Feeding practices and nutritional status of horses in Ganderbal District of Kashmir

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Abstract

Equines have a significant impact on socio-economics of poor farmers; however improper nutritional management leads to their below average performances, and thus lack of interest in equine rearing, the main cause for continuous decline in equine population. The present study was conducted on 90 horse rearing households in three blocks (Ganderbal, Kangan, and Lar) of Ganderbal district, the northern Himaliyan region of J&K (UT) to assess the feeding practices followed by the farmers and the nutritional status of different classes of horses. The feed ingredients offered to animals were collected for nutrient composition and the feed intake was recorded for determination of nutritional status of equines in terms of intake of dry matter (DM), crude protein (CP), digestible energy (DE), and macro minerals (Ca and P). Daily DM intake was optimal in adult equines and 18.01% below requirements in foals. The mean daily intake of CP in adult equines was 17.13% higher, while in foals and nursing mares it was 5.97% and 9.20% lower than requirement, respectively. In all categories of equines, the mean daily Ca and P intakes were either optimal or above requirements. It is concluded that horse owners had limited scope of feed/fodder resources for feeding their animals which led to deficiency in DM, DE, CP, and Ca, particularly in foals.

Keywords: farmers; feeding; nutritional status; Equine; Himalayan region

Introduction

Working equids (horses, donkeys, and mules) help some of the world's poorest communities by allowing individuals in low and middle income nations to earn a living and support their families (Norris *et al.*, 2021). They play a wide range of roles (Kubasiewicz *et al.*, 2020) being a valuable source of labor in the construction, agriculture, and tourist industries, as well as provide support by transporting people and essential commodities. Working equids provide a living for almost 600 million people worldwide (Sommerville *et al.*, 2018). The most important contribution of today's horse population is their survival as pack animals or cart pullers, as well as their participation in sports and warfare. Draft animal species like Yak (Behl et al 2020) and double humped camel (Vyas et al, 2015) are available in Indian hilly zones, but equines are the most important draft species. And like in other hilly zones of the country, equines have a significant impact on socio-economics of populace where horses are primarily owned by socially and economically disadvantaged landless, marginal, and small farmers (Bhat *et al*., 2021).

Through the process of domestication, the horse's physical and behavioral requirements have remained relatively unchanged (Willekes, 2013), though the number of horses has decreased either as a result of historical events or focused government interests. Besides, very little knowledge of equine owners about balanced feeding often leads to poor performance and mortality further stressing the declining population of horses. Moreover, reduced utilities of equines in the hills and tough terrains, and loss of interest among livestock farmers due to their poor performance and unhealthy body conditions have also resulted into dropping of the overall population of these species in the majority of the pockets (Gupta *et al*. 2012a, b). The same causes have resulted in the decline of horse population by 56% in J&K state i.e. from 1.44 lakh to 0.62 lakh only (DAHK, 2019). However, J&K has retained its second position in India for the highest equine population after Uttar Pradesh as the trends for a drastic decrease in the number of horses is followed pan India.

Nutrition is an empirical component of livestock since it has a significant effect on performance and productivity. In horses, improper nutrition can lead to a variety of disease conditions, (Hoffman *et al.*, 2009), poor performance, and is considered as one of the major contributing factor for declining equine population. Thus, there is an urgent need to document the nutritional status, and feeding practices adopted by horse rearing farmers in Kashmir to suggest corrective measures to check the declining horse population.

Materials and Methods

The study was conducted in three horse-raising blocks (Ganderbal, Kangan, and Lar) of district Ganderbal, the northern hilly district of Himalayan region of J&K (UT) with a total horse population of 6000 (Anonymous, 2011). This district in Kashmir valley is situated on the north of Srinagar, with elevations ranging from 1650 to 3000 meters above sea level. A total of 90 horse-raising households were surveyed to learn about feeding techniques and nutritional conditions of various equines. The research included 90 adult horses (30 from each block), 12 nursing mares (06 from Ganderbal, 06 from Kangan, but no nursing mares were seen in the Lar region), and 24 foals (08 from each block surveyed).

