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Mineral Profile Status of Dairy Animals of S.D.A.U Adopted Villages of Dantiwada Taluka

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Abstract

Ten villages adopted by Sardarkrushinagar Dantiwada Agricultural University were selected for the study of mineral profile in dairy animals. Samples of various feeds and fodders were collected with detail information of feeding practices in area. The requirement of Cu, Mn and Zn for potential production were calculated which were compared with actual availability of the minerals. The outcome of the study revealed significant low level of Cu and Zn in Diet while Mn was in good amount. To overcome deficiency of Cu and Zn, supplementation level were suggested.

Keywords: Feed; Minerals; Production; Supplementation.

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Introduction

Mineral elements are considered to be inevitable for the normal metabolic and physiological processes of animal systems. The under supply of minerals in livestock rations is the most common feature. Especially, marginal deficiencies are expressed as sub-normal growth or low productions that are difficult to diagnose and result in significant economic losses. The deficiency of certain minerals may not affect crops yields but their availability from such forages may be inadequate for requirement of livestock. It is therefore necessary to generate information on mineral status area wise so as to identify deficiencies or toxicities.[1] Area wise mapping of elements in feed and fodder is relatively a rapid, reliable and cost effective method of providing baseline data on the levels of macro and microelements.

Materials and Methods

The survey was conducted in ten villages *viz.* Vaghrol, Nilpur, Lodapa, Fatepura, Dhaneri, Jegol, Dantiwada, Bhadali, Nani Bhakhar, and Moti Bhakhar. Random sampling technique was used to select the respondents. In each village, 10 farmers who own animal/s producing at least 10 kg or more milk per day

Table 1: Average Estimated Levels of Cu, Mn and Zn Supplied to Buffaloes in Comparison to their Calculated Requirement

Village	Mineral intake (mg/day)			Mineral Requirement (mg/day)			Mineral intake (% of Requirement)		
	Cu	Mn	Zn	Cu	Mn	Zn	Cu	Mn	Zn
Vaghrol	150.01	975.55	777.89	172.23	715.58	1417.96	87.10	136.33	54.86
Nilpur	129.60	937.20	732.62	160.56	658.24	1302.45	81.35	142.38	56.25
Lodapa	147.84	952.24	816.34	168.14	704.10	1430.67	88.16	135.24	57.06
Fatepura	131.72	854.24	682.66	148.84	621.36	1250.31	89.00	137.48	54.60
Dhaneri	158.09	963.88	860.98	179.41	742.25	1472.27	88.11	129.86	58.48
Jegol	143.50	882.51	644.23	164.05	667.86	1360.00	87.50	132.14	47.37
Dantiwada	134.48	809.40	705.70	156.84	648.46	1286.37	85.66	124.82	54.86
Bhadali	149.04	887.78	715.07	162.00	679.88	1299.00	92.68	130.58	55.12
Nani Bhakhar	134.30	816.38	838.57	158.36	653.21	1302.33	85.46	124.98	64.39
Moti Bhakhar	131.38	822.71	730.46	151.74	632.37	1275.25	87.33	130.10	57.28
Average	**140.99**	**890.18**	**750.45**	**162.21**	**672.33**	**1333.66**	**87.23**	**132.39**	**56.02**

Table 2: Average Estimated Levels of Cu, Mn and Zn Supplied to Cows in Comparison to their Calculated Requirements

Village	Mineral intake (mg/day)			Mineral Requirement (mg/day)			Mineral intake (% of Requirement)		
	Cu	Mn	Zn	Cu	Mn	Zn	Cu	Mn	Zn
Vaghrol	136.79	846.05	739.24	153.27	613.08	1260.22	89.26	138.00	58.66
Nilpur	124.99	848.26	679.68	146.88	587.52	1207.68	85.10	144.38	56.28
Lodapa	140.31	853.58	758.82	153.08	612.02	1258.00	91.66	139.47	60.32
Fatepura	131.22	776.20	731.68	142.23	568.86	1169.20	92.26	136.45	62.58
Dhaneri	137.91	846.41	763.18	156.42	625.68	1286.12	88.17	135.28	59.34
Jegol	126.58	728.28	589.31	135.54	542.16	1114.44	93.39	134.33	52.88
Dantiwada	120.98	704.89	682.63	137.16	548.64	1227.76	88.21	128.48	55.60
Bhadali	136.02	778.59	786.19	145.26	581.04	1194.36	93.64	134.00	60.74
Nani Bhakhar	126.88	744.66	754.93	147.33	589.32	1211.38	86.12	126.36	62.32
Moti Bhakhar	122.62	720.43	654.75	138.78	555.12	1141.08	88.36	129.78	57.38
Average	**130.43**	**783.82**	**714.41**	**145.53**	**582.34**	**1207.02**	**89.61**	**134.65**	**58.61**

Table 3: Suggested Supplementation of Cu and Zn to Obviate Deficiency in Buffaloes

Village	CuS04 (mg/d)	ZnS04 (g/d)	Mineral Mixture as per BIS Specification
Vaghrol	92.58	1.93	80
Nilpur	129.00	1.72	72
Lodapa	85.25	1.86	76
Fatepura	71.33	1.72	72
Dhaneri	92.54	1.54	64
Jegol	85.62	1.44	60
Dantiwada	93.16	1.93	80
Bhadali	54.00	1.77	73
Nani Bhakhar	100.0	1.40	59
Moti Bhakhar	84.83	1.65	69

Table 4: Suggested Supplementation of Cu and Zn to Obviate Deficiency in Cows

Village	CuS04 (mg/d)	ZnS04 (g/d)	Mineral Mixture as per BIS Specification
Vaghrol	68.48	1.57	65
Nilpur	91.89	1.60	67
Lodapa	53.20	1.51	63
Fatepura	45.87	1.32	55
Dhaneri	77.12	1.58	66
Jegol	37.33	1.59	66
Dantiwada	38.5	1.65	69
Bhadali	85.20	1.23	51
Nani Bhakhar	67.33	1.38	57
Moti Bhakhar	62.10	1.47	61

were selected. Information regarding the amount and types of feeds and fodders being offered to the animals, approximate rate of daily feed intake by individual animal, milk yield were collected with the fair degree of precision on a questionnaire from individual farmer using standard sampling procedure, samples of green fodder, dry roughage, individual concentrate ingredients, compound concentrate mixtures and homemade concentrate mixtures were collected from all the respondents. Their requirements for Cu and Mn [2] and Zn[3] were worked out. The contents of Cu, Mn and Zn were analyzed using Atomic Absorption Spectrophotometer (ECIL, AAS 4141).The data were subjected to statistical analysis using methods of Snedecor and Cochran.[4]

Results and Discussion

The overall availability of Cu in daily diet of dairy animals was low. In case of buffaloes, 140 mg/day against the requirement of 162 mg/day. In case of cattle, it was 130 mg/day against requirement of 145 mg/day. The availability of Mn was higher than needed one. In case of buffaloes, actual availability was 890 mg/day against the requirement of 672 mg/day and in cattle, 783 mg/day against requirement of 582 mg/day. The availability of Zn was significantly low in dairy animals feeding. In case of buffaloes was 750 mg/day against the requirement of 1333 mg/day. In case of cattle, it was 714 mg/day against requirement of 1207 mg/day. Overall there were deficiency of 12.77% and 43.98% in Cu and Zn supply for buffaloes and which was of 10.38% and 41.39% in case of cattle. To maintain the essential level in daily diet plan supplementation of $CuSO_4$ and $ZnSO_4$ should be given. Suggested level of $CuSO_4$ (24%) in buffaloes were 54 to 129 mg/day while $ZnSO_4$ (33%) 1.40 to 1.93g/day to overcome deficiency. In cattle level of $CuSO_4$ (24%) in was 38 to 91 mg/day while $ZnSO_4$ (33%) 1.23 to 1.60 g/day.

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Feeding and Resting Behaviour of Kankrej Cows under Different Shelters in Various Seasons

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Abstract

Feeding and resting behaviour of lactating Kankrej cows was noted under three housing systems, viz. First group was provided RCC shed (T_1), second group was kept under Thatched roof (T_2) and third group was provided Tree shelter (T_3). Fodder eating time was significantly ($P< 0.01$) higher under T_1 (292.15 ± 4.32 min.). Significantly higher feeding activity was observed in day time as compared to night in all treatments. In summer season standing idle time was significantly ($P< 0.05$) higher under T_1 (299.34 ± 3.15 min.). Sitting lying ruminating time was significantly higher in T_3 (278.93 ± 2.09 min.) in summer season as compared to T_1 (233.20 ± 2.13 min.) and T_2 (219.5 ± 2.14 min.), while in monsoon and winter season, it was significantly higher in T_1 (270.30 ± 2.11 and 259.10 ± 3.26 min. respectively). Sleeping pattern in all the seasons did not differ significantly between treatments. However, it was significantly ($P< 0.05$) higher in night as compared to day. Frequencies of defecation and urination did not differ due to treatments but was significantly higher in day. Feeding temperament score was not affected by seasons or treatments.

Keywords: Kankrej cows;Thatched roof;Ruminating time;Fodder eating time.

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Introduction

Rapidly depressed feed consumption with increased environmental temperature has been observed.[1] Inadequate housing system, overcrowding and uncomfortable conditions have detrimental effects on animal's feeding and resting behaviour. The heat load on the animals can be reduced by providing comfortable housing and feeding proportion of concentrate in the daily ration.[2,3] Therefore the present study was undertaken to find out the effect of housing systems on feeding and resting behaviour of lactating Kankrej cows.

