feed	6.45(4.0–8.5)	93.55(91.5–96.0)	15.15(14.9–16.4)	3.85(1.7–8.7)	44.8(42–56)
Cotton-seed cake	4.82(3.2–7.5)	95.18(83.5–96.3)	26.6(15.0–32.3)	6.10(1.7–7.5)	48.1(43–61)
Wheat bran	5.63(3.7–8.2)	94.37(91.8–96.3)	16.0(11.3–19.3)	2.97(1.2–4.5)	40(26–52)
Rice polish	7.0(5.5–9.7)	93.0(90.3–94.5)	15.6(14.8–16.0)	2.4(2.1–2.6)	51.3(40–58)
Dried *chapati*	8.7(4–16.5)	91.3(83.5–96.0)	14.8(11.6–17.4)	2.35(1.7–2.8)	47.4(35–52)
Brewery waste	5.2(3.6–7.5)	94.8(92.5–94.4)	16.1(13.4–20.2)	6.8(6.2–6.8)	51.9(34–61)
Masar chunni	6.25(5.2–7.5)	93.75(92.5–94.8)	18.1(16.4–20.2)	2.6(2.3–2.7)	43.4(26–48)
Maize husk*	4.85(4.02–6.23)	95.15(93.8–96.0)	10.12(9.5–10.4)	1.60(1.5–1.7)	60.0(58.2–61.3)
Green fodder	9.54(4.0–14.5)	90.46(85.5–96.0)	8.87(1.21–13.8)	2.5(2.5–3.0)	70.9(59–81)

Figures in parenthesis represent range, *starch industry waste.

urea N (MUN), an indicator of nutritional status of animals, specifically with respect to protein was highest (P<0.05) in LDC and HDC as compared to MUN in animals of other peri-urban dairy complexes and lowest in FDC.

The urinary purine derivatives (a tool to assess the microbial protein synthesized in the rumen) were highest (P<0.05) in animals of ADC as compared to those of JDC, but statistically comparable with the animals in other peri-urban dairy complexes (Table 2). The relative proportion of allantoin and uric acid was 94.5: 5.5 (HDC) to 98.4: 1.6 (LDC), confirming the earlier report (Wadhwa *et al.* 2005, 2006). The purines absorbed and microbial N synthesized in the rumen were highest (P<0.05) in animals of ADC as compared to that of JDC, but statistically comparable with those of other dairy complexes.

Agro-industrial by-products particularly wheat bran was the most common feedstuff used in the rations of lactating animals. Non-conventional feed resources like moong chunni, dried *chapatis*, brewery and starch industry waste were used extensively in peri-urban dairy production system. The chemical composition of feedstuffs revealed that the commercial feed had low CP and high NDF content as compared to home made feed (Table 3). The CP content was lower but EE content was higher than the recommended ISI (1976) levels in compounded concentrate mixture. The EE content in cotton seed cake was lower than the recommended level.

The chemical composition of complete diet was worked out from the composition of different feedstuffs available and the quantity consumed. The diet of animals in JDC had lowest (P<0.05) CP and highest (P<0.05) NDF as compared to diet offered to animals in LDC and HDC. The diet offered to animals in FDC had the lowest (P<0.05) EE content as compared to the diet offered in LDC and HDC. The CP and EE content in the diet of animals was less than the recommended level (NRC 1989) to the extent of 28 and 30%, 17 and 32%, 22 and 38%, 13 and 26%, 12 and 4% respectively in JDC, ADC, FDC, LDC and HDC (Table 4). While the NDF content in complete feed was 114 to 144% higher than the recommend level of >28% for dairy cattle (NRC 1989). About 24, 14, 64, 83 and 50% of the dairy houses of JDC, ADC, FDC, LDC and HDC, respectively, offered less DM than required by the animals. Singh *et al.* (2008) also found that dairy animals in urban, peri-urban and rural areas were offered diet deficient in DM, CP and TDN. The roughage to concentrate ratio revealed that the animals of LDC were offered highest (P<0.05) level of concentrate mixture (40%) as compared to those of HDC, while reverse trend (P<0.05) was observed in level of roughage offered. Within the roughages the relative proportion of green fodder was the highest (P<0.05) in HDC and lowest in LDC and reverse trend (P<0.05) was observed with respect to wheat straw. The roughage level in the diet modify rumen microbial population, leading to changes in the secretion of microbial enzyme responsible for digestibility of nutrients which in turn may affect productivity of animals (Bakshi *et al.* 2004). The daily consumption of nutrients was over and above the requirements in JDC, ADC and HDC (Fig. 1), but less (P<0.05) than the requirements in LDC (22% DM, 18%CP, 15%DCP and 21%TDN) and FDC (5%DM,