The feed samples offered to equines were collected, processed, and evaluated for proximate composition (AOAC, 2005), fiber fractions (Van Soest *et al.*, 1991), and calcium and phosphorus (Talapatra *et al.*, 1948). The digestible energy (DE) of the available feeds/fodders was estimated using equations (NRC, 2007).

1. Digestible energy (DE) (Mcal/kg) for dry forages and roughage = 4.22–0.11(% ADF) + 0.0332(% CP) + 0.00112(% ADF^2)
2. DE (Mcal/kg) for concentrates = 4.07 – 0.055(% ADF).

The daily intakes of dry matter (DM), crude protein (CP), DE and macro minerals (calcium - Ca and Phosphorus - P) by different categories of horses were calculated from feed intake on the basis of average nutritive value of feeds and fodders from particular study area. Equines' nutritional status was established by comparing projected supplies of essential nutrients (DM, CP, and DE) and macro minerals (Ca and P) to dietary requirements (NRC, 2007).

Proforma data was collected, processed, and analyzed according to the Snedecor and Cochran (1994). The data were analyzed using the descriptive statistic approach to assess the variance and mean differences (DNMRT). Tests of proportions were used to assess the importance of different proportionalities.

The test statistic used was:

$$Z = p_1\text{-}p_2/\sqrt{p\ q\ (1/n_1+1/n_2)}$$

Where, p1 and p2 are two proportions and $p=x_1+x_2/n_1+n_2$ ($x_1$and $x_2$stands for number of occurrences in two samples of size n_1 and n_2, respectively; q=1-p

Results and Discussions

Available feeds and feeding practices adopted

Equine owners were found to feed maize stover, mixed grass hay, oat hay and paddy straw as roughage and maize grain, mustard oil cake, rice bran, and wheat bran as concentrates to their animals. Grazing was permitted during periods of rest or in the absence of work. Equines were allowed to graze for three hours each day in areas where there were plenty of pastures. Three times a month, equines were fed 200-300 g of masala made up of onion, ginger, garlic, clove, green chilies, turmeric, black cumin, and salt. Traditional masala is thought to regulate body temperature and appetite, as well as clear infection from the intestines, and promote gut health. Approximately 100g of gur was offered to working equines only during the winter season, and no other supplemental feeds were found to be fed to equines in any of the district's study blocks. In all blocks of the district, equine owners did not use pellet feeds, oat grain, gram, oilseeds, and mineral mixtures in the ration of their equines, which are otherwise essential for the performance and well-being of equines. Horse owners had limited options for feed ingredients for ration formulations, which could be explained by a lack of feed/fodder resources as equines are on the third tier of feeding priorities, contributing to nutritional deficiencies, particularly in foals. The feeding practices used by equine owners in the various study areas are consistent with previous reports by Hassan *et al.* (2018 and 2019) and Bhat *et al.* (2021).

Chemical composition of feed and fodders

The chemical composition (as percent dry matter) of feeds and fodders offered to equines in the different blocks of the district is presented in Table-1 while average district composition of feeds and fodders is depicted in Table-2. The CP content of roughages was found to be highest in oat hay (10.16±0.26) and lowest in maize stover (3.36±0.16). The ether extract (EE) content of maize stover ranged from 2.50±0.17% to 3.28±0.12% in oat hay. The highest ash content was found in paddy straw (13.10±0.30) and the lowest in oat hay (10.37±0.23). The highest neutral detergent fibre (NDF) content was found in paddy straw (69.19±0.46) and the lowest in mixed hay (53.25±0.57). The highest acid detergent fibre (ADF) content was found in paddy straw (54.30±0.51) and the lowest in mixed hay (11.90±0.44 percent DM). Ca content in mixed hay was found to be the highest (1.07±0.03), followed by P content in oat hay (0.75±0.01). Among concentrates, mustard oilcake (MOC) had the highest CP content (36.69±0.40) and maize had the lowest (5.07±0.13). The EE content in concentrate feed ranged from 2.33±0.09 percent DM in wheat bran to 13.12±0.22 percent DM in MOC. Rice bran had the highest ash content (12.65±0.21) and maize grain had the lowest (3.09±0.14). Ca content was found to be highest in wheat bran (0.69±0.02 percent DM) and P in MOC (1.09±0.03 percent DM). The chemical composition of feeds and fodders fed to the equines in the study areas of district Ganderbal was within normal ranges (ICAR, 2013). Our findings support the findings of Hassan *et al.* (2018 and 2019), Ganai *et al.* (2006), and Bhat *et al.* (2021). The nutrient content of feeds and fodders is determined by the region's agro-climatic and edaphic conditions. The introduction of high-yielding crop varieties, intensive crop cultivation, and extensive use of various fertilizers all change the nutrient content of feedstuffs and in turn, the quality and quantity of feed available to animals in a given region have a significant impact on their productivity and health (Ganai *et al.*, 2006).