Materials and Methods

Eighteen lactating Kankrej cows of almost same stage of lactation, level of production and body weight were selected for present study. These cows were divided into three groups of six animals each. Each group was randomly allotted to one of the three treatments viz., RCC shed (T_1), Thatched roof (T_2) and Tree shelter (T_3). The experiment was conducted for one year covering all the three seasons. Individual feeding and resting activities were recorded for 24 hours once in a month for one year. The activities recorded were eating, standing ruminating, standing idle, sitting lying ruminating, sitting idle, sleeping, frequency of defecation, urination and feeding temperament score as given in Table:1. The collected data were analyzed by standard statistical methods.[4]

Results and Discussion

In summer season time (minutes) spent for feeding was significantly higher for T_1 (292.15 ± 4.32) followed by T_2 (276.44 ± 2.90) and T_3 (261.51 ± 5.10). Animals took more eating time and standing idle time in T_1 (RCC shed). It was significantly higher over night as compared to day time (177.95 ± 3.14 Vs. 114.20 ± 1.18; 171.89 ± 1.70 Vs. 104.55 ± 1.20 and 150.46 ± 3.60 Vs. 111.05 ± 1.50 in T_1, T_2 and T_3, respectively). Time for standing ruminating was significantly ($P < 0.05$) higher in T_2 (274.63 ± 3.10) as compared to T_1 (182.23 ± 2.60) and T_3 (227.32 ± 2.92). Standing idle time was significantly higher in T_1 (299.34 ± 3.15) .In thatched roof (T_2), idle standing was significantly ($P < 0.01$) less. Standing idle time was significantly affected by photoperiod being higher during day time. Sitting lying ruminating time was maximum in T_3 (278.93 ± 2.09) followed by T_1 (233.20 ± 2.13) and T_2 (219.50 ± 2.14). It was significantly ($P < 0.05$) higher in night as compared to day in all the treatments. Sleeping time was not significantly affected by treatments, but significantly ($P < 0.05$) higher in night as compared to day in all the treatments. Sitting lying idle time was significantly ($P < 0.05$) less in T_3 (238.50 ± 4.76) followed by T_1 (245.40 ± 4.06) and T_2 (248.83 ± 5.98). Values for day and night were similar and also statistically at par.

In monsoon season, eating fodder time was significantly ($P < 0.01$) higher in T_2 (259.63 ± 3.92 min.). In day, it was significantly ($P < 0.01$) higher over night in all the treatments. Standing ruminating time was significantly ($P < 0.05$) higher in T_3 (229.20 ± 2.12) .It was also significantly ($P < 0.05$) higher in day compared to night. Standing idle time of T_2 (296.40 ± 2.78) was significantly ($P < 0.05$) higher compared to T_1 (278.40 ± 2.31) and T_3 (284.30 ± 2.28). Photoperiod did not affect it significantly, though it was higher in night. Sitting lying ruminating time under T_1 (270.30 ± 2.11) was significantly ($P < 0.05$) higher compared to T_2 (258.40 ± 2.13) and T_3 (248.70 ± 2.09). It was significantly ($P < 0.05$) higher in night as compared to day in all the treatments. Sleeping pattern was not influenced by the treatments but, it was significantly higher in night over day. Sitting lying idle time in T_1, T_2 and T_3 was 241.60 ± 3.28, 256.40 ± 3.45 and 230.20 ± 3.41, respectively. The difference due to treatments was non-significant. Photo period also did not affect it.

In winter season, cows spent higher time (Min.) in eating fodder in T_1 (262.46 ± 4.42). However, the difference due to treatment was non-significant. It was significantly ($P < 0.05$) higher in day as compared to night (169.44 ±

Table 1: Feeding and Resting Behaviour (Time in Different Activities in Minutes)

Treatment	Photoperiod	Eating fodder	Standing ruminating	Standing idle	Sitting lying ruminating	Sleeping
SUMMER SEASON						
T_1	Day	177.95 ± 3.14[a]	91.40 ± 1.41[a]	170.70 ± 2.48[a]	92.21 ± 1.04[a]	7.3 ± 0.24[a]
	Night	114.20 ± 1.18[b]	90.83 ± 1.91[a]	128.64 ± 0.67[b]	140.99 ± 1.09[b]	10.8 ± 0.74[b]
	Total :-	292.15 ± 4.32[c]	182.23 ± 2.60[b]	299.34 ± 3.15[c]	233.20 ± 2.13[c]	18.1 ± 0.98
T_2	Day	171.89 ± 1.70[d]	105.87 ± 2.34[c]	171.38 ± 1.91[a]	91.16 ± 1.02[a]	8.9 ± 0.17[a]
	Night	104.55 ± 1.20[e]	168.76 ± 0.76[d]	110.02 ± 1.07[b]	128.34 ± 1.12[b]	10.3 ± 0.93[b]
	Total :-	276.44 ± 2.90[f]	274.63 ± 3.10[e]	281.40 ± 2.98[d]	219.50 ± 2.14[c]	19.2 ± 1.10
T_3	Day	150.46 ± 3.60[g]	102.78 ± 1.89[f]	175.55 ± 2.03[a]	123.48 ± 0.81[d]	9.3 ± 0.52[a]
	Night	111.05 ± 1.50[h]	124.54 ± 1.03[f]	118.79 ± 1.18[b]	155.45 ± 1.28[e]	10.1 ± 0.72[b]
	Total :-	261.51 ± 5.10[i]	227.32 ± 2.92[g]	294.34 ± 3.21[c]	278.93 ± 2.09[f]	19.4 ± 1.24
MONSOON SEASON						
T_1	Day	160.40 ± 3.16[a]	105.70 ± 1.02[a]	128.10 ± 1.02	110.70 ± 0.95[a]	7.9 ± 0.86[a]
	Night	99.43 ± 1.02[b]	76.90 ± 0.96[b]	150.30 ± 1.29	159.60 ± 1.16[b]	9.6 ± 0.32[b]
	Total :-	259.83 ± 4.18[c]	182.60 ± 1.98[c]	278.40 ± 2.31[a]	270.30 ± 2.11[c]	17.5 ± 1.18
T_2	Day	173.30 ± 2.23[d]	125.64 ± 1.19[a]	126.07 ± 1.02	115.40 ± 1.32[a]	6.3 ± 0.22[a]
	Night	86.33 ± 1.69	83.66 ± 0.99[b]	170.33 ± 1.76	143.00 ± 0.81[b]	9.9 ± 0.69[b]
	Total :-	259.63 ± 3.92[c]	209.30 ± 2.18[d]	296.40 ± 2.78[b]	258.40 ± 2.13[c]	16.2 ± 0.91
T_3	Day	151.84 ± 2.79[a]	140.82 ± 1.21[a]	118.80 ± 0.46	109.45 ± 1.43[a]	6.4 ± 0.42[a]
	Night	96.32 ± 1.04[b]	88.38 ± 0.91[b]	175.50 ± 1.82	139.25 ± 0.66[b]	9.7 ± 0.78[b]
	Total :-	248.16 ± 3.83[e]	229.20 ± 2.12[d]	284.30 ± 2.28[a]	248.70 ± 2.09[d]	16.1 ± 1.20
WINTER SEASON						
T_1	Day	169.44 ± 2.93[a]	128.26 ± 1.89	124.58 ± 1.41	198.24 ± 1.45[a]	6.8 ± 0.94[a]
	Night	93.02 ± 1.49[b]	127.54 ± 1.29	116.52 ± 1.05	150.86 ± 1.81[b]	9.4 ± 1.07[b]
	Total :-	262.46 ± 4.42	255.80 ± 3.18	241.10 ± 2.46[a]	259.10 ± 3.26	16.2 ± 2.01
T_2	Day	166.78 ± 3.18[a]	129.24 ± 2.88[a]	140.43 ± 1.33	99.48 ± 1.45[a]	7.2 ± 0.17[a]
	Night	88.92 ± 1.61[b]	120.96 ± 0.53[b]	136.07 ± 1.25	140.22 ± 1.53[b]	9.7 ± 0.91[b]
	Total :-	255.70 ± 4.79	250.20 ± 3.41	276.50 ± 2.58[b]	239.70 ± 2.98	16.9 ± 1.08
T_3	Day	156.40 ± 3.37[a]	132.42 ± 2.81[a]	138.68 ± 1.19	94.33 ± 1.43[a]	6.9 ± 1.01[a]
	Night	90.19 ± 1.54[b]	119.98 ± 0.57[b]	136.72 ± 1.14	140.47 ± 1.66[b]	8.9 ± 1.19[b]
	Total :-	246.59 ± 4.91	252.40 ± 3.38	275.40 ± 2.33[b]	234.80 ± 3.09	15.8 ± 2.20

Treatment	Photoperiod	Sitting lying idle	Frequency of defeacation	Frequency of urination	Feeding temperament score
SUMMER SEASON					
T_1	Day	120.50 ± 2.88	3.03 ± 0.18	3.28 ± 0.13[a]	1.10 ± 0.05
	Night	124.90 ± 1.18	2.72 ± 0.02	2.07 ± 0.05[b]	1.20 ± 0.05
	Total :-	245.40 ± 4.06[a]	5.75 ± 0.20	5.35 ± 0.18	1.15 ± 0.05 (Av.)
T_2	Day	110.80 ± 2.94	2.90 ± 0.06	3.58 ± 0.11[a]	1.10 ± 0.04
	Night	138.03 ± 3.04	2.33 ± 0.12	2.02 ± 0.10[b]	1.15 ± 0.09
	Total :-	248.83 ± 5.98[a]	5.23 ± 0.18	5.60 ± 0.21	1.13 ± 0.06 (Av.)
T_3	Day	98.43 ± 2.41	2.10 ± 0.10	3.30 ± 0.09[a]	1.12 ± 0.03
	Night	140.07 ± 2.35	2.82 ± 0.11	2.45 ± 0.05[b]	1.00 ± 0.04
	Total :-	238.50 ± 4.76[b]	4.92 ± 0.21	5.75 ± 0.14	1.06 ± 0.05 (Av.)
MONSOON SEASON					
T_1	Day	130.40 ± 2.73	3.10 ± 0.20	2.91 ± 0.42[a]	1.08 ± 0.03
	Night	111.20 ± 0.55	2.79 ± 0.12	1.94 ± 0.29[b]	1.15 ± 0.07
	Total :-	241.60 ± 3.28	5.89 ± 0.32	4.85 ± 0.71	1.12 ± 0.05 (Av.)
T_2	Day	133.30 ± 2.69	2.80 ± 0.11	3.38 ± 0.11[a]	1.13 ± 0.04
	Night	123.10 ± 0.76	2.18 ± 0.23	1.72 ± 0.05[b]	1.12 ± 0.05
	Total :-	256.40 ± 3.45	4.98 ± 0.34	5.10 ± 0.16	1.13 ± 0.05 (Av.)
T_3	Day	134.30 ± 2.83	3.10 ± 0.19	3.83 ± 0.09[a]	1.18 ± 0.06
	Night	95.90 ± 0.58	2.85 ± 0.09	1.07 ± 0.07[b]	1.21 ± 0.07
	Total :-	230.20 ± 3.41	5.95 ± 0.28	4.90 ± 0.16	1.20 ± 0.07 (Av.)
WINTER SEASON					
T_1	Day	133.78 ± 1.96	3.30 ± 0.54	2.90 ± 0.18	1.30 ± 0.04
	Night	106.03 ± 0.92	2.39 ± 0.25	2.98 ± 0.10	1.20 ± 0.02
	Total :-	239.81 ± 2.88	5.69 ± 0.79	5.88 ± 0.28	1.25 ± 0.06 (Av.)
T_2	Day	130.30 ± 1.76	3.02 ± 0.45	3.08 ± 0.19	1.18 ± 0.09
	Night	116.95 ± 0.85	2.16 ± 0.23	3.12 ± 0.13	1.12 ± 0.06
	Total :-	247.25 ± 2.61	5.18 ± 0.68	6.20 ± 0.32	1.15 ± 0.08 (Av.)
T_3	Day	134.81 ± 1.91	3.06 ± 0.35	3.34 ± 0.19	1.19 ± 0.01
	Night	118.02 ± 0.65	2.92 ± 0.26	3.36 ± 0.05	1.13 ± 0.05
	Total :-	252.83 ± 2.56	5.98 ± 0.61	6.70 ± 0.24	1.16 ± 0.03 (Av.)