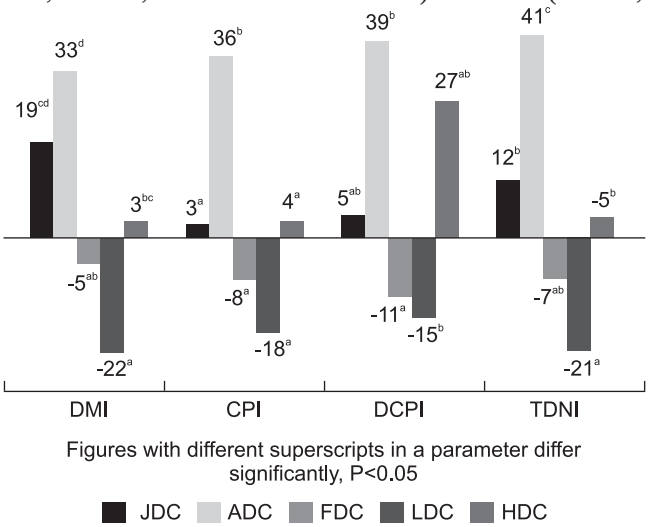

Fig. 1. Nutrient consumed vs. requirement (%) of dairy animals in different peri-urban dairy complexes of Punjab, India.

Table 4. Chemical composition of complete feed, nutrients consumed and reproductive problems in the animals

Parameters	JDC	ADC	FDC	LDC	HDC	PSE
			DM consumed, kg/d			
DM intake	13.4^{b}	14.4^{b}	10.0 ^{a}	10.0 ^{a}	12.4 ^{b}	0.30
Green fodder	7.33^{b}	7.26^{b}	4.51^{a}	2.83^{a}	9.58^{c}	0.47
Straw	2.64 ^{b}	3.01^{b}	2.94^{b}	3.05^{b}	0.03^{a}	0.18
Concentrate	3.30^{ab}	4.56^{c}	2.47^{a}	4.09^{bc}	3.37^{ab}	0.15
			Concentrate: roughage			
Concentrate	24.8^{a}	31.1^{a}	28.4^{a}	39.8^{b}	24.5^{a}	1.00
Roughage	75.2^{b}	68.9^{b}	71.6^{b}	60.2^{a}	75.5^{b}	1.00
Green fodder[1]	74.4^{b}	71.1^{b}	51.0^{a}	46.0^{a}	99.6^{c}	2.50
Straw[1]	25.6^{b}	28.9^{b}	49.0^{c}	54.0^{c}	0.37^{a}	2.50
			Chemical composition of complete feed,% DM basis			
CP	9.4^{a}	10.8^{ab}	10.1^{ab}	11.3^{b}	11.4^{b}	0.21
NDF	68.4^{c}	63.1^{ab}	66.5^{bc}	59.8^{a}	65.2^{bc}	0.56
EE	2.09^{ab}	2.05^{ab}	1.85^{a}	2.21^{b}	2.88^{c}	0.05
			Nutrients consumed, kg/animal/d			
CP	1.26^{ab}	1.56^{c}	1.02^{a}	1.16^{ab}	1.40^{bc}	0.04
DCP	0.84^{ab}	1.0^{ab}	0.63^{a}	0.80^{ab}	1.22^{b}	0.06
TDN	7.5^{b}	8.8^{b}	5.7^{a}	6.1^{a}	7.6^{b}	0.19
NDF	9.1^{b}	9.1^{b}	6.6^{a}	5.9^{a}	8.1^{b}	0.21
			Mineral supplements offered and reproductive problems,% of dairy houses			
Mineral mixture	0.0	0.0	3.6	25.0	0.0	-
Salt	31.0	46.4	25.0	83.3	34.6	-
Abortions*	10.1	12.4	3.5	3.3	6.6	-
Mastitis	69.0	85.7	67.9	79.2	69.2	-