2.93, 166.78 ± 3.18 and 156.40 ± 3.37 Vs. 93.02 ± 1.49, 88.92 ± 1.61 and 90.19 ± 1.54 in T_1, T_2 and T_3, respectively). Standing ruminating time did not differ significantly between treatments. However, it was significantly ($P < 0.05$) higher in day over night in all the treatments. Standing idle time was significantly ($P < 0.05$) higher in T_2 (276.50 ± 2.58) and T_3 (275.40 ± 2.33) than T_1 (241.10 ± 2.46). However, photoperiod did not affect it. Sitting lying ruminating time did not showed significant variation between treatments but was significantly ($P < 0.05$) higher in night than day. Sleeping time did not show difference due to treatments but significantly ($P < 0.05$) higher in night over day in all the treatments. Sitting lying idle time for T_1, T_2 and T_3 was 239.81 ± 2.88, 247.25 ± 2.61 and 252.83 ± 2.56, respectively. The difference due to treatments and photo period was non-significant.

The detail analysis revealed that eating activity in all the groups was mainly in day time. Sitting lying ruminating, sitting idle and sleeping activities were more in night time. Standing idle time was more in night except in summer season. Higher feeding activity in day was also observed by Schake and Riggs and Regina Vasilators and Pant J.[5,6] Wangsness (1980), Varlyakov *et al.* and Sharma .[7,8] Kotvas and Vavak and Kataktalware also observed almost same activity pattern.[9,10] Frequencies of defeacation and urination were not affected by the treatments. Feeding temperament score was not affected by treatment or photoperiod.

Conclusion

In summer season, sitting lying ruminating time was significantly higher in T_3, while in monsoon and winter season, it was higher in T_1. Thus, it can be concluded that cows were better placed under T_3 in summer while, under T_1 in winter and monsoon. Frequencies of defecation and urination were mostly higher in day time. Feeding temperament score was not influenced by the housing system.

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Effect of Sodium Selenite Supplementation on Serum Mineral Profile of Male Kids (*Capra Hircus*)

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Abstract

An experiment was conducted on 12 male kids (about 2-3 months of age and 6.30 ± 0.39 kg average body weight) to elucidate the effect of supplementation of sodium selenite on their serum mineral profile. Kids were randomly divided into two equal groups and fed a basal diet consisted of concentrate mixture and paddy straw to meet their nutrient requirement. Group I served as control (without any supplementation), whereas animals in group II were supplemented with 0.3 mg selenium kg^{-1}DM as sodium selenite. Experimental feeding lasted for a period of 90 days, during which blood samples were collected on day 0 and 90 days of the experimental feeding to study the serum mineral profile of kids. Results revealed significant ($P<0.05$) increased in serum selenium concentration in sodium selenite supplemented group than control. Serum calcium, phosphorus, iron, copper, zinc, manganese were similar ($P>0.05$) among the two groups. It may be concluded that supplementation of 0.3 ppm Se as sodium selenite enhanced the serum Se concentration with out affecting other serum minerals of kids.

Keywords: Sodium selenite; Serum; Minerals; Kids

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Introduction

Selenium (Se) is an important trace mineral, required for antioxidant defence, anti-inflammatory, thyroid hormone function and reproduction in animals.[1] The nutritional essentiality of selenium arose from the work of Patterson *et al* in chickens.[2] It acts in synergism with vitamin E and other anti-oxidative agents such as Zn and Cu to inhibit the oxidation of membrane lipids and DNA by oxygen radicals produced during aerobic metabolism.[3] Selenium, copper and zinc are microelements that plays important role in intermediate metabolism of the animals. Several reproductive problems like retained placenta, abortion, premature birth, cystic ovaries, metritis, and delayed conception were reported due to deficiency of Se.[4] The level of absorption and retention of microelements is modulated by their actual levels in the tissue and their concentrations in the diet.[5] Some reports indicated that supplementation of Se inhibits absorption of zinc.[6] Cristaldi *et al* reported that administration of Se to sheep grazing on copper deficient pastures increased copper absorption.[7] However, a high Se supplement could disturb the Zn, Cu and Fe metabolism leads to deficiency of these minerals in young animals.[8] In view of these facts, the present study was conducted on growing male kids to find out the effects of Se supplementation on their serum mineral profiles.

Material and Methods

Animal's Management and Feeding

The experiment was conducted on 12 male kids (*Capra hircus*; about 2-3 months of age, average live weight 6.30±0.39 kg) in Instructional Livestock Farm, Orissa University of Agriculture and Technology, Bhubaneswar, Odisha (India). These animals were adapted on the experimental diet comprising of concentrate mixture and paddy straw for a period of one month during which they were treated against ecto and endo parasites and subsequently at regular intervals. All the kids were vaccinated against foot and mouth disease and *peste des petits of ruminants* (PPR). These animals were distributed in to two different groups of six kids in each on the basis of their body weights following randomized block design, and were kept in a well ventilated shed with individual feeding and watering arrangements. Kids in two groups were fed on concentrate mixture and paddy straw to meet their nutrient requirements for 50 g daily weight gain .[9] The concentrate mixture consisted of (%) crushed maize grain 30, soybean meal 35, wheat bran 32, mineral mixture 2 and common salt 1.Treatments were: group I (control), without any supplementation, group II supplemented with 0.3 ppm Se as sodium selenite through the concentrate mixture. Paddy straw was provided to the animals after total consumption of concentrate mixture. All the kids were offered about 100 g of maize (*Zea mays*) fodder once a week to meet their vitamin A requirements. Clean and fresh drinking water was provided twice a day to all the animals. This feeding practice lasted for 90 days.

Collection of Blood

About 5 ml blood was collected from each kid through jugular venipuncture in the morning (before watering and feeding) at zero and 90 day of the experimental feeding. The blood was collected into clean and dry test tube and kept in slanting position for 45 min. Then the blood samples were centrifuged at 3000 rpm for 10 min at 4^{o}C and serum was separated. The serum was collected in plastic vials and kept at -40^{o}C until study the serum minerals concentration.

Estimation of Serum Minerals

Diagnostic kits manufactured by crest bio-systems, Goa (India), were used for the analysis of serum Ca and Phosphorus. Serum Ca was estimated by the method of Trinder .[10] Phosphorus in blood serum samples was determined by method of Gomorri.[11] Selenium concentrations in the serum and colostrum were measured by hydride

generation atomic absorption spectrophotometer (AAS), according to the method described by Tiran *et al* .[12] One ml blood serum was taken in a 50 ml clean and dry micro Kjeldhal flask and to it 5 ml tripple acid (HNO_3,$H2SO_4$and $HClO_4$; 4: 2 : 1) mixture was added, followed by heating it on a hot plate till thick smoke of perchloric acid ceased to come out. The contents of flask were then cooled and volume was made up to 25ml with triple glass-distilled water.Serum concentration of trace minerals like Fe, Cu, Mn and Zn were estimated by Atomic Absorbance Spectrophotometer (Model SL243, ELICO, Hyderabad, India).

Table 1: Chemical Composition (% DM Basis) of Concentrate Mixture and Paddy Straw Fed to Kids

Nutrients	Concentrate mixture	Paddy Straw
Crude protein	19.70	3.10
Ether extract	2.50	1.30
Neutral detergent fiber	36.70	81. 50
Acid detergent fiber	12.10	56. 30
Hemicelluloses	24.60	25. 20
Cellulose	10.10	47. 60
Calcium	1.65	0.68
Phosphorus	0.94	0.14
Selenium, mg kg^{-1}	0.11	0.10

Table 2: Effect of Sodium Selenite on Serum Minerals Profile of Goat

Group	Days		Mean	SEM	P Value		
	0	90			G	P	GXP
Ca (mg/dl)							
I	9.29	10.18	9.73	0.26	0.18	0.15	0.37
II	9.65	9.97	9.75	0.22			
P (mg/dl)							
I	5.10	5.52	5.31	0.29	0.72	0.84	0.95
II	5.28	5.41	5.34	0.17			
Fe(mg/l)							
I	7.80	7.98	7.69	0.26	0.53	0.91	0.91
II	7.92	8.05	7.96	0.32			
Cu (mg/l)							
I	3.87	3.65	3.73	0.36	0.14	0.08	0.10
II	3.54	4.08	3.61	0.44			
Mn (mg/l)							
I	1.53	1.81	1.67	0.14	0.16	0.07	0.34
II	1.62	2.10	1.86	0.19			
Zn (mg/l)							
I	3.87	4.04	3.95	0.30	0.61	0.06	0.07
II	3.72	3.65	3.66	0.19			
Se (ppb)							
I	190.31	197.65	193.58[a]	8.98	0.01	0.02	0.01
II	188.78	265.17	226.97[b]	9.32			

[ab] Means bearing different superscripts in a column differ significantly (P<0.05)

Statistical Analysis

Data collected for different parameters were analysed as a randomized block design with kid as the experimental unit using the General Linear Model (GLM) procedure of SPSS[13] and treatments were compared using Tuckey's test. [14]

Results and Discussion

The chemical composition of concentrate mixture and paddy straw is presented in Table 1. The crude protein content of the concentrate mixture and paddy straw was 19.70 and 3.10 %, respectively, whereas the basal Se concentration in concentrate mixture and paddy straw were 0.11 and 0.10 mg kg^{-1}, respectively. The mean Ca values (mg/dl) did not differ among the different groups (P>0.05). Similar to our results, Mudgal *et al*.[15] reported that supplementation of 0.3 ppm Se in the diet of buffalo calves had no effect on their plasma Ca levels. Like Ca, the plasma phosphorus level was also comparable (P>0.05) among different groups. Mudgal *et al* (2012) reported that supplementation of graded levels of vitamin E and 0.3 ppm Se to cattle and buffalo calves respectively, did not have any effect on plasma phosphorus levels. Similarly, Arthur *et al* [16] also did not find any difference on plasma phosphorus concentration of steers fed on either a Se deficient (0.015 ppm) or sufficient (0.1 ppm) diet. Like Ca and P, blood serum Fe, Cu, Mn and Zn levels (mg/l) were also comparable (P>0.05) among two groups. Similarly Hoac *et al* reported that supplementation of 25 mg of selenium yeast/ day for 2wk had no effect on plasma Zn and Cu concentration.[17] Moeini *et al* did not observed significant changes in serum Cu and Fe concentration in heifer injected with different doses of Se.[18] Contrary to this, Atwal *et al* (2003) observed high plasma levels of Zn and Mn in anestrous buffaloes fed with selenium.[19] Cristaldi *et al* also observed increased copper concentration in serum of sheep supplemented with Se.[7]

The overall mean Se levels (ppb) in serum of

kids were 193.58 and 226.97 respectively in four groups. Statistical analysis revealed that the Se levels were significantly ($P<0.05$) different in two different groups, indicating that the plasma Se levels in the groups supplemented with Se was increased. Similar to our results, Pherson and Johnsson in young cattle bulls,[20] Weiss *et al* in Holstein cows [21] and Rowntree *et al* in Hereford cows reported that supplemental Se increased the blood levels of Se.[22]

Conclusion

It may be concluded that supplementation of sodium selenite in the diet improved the selenium status of the animals with out affecting other minerals in the serum of kids.

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Effect of Supplementing Chromium on the Nutrients Intake, Digestibility and Feed Efficiency of Equines Used for Antitoxin Production

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Abstract

For this study, twenty-four healthy equines, were randomly divided in three equal groups viz, T_0,T_1 and T_2, each having eight animals (four mules and four ponies). Group T_0 served as control and received ration as per standard feeding practice followed on the farm. Group T_1 and T_2 were fed with same ration as used for group T_0 supplemented with chromium tripicolinate @ 210 and 420 πg/kg ration, respectively. The feed treatments had no significant effect on the average daily DM intake of the animals from different groups. The average per cent daily dry matter intake and average dry matter intake per unit metabolic body size of equines from control group was significantly (P≤0.01) higher than that of groups T_1 and T_2, however, differences between later two groups was non-significant. The average TDN intake of the equines from groups T_1 and T_2 was significantly (P≤0.01) higher than that of group T_0. However the difference between groups T_1 and T_2 was statistically non-significant. The average daily DCP intake in experimental animals from groups T_0, T_1 and T_2 were significantly (P≤0.01) different from each other. The average fortnightly body weights of the animals from the control group T_0 were significantly lower than the body weights of groups T_1 and T_2. The average body weights of animals from groups T1 and T_2 did not differ significantly from each other. The feed treatments showed no significant effect on the average gain in weights of the animals from different groups. The feed efficiency in terms of daily dry matter, TDN and DCP intake (kg) / kg gain in weight was highest in chromium supplemented treatment groups.

Keywords: Digestibility; TDN; DCP; Feed efficiency; Supplementation.

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Introduction

Chromium is essential trace element for normal carbohydrate metabolism which potentiates insulin action and stimulate glucose clearance and also aids in the conversion of thyroxin to tri-iodothyronine which results in increasing metabolic rate. Although lot of literature is available on the role of chromium on glucose metabolism in various species of animals; very scanty information is available on the effect of chromium on horses used for anti-snake venom production which remain under stress due to regular toxin antigen dosing and frequent bleeding. Considering the scope for chromium supplementation to reduce the stressed condition in the equines used in anti-venum production programme, the present experiment was planned to study the effect of different levels of chromium supplementation on nutrients intake; its utilization and feed efficiency.

Materials and Methods

For this study twenty four healthy equines (twelve mules and twelve ponies) of about 4-5 years of age used in routine hyper-immunization bleeding programme for anti-snake venum production, were selected. The animals were divided randomly in to three equal groups namely, T_0 (control), T_1 and T_2 group each having eight equine animals (four mules and four ponies) on the basis of species, breed, body weights, age and sex. Group T_0 served as control and received ration as per standard feeding practice followed on the farm. Group T_1 and T_2 were fed with same ration as used for group T_0 supplemented with chromium tripicolinate @ 210 and 420 µg/kg ration, respectively. Measured quantity of chromium tripicolinate in the form of premix was supplemented daily through the ration of individual animal. Measured amount of concentrate mixture was fed twice daily divided in two equal parts, offered individually in the manger in the stable. The animals were let loose group wise in open paddocks for roughage feeding and were fed with greens like Lucerne and maize and dry roughage like hay. Ad lib water was made available to individual equines in the stable throughout the experiment. The percent ingredient and chemical composition of the farm concentrate mixture is given in Table 1 and 2, respectively. The average chemical composition (% DMB) of hay, green maize and Lucerne is given in Table 3.

The experimental animals were housed in

Table 1: Percent Ingredient Composition of the Farm Concentrate Mixture

Name of ingredient	Per cent level
Maize	16.80
Soybean meal	17.00
Cottonseed cake	08.00
Rice polish	10.00
Deoiled rice bran	18.00
Wheat bran	17.00
Molasses	10.00
Dicalcium phosphate	01.50
Lime stone powder	00.50
Mineral mixture	00..20
Salt	01.00
Total	100.00

Table 2: Per cent Chemical Composition (%DMB) of Farm Concentrate Mixture

Nutrient	Per cent
Dry matter	90.22
Moisture	09.78
Crude protein	21.12
Ether extract	04.98
Crude fibre	10.61
Nitrogen free extract	52.91
Total ash	10.38
Acid insoluble ash	02.37
Calcium	01.32
Phosphorus	00.65

Table 3: The Average Chemical Composition (%DMB) of Hay, Green Maize and Lucerne

Particulars	Hay	Green maize	Lucerne
Dry matter	88.32	26.81	22.12
Moisture	11.68	73.19	77.88
Crude protein	02.25	05.54	22.68
Ether extract	02.55	01.80	01.89
Crude fibre	37.28	26.85	22.30
Nitrogen free extract	49.05	57.51	41.22
Total ash	08.87	08.30	11.91
Acid insoluble ash	05.95	03.62	00.72
Calcium	00.95	00.65	01.48
Phosphorus	00.28	00.15	00.35

Table 4: Change in Body Weight, Nutrients Intake, Feed Efficiency and Body Condition Score of the Equines from Different Experimental Groups

Parameters	T_0	T_1	T_2	treatment	Fortnight periods
Initial body weights (kg)	246.00	267.25	264.38	--	--
Final body weights (kg)	248.08	265.60	264.50	--	--
Average body weights (kg)	243.3[a]	268.98[b]	265.97[b]	**	NS
Average gain in weights (kg)	0.346	0.495	0.438	NS	NS
Average daily DM intake(kg)	04.63	04.79	04.75	NS	NS
Percent DM intake (kg)	1.90[a]	1.78[b]	1.79[b]	**	NS
DM intake g (W kg $^{0.75}$)	75.29[a]	72.03[b]	72.11[b]	*	NS
Average daily TDN intake(kg)	2.61[a]	2.95[b]	3.01[b]	**	NS
Average daily DCP intake(kg)	0.501[a]	0.573[b]	0.606[b]	**	NS
DMI kg/kg gain in weight	13.38	09.68	10.84	__	__
TDNI kg/kg gain in weight	07.54	05.96	06.87	__	__
DCPI kg/kg gain in weight	1.448	1.158	1.384	__	__
Body condition score	07.25	07.50	07.63	NS	**

Note: Figures with different superscripts differ significantly
2. * Significant at 5 % ** Significant at 1 %

ideal stables with proper ventilation and flooring. Normal methods of hygine, management, feeding practices, vaccination and deworming programmes were followed for all the experimental animals throughout the trial period. Animals were let loose daily in open paddock for roughage feeding, watering and exercise.

Parameters Studied

Following parameters were studied during the experiment of 13 weeks.

DM intake, daily total dry matter intake (kg) as obsolute percent body weight and as per kg metabolic body weight (W $kg^{0.75}$), digestibility of different nutrients, TDN and DCP content of equine rations of different rations. Body weight changes of equines under different feed treatments. The feed efficiency in terms of DM, TDN and DCP required per kg gain in body weight. Body condition score was evaluated at the beginning of the experiment and at the monthly intervals by using standard charts. At the end of experiment during last week, digestibility trial of seven days duration was conducted by total collection method.

Analytical Techniques

The proximate analysis of feed and fodder samples collected during experiment was carried out as per A.O.A.C.[1] Phosphorus estimation was carried out as per N.I.N.[2] and calcium as per Talpatra *et al*.[3] Body condition score was evaluated at the beginning of the experiment and at the monthly interval by using standard charts. A scoring system with 1 to 9 scales was used to measure body condition of experimental animals. Body condition score of equines from various was evaluated as per Henneke *et al* and recorded at monthly interval.[4] All the data collected during experimental period were subjected to statistical analysis as per Snedecor and Cochran (1998) by using randomized block design to draw the conclusions.

Results and Discussion

Change in body weight, nutrient intake, feed efficiency and body condition score of the equines from different experimental groups is given in Table 4.

The average daily DM intake during experimental period for groups T_0, T_1 and T_2 was 4.63,4.79 and 4.75 kg, respectively. It was seen that the feed treatments had no significant effect on the average daily DM intake of the animals from different groups. The average percent daily DM intake was 1.90,1.78 and 1,79 kg for groups T_0, T_1 and $T_{2,}$ respectively. The average percent daily DM intake of equines from control group was significantly (P≤0.01)

Table 5: Average Percent Digestibility Coefficients, TDN and DCP Contents of Rations from Various Experimental Groups

Parameters	T_0	T_1	T_2
Digestibility Coefficients %			
Dry matter	63.22	64.67	66.82
Organic matter	64.82	67.32	67.88
Crude protein	70.18	73.22	75.23
Ether extract	75.00	77.24	78.92
Crude fibre	47.28	51.75	52.22
Nitrogen free extract	63.78	64.98	67.92
TDN %	56.52	60.82	61.78
DCP %	10.82	11.95	12.76

higher than that of groups T_1 and T_2, however, differences between later two groups was non-significant. The average daily DM intake per unit metabolic body size recorded was 75.29, 72.03 and 72.11 g for groups T_0, T_1 and T_2, respectively. The average daily DM intake per unit metabolic body size of equines from control group was significantly (PdH0.05) higher than that of groups T_1 and T_2, however, differences between later two groups was non-significant.