Figures with different superscripts in a row differ significantly, P<0.05; [1]Within the roughage portion; *Per cent of animals.

8%CP, 11%DCP and 7%TDN). Intake of all the nutrients (33 to 41%) was higher (P<0.05) in ADC in comparison to that in JDC and HDC.

The importance of mineral in regulating biological systems, growth, production and reproduction is well documented (McDowell *et al*. 1984). Only 3.6% of the dairy houses of Ferozepur and 25% of the dairy houses of LDC, offered mineral mixture to their animals (Table 4), while none of the dairy farmer of ADC and HDC used mineral mixture. Mastitis was frequently observed in 68 to 86% of dairy houses in different dairy complexes. Number of cases of abortion was highest (12% of animals) in ADC and lowest (3.3 to 3.5%) in LDC and FDC.

General observations: In the peri-urban dairy complexes, the conditions were very unhygienic like poor cleanliness, stripping of milk or flakes from infected udder on floor and heaps of dung on ground was the common scenario. The number of animals per unit space was very high and animals were unable to move. The dairy farmers rarely let lose the animals for exercise. The poor living conditions could be responsible for high incidence of mastitis in milking herd. In all the dairy complexes, the banned hormone oxytocin was used extensively, at higher doses (6–10 ml or even more), for let down of milk and same needle was used for all animals. Perhaps this could be one of possible reasons for high incidence of abortions (1–20%) at most of the dairy houses. Mismanagement and negligence are the key factors responsible for spread of diseases and very high calf mortality. The sick animals were usually given self treatment or were examined by so called doctors (quacks). The recommended deworming and vaccination schedule was not followed strictly.

Irrespective of the status of health (sick; mastitis infected and the normal), almost all the animals were milked and the mixed milk was sold in the market for human consumption. The sick animals given antibiotic therapy were also milked without taking into consideration, the withdrawal period, necessary to avoid the antibiotic residues in the milk used for human consumption. Moreover the animal which aborted was offered additional concentrate and once they started milking, the milk was sold to local market from very first day.

The farmers were unaware of the nutrient requirements of dairy animals and the animals were offered feed in the manger (group of 10 to 15 animals). In some of the dairy houses feed was removed from the mangers after some time and the same manger was used for serving the drinking water. There were no separate mangers for smaller animals. A trend of homemade concentrates prevailed, which were highly imbalanced with respect to protein, carbohydrate and fat content. Some farmers offered 200 to 300 ml mustard oil/ animal weekly or fortnightly and some of the farmers drenched oil to their animals, just prior to calving. Only a

few offered mineral mixture to their animals, while the rest of the lot frequently offered salt (Pakistani *namak*) or liquid calcium (before and after parturition) to their animals. All dairy farmers depend upon '*Gwalas*' to look after their animals. The animal organic waste of commercial peri-urban dairy complexes is disposed off in a stream '*Ganda nallah*', from where the water is pumped into the fields for irrigation of forages. The mobile dairy farmers let there animals in this stream for bathing during hot season.

It was concluded that CP and EE content in the diet of the animals was less than the recommended levels in all the peri urban dairy complexes in Punjab, but the daily consumption of nutrients was less than the requirements, only in LDC and FDC. The farmers need to be motivated to feed nutritionally balanced diet to improve productive as well as reproductive efficiency of cattle/buffaloes.

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