The average daily TDN intake of the animals was 2.61, 2.95 and 3.01 kg for groups T_0, T_1 and T_2, respectively. The average daily TDN intake of the equines from groups T_1 and T_2 was significantly (P≤0.01) higher than that of group T_0. The differences in the values for daily TDN intake of groups T_1 and T_2 was statistically non-significant.

The average daily DCP intake of the animals was 0.501, 0.573 and 0.606 kg for groups T_0, T_1 and T_2, respectively. The average daily DCP intake in experimental animals from groups T_0, T_1 and T_2 were significantly (P≤0.01) different from each other.

The average initial body weights of the animals in groups T_0, T_1 and T_2, were 246.00, 267.25 and 264.38 kg, respectively. Corresponding body weights at the end of three months of experimental period were 248.08, 265.60 and 264.50 kg for groups T_0, T_1 and T_2, respectively. The average fortnightly body weights of the animals in groups T_0, T_1 and T_2 were 243.30, 268.98 and 265.97 kg, respectively. The average fortnightly body weights of the animals from the control group (T_0) were significantly lower than the body weights of the groups T_1 and T_2. The The average body weights of the animals from groups T_1 and T_2 did not differ significantly from each other. The average fortnightly gains of the animals in groups T_0, T_1 and T_2 were 0.346, 0.495 and 0.438 kg, respectively for groups T_0, T_1 and T_2. The statistical analysis revealed that the average gain in weights of the animals from different groups were non-significant..as no such work is reported in literature, the findings of the present research work could not be compared. Further it appears that there is no adverse effect of bleeding on body weights of equines from different feeding regimes speculated on considerations in fortnightly gain in weights were observed.

Feed efficiency was calculated in terms of DM, TDN and DCP (kg) required per kg gain jn weight. The average daily DM intake kg/kg gain in weight during experimental period for groups T_0, T_1 and T_2 was 13.38, 9.68 and 10.84 kg, respectively. The average daily TDN intake and DCP intake kg/kg gain in weight during experimental period for groups T_0, T_1 and T_2 Was 7.54 and 1.448, 5.96 and 1.158 and 6.87 and 1.384 kg, respectively. It was observed that the feed efficiency in terms of daily DM, TDN and DCP intake kg/kg gain in weight was highest in chromium supplemented treatment groups when compared with that of control suggestive of positive effect of chromium supplementation on feed efficiency, although data was not analyzed and tested statistically.

The average body condition score for groups T_0, T_1 and T_2 Were 7.25, 7.50 and 7.63, respectively. It was seen that chromium supplementation had no significant effect on the average body condition score of the equines from different groups, indicative of no adverse effect of such supplementation on the well being of animal.

Results of digestibility are given in Table 5. The digestibility of DM was 63.22, 64.67 and 66.82 % for groups T_0, T_1 and T_2, respectively. The digestibility of OM for groups T_0, T_1 and T_2 Was 64.82, 67.32 and 67.88 %, respectively. The digestibility of CP for groups T_0, T_1 and T_2 Was 70.18, 73.22 and 75.23 %, respectively. The digestibility of EE for groups T_0, T_1 and T_2 Was

75.00, 77.24 and 78.92 %, respectively. The digestibility of CF for groups T_0, T_1 and T_2 Was 47.28, 51.75 and 52.22 %, respectively. The digestibility of NFEfor groups T_0, T_1 and T_2 Was 63.78, 64.98 and 67.92 %, respectively. It was noticed from digestibility coefficient data that the overall digestibility of all the nutrients was higher for group T_2 followed by group T_1 and T_0.

TDN content for groups T_0, T_1 and T_2 Was56.52, 60.82 and 61.78 %, respectively.DCP content for groups T_0, T_1 and T_2 Was 10.82, 11.95 and 12.76 %, respectively.

Conclusion

From the overall performance of equines from the present study, it is summerised that chromium supplementation to ration fed to equines for anti-sera production programme resulted higher TDN and DCP intake, higher nutrient digestibility, better feed efficiency in terms of DM, DCP and TDN required/kg gain in weight, without affecting DM intake and gain in body weight. Supplementation of chromium in the form chromium tripicolinate @ 420 µg/ kg ration, to the equines give numerically superior performance when compared with the performance that of @ 210 µg/kg ration, although the differences were not statistically significant. Thus it is concluded from the overall results of the present study that chromium tripicolinate can be supplemented @ 210 µg/ kg ration of equines for better anti-sera production programme without affecting plane of nutrition and animal wellbeing. For steady performance the supplementation of chromium tripicolinate @ 420 µg/kg ration of equines can be done.

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Technological Interventions in Animal Nutrition and Feeding Techniques to Reduce Methane Emission

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Abstract

Methane emissions in ruminants account for a 2% to12% of gross energy loss of feeds depending upon the type of diets. Therefore, inhibition of methane production in the rumen has been attempted for more than three decades to increase the utilization of feed energy for production purposes. Dietary/nutritional interventions look promising in suppressing methane emissions in ruminants, however, results are not consistent in different studies because of great variations in chemical composition of inhibitory compounds used, doses, and feed composition.

Keywords: Emmission; Interventions; Composition; Greenhouse; Ruminant; Gross energy.

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Introduction

Methane (CH_4) is the second largest anthropogenic greenhouse gas after carbon dioxide.[1] Globally, livestock produces about 80 million tonnes of enteric CH_4 annually. Most of the CH_4 from ruminant livestock originates from microbial fermentation in the rumen and lower digestive tract, referred to as enteric CH_4 emissions. Methane emissions in ruminants also account for a 2% to12% of gross energy loss of feeds depending upon the type of diets.[2] Therefore, inhibition of CH_4 production in the rumen has been attempted for more than three decades to increase the utilization of feed energy for production purposes. In recent years, CH_4 mitigation research has gained momentum because of the greenhouse effects contributed by CH_4.

Nutritional Strategies to Reduce Methane Emission

1. Ionophore Compounds

Ionophore antibiotics such as monensin have also been shown to depress CH_4 production in ruminants in dose-dependent manner. The CH_4 production has been reported to decrease up to 76% *in vitro* and to an average of 18% *in vivo*.[3] Ionophores change the bacterial population from Gram-positive to Gram-negative organisms with a concomitant change in the fermentation from acetate to propionate. This fermentation shift lowers the availability of H_2 for CH_4 production by methanogens.

Higher doses (24–35 mg kg^{-1} diet) decreased CH_4 production by 4–10%[4] with short-term decreases in CH_4 up to 30% at a dose level of 33 mg kg^{-1} diet .[5] Unfortunately, some long-term trials suggest that the inhibition of methanogenesis by ionophores may not persist over time.[5] However, the use of ionophores as feed additives has been banned in the European Union and is restricted in some other countries as feed additives.

2.Dietary Supplementation of Deficit Nutrients

In developing countries, low-quality crop residues are fed to ruminants, which are deficient in protein, minerals, and vitamins. Dietary supplementation of these low-quality feeds with energy or protein supplements could reduce CH_4 production as a result of improved efficiency of rumen fermentation. A high level of concentrate feeds in diets increase the propionate production, which decreases H_2 availability for CH_4 production. Lovett *et al* reported that increasing the ratio of concentrate in the diet of beef heifers from 35% to 90% decreased CH_4 production and increased body weight gain.[6] Again, increasing the levels of green fodder such as berseem, oat, and sorghum in straw and stover-based diets may reduce CH_4 release. For instance, methane production in crossbred cows decreased by 33% when green sorghum replaced the wheat straw by 30%.[7] Similarly, increased feeding of green oat fodder and berseem forage with the wheat straw diets lowered CH_4 production by 8% to 23% and 20% to 30%, respectively, depending on the ratios of green fodders in diets.[8] The urea-treated straw has also shown to lessen CH_4 emissions in sheep.[9] The use of molasses/ urea multi-nutrient blocks has been found to be a cost-effective diet supplementation strategy with potential to reduce CH_4 emissions by 10% to 25% [10] and to increase milk production at the same time.

3. Forage Species

Some legume forages have been shown to decrease CH_4 production in ruminants, which are often explained by the presence of condensed tannins (CT), low fiber content, high dry matter (DM) intake, and faster rate of passage from the rumen.[11] Feeding of different levels of kobe lespedeza (*Lespedeza striata*) decreased CH_4 production linearly in goats, and it has been attributed to the presence of CT.[12] Furthermore, it has been reported that C_3 forages such as ryegrass and wheat might yield less CH_4 per unit of digestible DM than C_4 forages such as corn and sorghum [13] presumably due to high content of fiber in C_4 plants, but more studies are needed to explain this result.

4. Chemical Compounds

For a long time, halogenated CH_4 analogs and related compounds such as chloroform and chloral hydrate were tested for CH_4 production inhibition in ruminants. Bromochloromethane and 2-bromoethanesulfonic acid, a bromine analogue of coenzyme F involved in methyl group transfer during methanogenesis decreased CH_4 outputs [14] but their anti-methanogenic activity was reported to be transient. Garcia-Lopez *et al* and Kung *et al* reported that 9,10-anthraquinone inhibited methanogenesis.[15,16] However, they cause liver damage and death of animals after a long period of feeding. Therefore, it appears that they are not suitable for use in practice.

5. Fat Addition

Fat inclusion in the diets causes a decrease in CH_4 production depending upon the levels of fat supplementation, fat sources, forms of fat supplementation, and types of diet. Irrespective of fat sources, CH_4 emissions (grams per kilogram of DM intake) were calculated to be reduced by 5.6% with each 1% addition of fats.[11] A decrease in CH_4 production by fat supplementation may be mediated through combined influences on the inhibition of growth of methanogens and protozoal numbers and reduction of ruminal organic matter (OM) fermentation and hydrogenation of unsaturated fatty acids (acting as a alternative H_2 sink) in the rumen.

Although fat inclusion in diets lowers CH_4 emissions consistently for long periods, fat particularly at concentrations above 6–7% of dietary DM can significantly diminish DM digestion particularly fiber components and DM intake, and again the severity of the effect varies with the fat used and type of diets.[11,17] Besides, high levels of added fat can reduce milk fat percentage and daily gain or milk yield.[18] Supplementation of fat through whole cottonseed decreased CH_4 (grams per day or gram of per unit of products) and also increased milk production in dairy cows.[19] However, cost of fat supplementation with edible oils might not be economical for the livestock producers. Therefore, care must be taken in choosing the appropriate fat sources and level of fat supplementation.

6. Plant Secondary Compounds

Recently, bioactive plant metabolites have been an important area of research to substitute chemical feed additives. Many phytochemicals such as saponins, tannins, and many other unknown metabolites from a wide range of plant sources show potential for CH_4 mitigation options.[20,21]

Addition of saponins in the diets might diminish CH_4 production, which is likely due to a decrease in protozoal numbers and/or methanogenic archaeal activity. Saponins of *Sapindus saponaria* suppressed CH_4 production by 20% without affecting methanogen numbers in lambs.[22]

Addition of *Acacia mearnsii* tannin extracts suppressed CH_4 production in sheep by 10% and in cattle up to 30% decreased methanogenesis.[23,24] Methane production was also inhibited by inclusion of methanol extract of pericarp of *Terminalia chebula* in sheep fed 10 g kg^{-1} of DM intake.[25]

7.Essential Oils and Organosulfur Compounds

A number of reports are available showing abatement of CH_4 production by essential oils (EO) and organosulfur compounds. Agarwal *et al.* (2009) reported that inclusion of 0.33 ml/L of peppermint oil decreased CH_4 production by 20% without affecting volatile fatty acid production. Methanol and ethanol extracts of *Foeniculum vulgare* and *Syzygium aromaticum* inhibited CH_4 production *in vitro*.[26] In an experiment with sheep fed on wheat straw and concentrate (1:1), inclusion of *Allium sativum* at 10 g kg^{-1} of DM intake also reduced CH_4 production per unit of OM digested and increased digestibility of fiber.[25]

With organosulfur compounds, i.e., garlic oil and four of its main components (diallyl sulfide, diallyl disulfide, allyl mercaptan, and allicin), Busquet *et al.* observed that garlic oil and diallyl disulfide (300 mg L^{-1} of ruminal fluid) reduced CH_4 production by 74% and 69%,

respectively, without altering digestibility of nutrients in batch cultures.[27]

Conclusion

Overall, although dietary/nutritional interventions look promising in suppressing methane emissions in ruminants, however, results are not consistent in different studies because of great variations in chemical composition of inhibitory compounds used, doses, and feed composition. A great deal of research would be needed to carry out on these dietary compounds supplementation on long term basis and their practical application in livestock feeding.

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Effect of Supplementing Chromium on the Blood Chemistry Profiles of Equines Used for Antitoxin Production

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Abstract

For this study, twenty-four healthy equines, were randomly divided in three equal groups viz, T_0,T_1 and T_2, each having eight animals (four mules and four ponies). Group T_0 served as control and received ration as per standard feeding practice followed on the farm. Group T_1 and T_2 were fed with same ration as used for group T_0 supplemented with chromium tripicolinate @ 210 and 420 πg/kg ration, respectively. The feed treatments had no significant effect on the average blood glucose and haemoglobin values of the animals from different groups. The average PCV values recorded for group T_2 were significantly (P≤0,01) lower than that of groups T_0 and T_1. However, differences between groups T_0 and T_1 were statistically non-significant. The chromium supplement had no significant effect on average neutrophyls counts, average percent lymphocytes, eosinophils, monocytes and basophils counts and average total serum protein of equines from different groups. The average serum albumin values and average serum albumin: globulin ratios values of the animals from control group (T_0)were significantly (Pd≤0,01) higher than that of other two groups. The average serum globulin values of the animals from the control group were significantly (P≤0,01) lower than that of other two groups supplemented with chromium. However, groups T_1 and T_2 did not differ significantly from each other. The average serum tryglyceride values of the animals from control group were significantly (P≤0,01) higher as compare to other two groups. Futrther values for group T_1 were significantly (P≤0,01) higher when compared with group T_2. The chromium supplementation had no significant effect on average serum cholesterol values of the animals from various experimental groups. The average serum LDL values observed for T_1 and T_2 groups were significantly (P≤0,01) lower as compared to control group. The average serum HDL values for groups T_1 and T_2 were significantly (P≤0,01) higher as compared to T_0 group. However, values for group T_1 and T_2 were comparable. Chromium supplementation had no effect on average serum VLDL values of the animals from different groups. Thus it is concluded from over all results of the present study that chromium tripicolinate can be supplemented to equines for better antisera production programme without affecting blood chemistry profile and animal well being.

Keywords: Blood glucose; Hemoglobin; Serum triglyceride; Cholesterol; LDL; HDL; VLDL.

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Introduction

Chromium is essential trace element for normal carbohydrate metabolism which potentiates insulin action and stimulate glucose clearance and also aids in the conversion of thyroxin to tri-iodothyronine which results in increasing metabolic rate. Although lot of literature is available on the role of chromium on glucose metabolism in various species of animals; very scanty information is available on the effect of chromium on horses used for anti-snake venom production which remain under stress due to regular toxin antigen dosing and frequent bleeding. Considering the scope for chromium supplementation to reduce the stressed condition in the equines used in anti-venum production programme, the present experiment was planned to study the effect of different levels of chromium supplementation on blood chemistry profile.

Materials and Methods

For this study twenty four healthy equines (twelve mules and twelve ponies) of about 4-5 years of age used in routine hyper-immunization bleeding programme for anti-snake venum production, were selected. The animals were divided randomly in to three equal groups namely, T_0 (control), T_1 and T_2 group each having eight equine animals (four mules and four ponies) on the basis of species, breed, body weights, age and sex. Group T_0 served as control and received ration as per standard feeding practice followed on the farm. Group T_1 and T_2 were fed with same ration as used for group T_0 supplemented with chromium tripicolinate @ 210 and 420 µg/kg ration, respectively. Measured quantity of chromium tripicolinate in the form of premix was supplemented daily through the ration of individual animal. Measured amount of concentrate mixture was fed twice daily divided in two equal parts, offered individually in the manger in the stable. The animals were let loose group wise in open paddocks for roughage feeding and were fed with greens like Lucerne and maize and dry roughage like hay. Ad lib water was made available to individual equines in the stable throughout the experiment. The percent ingredient and chemical composition of the farm concentrate mixture is given in Table 1 and 2, respectively. The average chemical composition (% DMB) of hay, green maize and Lucerne is given in Table 3.

Table 1: Percent Ingredient Composition of the Farm Concentrate Mixture

Name of ingredient	Per cent level
Maize	16.80
Soybean meal	17.00
Cottonseed cake	08.00
Rice polish	10.00
Deoiled rice bran	18.00
Wheat bran	17.00
Molasses	10.00
Dicalcium phosphate	01.50
Lime stone powder	00.50
Mineral mixture	00..20
Salt	01.00
Total	100.00

The experimental animals were housed in ideal stables with proper ventilation and flooring. Normal methods of hygine, management, feeding practices, vaccination and deworming programmes were followed for all the experimental animals throughout the trial period. Animals were let loose daily in open paddock for roughage feeding, watering and exercise.

Parameters Studied

Blood chemistry profiles in terms of glucose, Hb, PCV, DLC, total serum protein, albumin, globulin and albumin:globulin ratio, serum

Table 2: Per cent Chemical Composition (%DMB) of Farm Concentrate Mixture

Nutrient	Per cent
Dry matter	90.22
Moisture	09.78
Crude protein	21.12
Ether extract	04.98
Crude fibre	10.61
Nitrogen free extract	52.91
Total ash	10.38
Acid insoluble ash	02.37
Calcium	01.32
Phosphorus	00.65

Table 3: The Average Chemical Composition (%DMB) of Hay, Green Maize and Lucerne

Particulars	Hay	Green maize	Lucerne
Dry matter	88.32	26.81	22.12
Moisture	11.68	73.19	77.88
Crude protein	02.25	05.54	22.68
Ether extract	02.55	01.80	01.89
Crude fibre	37.28	26.85	22.30
Nitrogen free extract	49.05	57.51	41.22
Total ash	08.87	08.30	11.91
Acid insoluble ash	05.95	03.62	00.72
Calcium	00.95	00.65	01.48
Phosphorus	00.28	00.15	00.35

Table 4: Blood Chemistry Profile of Equines from Different Experimental Groups

Parameters	T_0	T_1	T_2	Treatment	Fortnight
Blood glucose mg/dl	97.46	88.86	88.55	NS	*
Hemoglobin g%	11.00	11.80	11.84	NS	NS
PCV %	39.63	39.51	35.40	**	*
Neutrophils%	53.68	55.50	51.83	NS	NS
Lymphocytes%	33.88	31.10	35.13	NS	NS
Eosinophils %	04.07	03.95	03.88	NS	*
Monocytes %	07.43	07.68	07.94	NS	NS
Basophils %	0.96	1.73	1.36	NS	NS
Total serum protein g/dl	07.51	07.89	07.92	NS	NS
Serum albumin g/dl	03.58[a]	03.09[b]	02.86[b]	**	**
Serum globulin g/dl	03.93[a]	04.80[b]	05.06[b]	**	**
A/G ratio	0.94[a]	0.67[b]	0.62[b]	**	**
Serum triglycerides mg/dl	61.13[a]	54.27[b]	49.76[b]	**	NS
Serum cholesterol mg/dl	94.45	92.43	92.91	NS	*
LDL mg/dl	48.21[a]	35.47[b]	31.01[b]	**	**
HDL mg/dl	33.96[a]	46.86[b]	49.45[b]	**	*
VLDL mg/dl12.2	12.28	10.10	12.45	NS	NS

Note:1. The mean with at least one common superscript in the same row do not differ significantly.
2. * Significant at 5 % level ** Significant at 1 % level NS Not Significant

tryglycerides, total cholesterol, LDL, HDL and VLDL were studied during experiment of 13 weeks.

Analytical Techniques

The blood samples were analyzed for Hb, PCV and DLC by using standard methods described by Sastry.[1] Total serum protein, serum albumin, serum globulin and albumin:globulin ratio was estimated by using Barret and BCG Dye binding method with Qualigans reagent kit on spectrophometer-104. Blood glucose and serum lipid profiling was carried out with the help of auto-analyzer. The standard laboratory procedure was followed for estimation of blood profiles. All the data collected during experimental period were subjected to statistical analysis as per Snedecor and Cochran by using randomized block design to draw the conclusions.[2]

Results and Discussion

Blood chemistry profiles of equines from different experimental groups is given in Table 4. The average blood glucose values for groups T_0, T_1 and T_2 were 97.46, 88.86 and 88.55 mg/dl, respectively. It was observed that the feed treatments had no significant effect on the average blood glucose concentration values of the animals from different groups. The numerically lower values of blood glucose concentration observed in animals supplemented with chromium might be due to enhanced glucose metabolism. Findings of

the present study are in agreement with the findings of Pagan *et al* who observed lower glucose levels in exercising horses supplemented with 5 mg of chromium.[3]

The average hemoglobin values for groups T_0, T_1 and T_2 were 11.00, 11.80 and 11.84 g %, respectively. It was seen that feed treatments had no significant effect on average blood hemoglobin values of the animals from different groups. Estrada *et al* reported no significant changes in hemoglobin throughout immunization.[4] The observations recorded from different regimes in the present study are in agreement with the above findings. Angulo *et al* observed drop in hemoglobin concentration and hematocrit in horses used for anti-venom production.[5]

The average PCV values of the equines from groups T_0, T_1 and T_2 were 39.63, 39.51 and 35.40 %, respectively. It was observed that PCV values recorded for group T_1 were significantly ($P \leq 0.01$) lower than that of groups T_0 and T_1. However, the differences in average of PCV values recorded for groups T_0 and T_1 were non-significant. The reduced PCV values in treatment groups may result in increased plasma recovery which is very much preferred in case of equines used for ASVS production.

The average percent neutrophils counts of the equines from groups T_0, T_1 and T_2 were 53.68, 55.50 and 51.83, respectively. It was observed that the chromium supplement had no significant effect on average neutrophils counts for different groups. The average percent lymphocytes counts for groups T_0, T_1 and T_2 were 33.88, 31.10 and 35.13 %, respectively. It was seen that the chromium supplement had no significant effect on average lymphocytes counts for different groups. The average values for groups T_0 and T_2 were almost comparable and that of group T_1 were lower.The average percent monocytes counts of the equines from groups T_0, T_1 and T_2 were 07.43, 07.68 and 07.94 %, respectively. It was observed that the chromium supplementation had non-significant effect on average percent eosinophils counts of equines for different groups. The values being 04.07, 03.95 and 03.88 %, respectively for groups T_0, T_1 and T_2. The average basophils count values for groups T_0, T_1 and T_2 were 0.96, 01.73 and 01.36 %, respectively. It was seen that the chromium supplement had no significant effect on average basophils counts for different groups.

The average total serum protein values for groups T_0, T_1 and T_2 were 07.51, 07.89 and 07.92 g/dl, respectively.It was seen that the chromium supplement had no significant effect on average total serum protein of the animals for different groups. Estrada *et al.* and Angulo *et al* observed a significant increment in total serum proteins in the second half of the immunization in the horses inoculated with snake venom for production of antivenom.[4,5]

The average serum albumin values of the equines from groups T_0, T_1 and T_2 were 03.58, 03.09 and 02.86 g/dl, respectively. It was observed that average serum albumin values of the animals from control group (T_0) were significantly ($P \leq 0.01$) higher than that of other two groups. The average serum albumin values of animals from groups T_1 and T_2 did not differ significantly from each other.

The average serum globulin values of the equines from groups T_0, T_1 and T_2 were 03.93, 04.80 and 05.06 g/dl, respectively. It was observed that average serum globulin values of the animals from control group (T_0) were significantly ($P \leq 0.01$) lower than that of other two groups. The average serum globulin values of animals from groups T_1 and T_2 did not differ significantly from each other. The average fortnightly serum albumin: globulin ratios of the equines from groups T_0, T_1 and T_2 were 0,94, 0.67 and 0.62, respectively. It was observed that average serum albumin :globulin ratios of the animals from control group (T_0) were significantly ($P \leq 0.01$) higher than that of other two groups. The average serum albumin :globulin ratios values of animals from groups T_1 and T_2 did not differ significantly from each other.

The average serum triglyceride values of the animals for groups T_0, T_1 and T_2 were 61.13, 54.27 and 49.76 mg/dl, respectively. It was observed that average serum triglyceride values of the animals from control group (T_0) were significantly ($P \leq 0.01$) higher than that of other two groups. Further, values for group T_1 were

significantly (P≤0.01) higher when compared with group T_2. Finding of the present study are matching with Uyanik *et al* who reported significant (P≤0.01) reduction in serum triglyceride levels of working horses receiving chromium picolinate @ 200 and 400 µg/day for 45 days.[6]

The average serum cholesterol values of the animals for groups T_0, T_1 and T_2 were 94.45, 92.43 and 92.91 mg/dl, respectively. It was seen that the chromium supplementation had no significant effect on average serum cholesterol values of the animals from various experimental groups. Similar findings were observed by Uynaik *et al* who observed slight reduction in serum cholesterol levels of working horses receiving chromium picolinate @ 200 and 400 µg/day for 45 days.[6]

The average serum LDL values from animals for groups T_0, T_1 and T_2 were 48.21, 35.47 and 31.01 mg/dl, respectively. It was seen that the values observed for T_1 and T_2 groups were significantly (P≤0.01) lower as compared to control group. However, values for groups $T_1$and T_2 were comparable.

The average serum HDL values from animals for groups T_0, T_1 and T_2 were 33.96, 46.86 and 49.45 mg/dl, respectively. It was seen that the values observed for T_1 and T_2 groups were significantly (P≤0.01) higher as compared to control group. However, values for groups T_1 and T_2 were comparable. Uyanik et al. (2008) reported no significant effect on serum HDL levels for working horses receiving chromium picolinate @ 200 and 400 µg/day for 45 days than that of horses receiving control ration without chromium.

The average serum VLDL values from animals for groups T_0, T_1 and T_2 were 12.28, 12.10 and 10.10 mg/dl, respectively. It was seen that the chromium supplementation had no effect on average serum VLDL values from animals from different groups.

Conclusion

From the overall performance of equines from the present study, it is summerised that chromium supplementation to ration fed to equines for anti-sera production programme resulted satisfactory blood chemistry profiles giving higher serum globuline values which is most important criteria to decide number of doses of antisera that will be produced from the equines. Supplementation of chromium in the form chromium tripicolinate @ 420 µg/kg ration, to the equines give numerically superior performance when compared with the performance that of @ 210 µg/kg ration, although the differences were not statistically significant. Thus it is concluded from the overall results of the present study that chromium tripicolinate can be supplemented @ 210 µg/kg ration of equines for better anti-sera production programme without affecting plane of nutrition and animal wellbeing. For steady performance the supplementation of chromium tripicolinate @ 420 µg/kg ration of equines can be done.

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Nutritional Status of Buffaloes in Banaskantha District of North Gujarat

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Abstract

A survey was undertaken to study the feeding practices and nutritional status of buffaloes in five talukas of Banaskantha district of North Gujarat. It was observed that most of dairy animals were stall-fed and provided dry and green fodder with various combinations of concentrate mixtures. The daily milk production and 6% FCM of buffaloes were 8.42 kg and 15.09 kg, respectively. The average DM, DCP and TDN Intake (kg/day) of the buffaloes in Banaskantha district were 12.74, 0.93 and 6.78, respectively.

Keywords: Buffaloes; DCP; TDN; FCM.

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Introduction

Adequate supply of feeds and fodders is a critical factor affecting performance of animals. Availability of green fodder, dry fodder and homemade concentrate/compound feed in an area largely determine the conventional feeding practices followed by the farmers. Buffaloes with high milk yielding potential produce milk up to their inherited capacity It is necessary to provide adequate and balanced nutrition in order that they can express their full potential.[1]

Materials and Methods

A survey of Banaskantha district of North Gujarat was conducted in five talukas viz. Dantiwada, Palanpur, Amirgadh, Deesa and Dhanera. Multistage random sampling technique was used to select the respondents. Two villages were selected in each taluka, which were geographically located apart in the direction and truly represented the animal husbandry practices of the taluka. In each village, 10 farmers who own animal/s producing at least 10 kg or more milk per day were selected. The selected farmers were interviewed on the basis of questionnaire developed. Information regarding type of feed offered, daily intake of individual animal, milk yield and its fat % were collected from all the respondents.

The record of intake of feeds and fodder were taken and on the basis of nutritive value given by Sen *et al.* , Ranjhan and ICAR the DM, DCP and TDN intake of buffaloes were calculated.[2-4] The samples of feeds and fodder were analyzed for proximate constituents by the methods of AOAC.[5] The data were subjected to statistical analysis using methods of Snedecor and Cochran .[6]

Results and Discussion

Most of the owners selected keep their animals stall-fed either at home or at farm within a limited area. They store dry fodder like straws of Bajri, Wheat, Jowar and Groundnut haulms. Most of them grow green fodders like Jowar, 'Rajaka-Bajari (multicut), Chicory leaves, Hybrid Napier, Lucerne and local mixed grasses. It was found that the dairy animals were fed roughages three times and concentrates offered twice a day at the time of milking. Among concentrate they fed Banasdan (compound cattle concentrate), maize grain, bajri grain, cottonseed cake etc. Similar

Table 1: Average Estimated Levels of Nutrients Supplied to Buffaloes in Comparison to their Calculated Requirements

Taluka	Village	MY (kg)	6% FCM	DM Intake	C:R Ratio		Available Nutrients (kg)		Require Nutrients (kg)		Nutrient Intake (%of Requirement)	
							DCP	TDN	DCP	TDN	DCP	TDN
Dantiwada	Odhva	6.75	14.10	10.46	35.73	64.27	0.906	7.52	1.000	8.15	90.60	92.26
	Nilpur	9.90	15.35	12.43	34.20	65.80	1.104	9.12	1.071	8.66	103.08	105.31
	Average	8.32	14.72	11.44	34.96	65.04	1.005	7.32	1.035	8.40	96.84	98.78
Palanpur	Jagana	5.79	13.67	11.82	34.54	65.46	1.176	8.18	0.976	7.97	120.49	102.63
	Kushkal	3.80	7.53	9.49	34.32	65.68	1.106	8.76	0.626	5.45	176.67	160.73
	Average	4.79	10.60	10.65	34.43	65.57	1.141	8.47	0.801	6.71	148.58	131.68
Amirgadh	Ikbalgadh	11.02	17.41	12.36	35.51	64.49	0.715	4.61	1.189	9.51	60.13	48.47
	Dabhela	9.00	16.50	14.23	33.60	66.40	1.039	8.28	1.137	9.14	91.38	90.59
	Average	10.01	16.95	13.29	34.56	65.45	0.877	6.44	1.163	9.32	75.75	69.53
Deesa	Zerada	10.77	17.11	14.99	35.05	64.95	0.728	5.11	1.172	9.39	62.11	54.41
	Vasada	10.73	16.03	12.65	36.32	63.68	0.768	5.20	1.110	8.94	69.18	58.16
	Average	10.75	16.57	13.82	35.69	63.32	0.748	5.15	1.141	9.16	65.64	52.28
Dhanera	Bhatib	8.29	16.52	15.14	34.21	65.79	0.861	5.86	1.138	9.06	75.65	64.67
	Saral	8.21	16.77	13.93	36.46	63.54	0.991	7.27	1.152	9.25	86.02	78.59
	Average	8.25	16.64	14.53	35.34	64.67	0.926	6.56	1.145	9.15	80.83	71.63
Average		**8.42**	**15.09**	**12.74**	**35.19**	**64.81**	**0.939**	**6.78**	**1.057**	**8.54**	**93.52**	**82.47**

Table 2: Percentage of Buffaloes Underfed, Moderately Underfed, Adequately Fed, Moderately Overfed and Overfed Out of those Surveyed

Taluka	DCP					TDN				
	U	**MU**	**A**	**MO**	**O**	**U**	**MU**	**A**	**MO**	**O**
Dantiwada	69.16	13.07	13.42	4.35	0	82.21	0	17.79	0	0
Palanpur	12.50	12.50	27.50	35.00	12.50	40.00	7.50	27.50	2.50	22.50
Amirgadh	78.78	5.61	4.39	11.22	0	77.56	0	5.61	16.83	0
Deesa	83.02	6.51	6.98	3.49	0	86.51	3.49	0	10.00	0
Dhanera	80.01	0	4.26	11.47	4.26	87.21	4.26	0	8.53	0

U -underfed (< 90 % of requirement), MU- Moderately Underfed (> 90 < 100 % of requirement), A- Adequately fed (> 100 <11 % of requirement), MO- Moderately Overfed (> 110 <125 % of requirement), O- Overfed (> 125 % of requiremen

kind of feeding practices observed by Gami et al. (2012).

The quantity of concentrate fed (kg/day) to buffaloes in different talukas ranged between 5.05 to 7.09. The district average was 6.16 kg/day. The feeding of green fodders to buffaloes in different talukas ranged between 19.36 to 28.02 kg/day. The district average worked out as 24.67 kg/day. The dry roughage feeding ranged between 4.97 and 6.41 kg/day in buffaloes. The district average for dry roughages worked out as 5.56 kg/day**.** The average concentrate to roughage ratio in buffaloes of different talukas ranged between 34.43: 65.57 to 35.69: 63.32 with an average of 35.19: 64.81 (Table 1).

The average DM, DCP and TDN Intake (kg/day) of the buffaloes in Banaskantha district was 12.74, 0.93 and 6.78, respectively. The DM, DCP and TDN Intake of buffaloes in different talukas did not differ significantly. However, the same differed significantly (P<0.05) between villages. Present findings are in accordance with Lal *et al*.[7] On the basis of nutrients available to buffaloes were grouped in to various classes like underfed, moderately underfed, adequately fed, moderately overfed and overfed are summarized in table 2.

The daily milk production and 6% FCM of buffaloes were 8.42 kg and 15.09 kg, respectively. Daily milk production and 6% FCM of buffaloes in different talukas did not differ significantly. However, the same differed significantly (P<0.05) between villages.

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Bench Evidence for Diabetic Peripheral Neuropathy: What does Animal Studies Inform Clinical Practice?

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Abstract

This short communication was aimed at enumerating the evidence from animal models of Diabetic peripheral neuropathy (DPN) in order to imply clinical decision-making in routine practice through a preliminary search of PubMed. The animal models demonstrated abnormalities in motor nerve conduction velocity (MNCV) and hind-limb digital sensory nerve conduction velocity (SNCV) deficits, thermal hypoalgesia, tactile allodynia, and a remarkable loss of intraepidermal nerve fibers. The streptozotocin (STZ)-induced diabetic rat is the most commonly employed animal model used to study mechanisms of painful diabetic neuropathy through behavioral assays of mechanical allodynia and heat hyperalgesia and to evaluate potential therapies.

Keywords: Bench-to-bedside; Knowledge translation; Evidence-based practice; Animal sciences.

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This short communication was aimed at enumerating the evidence from animal models of Diabetic peripheral neuropathy (DPN) in order to imply clinical decision-making in routine practice through a preliminary search of PubMed.

Historically, animal models of DPN studied streptozotocin-induced diabetic rats and mice forfunctional, metabolic, neurotrophic, and morphological abnormalities for type-1 diabetes, and leptin-deficient (ob/ob) mice for type-2 diabetes.[1] The animal models demonstrated abnormalities in motor nerve conduction velocity (MNCV) and hind-limb digital sensory nerve conduction velocity (SNCV) deficits, thermal hypoalgesia, tactile allodynia, and a remarkable loss of intraepidermal nerve fibers.[2]

Animal models and biomarkers of DN have been extensively used in neuropathic research. Diabetic rodents show behavioral, functional, structural and molecular biomarkers and they are widely used as models to investigate the etiology of DN as well as to screen the efficacy of the potential therapeutic interventions.[3] The streptozotocin (STZ)-induced diabetic rat is the most commonly employed animal model used to study mechanisms of painful diabetic neuropathy through behavioral assays of mechanical allodynia and heat hyperalgesia and to evaluate potential therapies.[4]

Analysis of slow axonal transport in BB rats revealed a delay in transport of the neurofilament (NF) subunits, tubulin, actin, and the 60, 52, and 30 kDa polypeptides in both systems. Morphometric analysis revealed that the cross-sectional area of axons was also increased proximally at the level of the motor roots and decreased distally. The changes in slow transport and caliber observed in central and peripheral axonal systems of diabetic BB rats are virtually identical to those previously described in rats with streptozotocin-induced diabetes.[5]

The bradykinin system was hypothesized to mediate hyperalgesia through the inducible bradykinin B1 receptor subtype which was evidenced by the efficacy of selective antagonists of the inducible bradykinin B1 receptor (BKB1-R) subtype.[6] In addition to dissociated cell culture of peripheral neurons (mainly DRG neurons) and Schwann cells, and explant culture of peripheral ganglia and retinas on diabetic animals or patients, adult animal neurons and Schwann cells were also cultured under high glucose conditions and adult animal neurons exposed to diabetic serum in order to study inter-relationship.[7]

Vincent *et al* demonstrated that overexpression of superoxide dismutase (SOD2) decreases superoxide (O(2)(-)) in cultured primary dorsal root ganglion (DRG) neurons and subsequently blocks caspase-3 activation and cellular injury; and underexpression of SOD2 in dissociated DRG cultures from adult SOD2(+/-) mice results in increased levels of O^{2-}, activation of caspase-3 cleavage and decreased neurite outgrowth under basal conditions that are exacerbated by hyperglycemia. SOD2 activity thus was an important cellular modifier of neuronal oxidative defense against hyperglycemic injury.[8]

Vincent *et al* explained the role of imbalance between mitochondrial biogenesis and fission in the pathogenesis of DPN, "During acute hyperglycemia, mitochondrial fission is a prominent response, and excessive mitochondrial fission may result in dysregulation of energy production, activation of caspase 3, and subsequent DRG neuron injury. During more prolonged hyperglycemia, there is evidence of compensatory mitochondrial biogenesis in axons."[9]

Wuarin-Bierman *et al* studied pain threshold and MNCV in three animal models of diabetic and nutritional neuropathies: Psammomysobesus (sand rat), streptozotocin-treated and galactose-fed rats. 75 rats were controls, 16 were hyperinsulinaemic, 46 were insulin-deficient and 12 were galactosaemic animals. The study confirmed that hyperalgesia was a constant feature of sensory dysfunction in spontaneous and experimental models of diabetic neuropathy.[10]

Kitahara *et al* examined the effect of long-term suppression of postprandial hyperglycemia and glycemic fluctuation in Goto-Kakizaki (GK)

rats, a type 2 diabetic animal model, by nateglinide (NG), a fast-acting hypoglycemic agent, and the slow-acting effect of glibenclamide (GC). The study findings suggested that meticulous control of postprandial hyperglycemia is essential to inhibit the development of neuropathy in type 2 diabetes.[11]

Wang et al compared four different herpes simplex virus (HSV)1-based vectors to produce one of two opioid receptor agonists (enkephalin or endomorphin), or one of two isoforms of glutamic acid decarboxylase (GAD65 or GAD67), alone and in combination, in the streptozotocin-induced diabetic rat and mouse models. The study found that a single subcutaneous hindpaw inoculation of vectors expressing GAD65 or GAD67 reduced diabetes-induced mechanical allodynia and thermal hyperalgesia which demonstrated that either GAD65 or GAD67 vectors are the most effective in the treatment of diabetic pain.[12]

The animal models demonstrated abnormalities in motor nerve conduction velocity (MNCV) and hind-limb digital sensory nerve conduction velocity (SNCV) deficits, thermal hypoalgesia, tactile allodynia, and a remarkable loss of intraepidermal nerve fibers. The streptozotocin (STZ)-induced diabetic rat is the most commonly employed animal model used to study mechanisms of painful diabetic neuropathy through behavioral assays of mechanical allodynia and heat hyperalgesia and to evaluate potential therapies.

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[1] Flink H, Tegelberg Å, Thörn M, Lagerlöf F. Effect of oral iron supplementation on unstimulated salivary flow rate: A randomized, double-blind, placebo-controlled trial. J Oral Pathol Med 2006;35:540-7.

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Reference from electronic media

[9] National Statistics Online—Trends in suicide by method in England and Wales, 1979-2001. www.statistics.gov.uk/downloads/theme_health/HSQ 20.pdf (accessed Jan 24, 2005): 7-18. Only verified references against the original documents should be cited. Authors are responsible for the accuracy and completeness of their references and for correct text citation. The number of reference should be kept limited to 20 in case of major communications and 10 for short communications.

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