Nutritional status of equines

Feed intake is usually regarded as an important index of the well-being and performance of an animal. All the horses studied in the present study were of non-descriptive breed. The daily dry matter intake (DMI) by adult horses, foals, and lactating mares are presented in Tables 3, 4, and 5 respectively. Total DMI (kg/day) by adult horses was found 6.97±0.05, which in comparison with requirement standards (NRC, 2007) depicted that DMI by adult equines was either optimum or above the requirements. DMI by foals of the district revealed a deficiency of 22.51%, 18.09%, and 13.85% in Ganderbal, Kangan, and Lar blocks with an overall deficiency of 18.01% in the district. Total DMI by lactating mares was 6.68±0.17 kg/day, which was optimum in all the study areas of the district. The DMI for adult equines and lactating mares was within the ranges in all the blocks of the district (NRC, 2007). This can be explained by the fact that the adult horses and lactating mares were used for work and hence were taken more care whereas foals were not put to work so were paid less attention by their owners. Our results were comparable with those of Pal *et al*. (2013), and Hassan *et al*. (2018 and 2019). However, Gallagher *et al.* (1992) and Honore *et al.* (1994) reported higher DMI than requirements.

DE intake (Mcal/day) by adult horses was found 17.47±0.16, which was found to be in excess by 2.71% than the requirements (NRC, 2007). Similarly, daily intakes of DE by foals of the district were found to be more than 15.34% than the requirements. While DE intake by lactating mares was found to be in excess by 7.09% and 15.51%, respectively in Ganderbal and Kangan areas when compared with the requirements with overall excess of 10.6% in the district. DE intake of lactating mares was found higher than adult equines; this may be due to feeding extra diet to lactating mares as compared to adult equines. Lawrence (1990) reported that horses performing light work should be fed a diet that contains 80% roughage and 20% concentrates while horses performing heavy work may be fed 33% roughage and 67% concentrate. DE intake of 39.04 Mcal/day for 500 kg horse (which corresponds to 18.02 Mcal for 250 kg) was reported by Glade (1983), which supports the results in the present study. Our results also fall in line with the earlier reports of Hassan *et al.* (2018 and 2019), and Bhat *et a.l* (2021).

Table 1: Chemical composition (%DM) of feeds and fodders of district Ganderbal

Block	Feed /fodder	DM	CP	EE	CF	TA	AIA	NDF	ADF	Ca	P
Ganderbal	Maize	86.97	5.42	2.02	3.17	3.14	2.32	16.14	4.53	0.28	0.31
	MOC	90.25	35.95	12.52	8.21	7.30	0.41	29.60	13.37	0.60	1.04
	Rice bran	89.56	12.76	2.46	15.90	13.39	9.25	63.05	29.71	0.62	0.88
	Wheat bran	89.99	13.37	2.22	13.54	5.51	0.74	41.46	10.36	0.63	0.46
	Maize Stover	85.78	3.95	1.99	33.22	13.70	1.92	69.12	46.85	0.53	0.16
	Mixed hay	85.75	5.60	2.23	34.42	12.31	2.07	53.35	10.37	0.99	0.53
	Oat hay	86.92	9.65	3.20	28.16	10.61	2.95	56.17	4.30	0.55	0.79
	Paddy straw	88.73	5.33	2.08	36.21	12.88	3.62	69.75	53.87	0.61	0.46
Kangan	Maize	90.06	5.21	2.79	4.27	3.49	1.17	18.05	5.88	0.19	0.33
	MOC	90.27	35.88	13.93	9.40	7.59	0.68	25.66	12.30	0.63	1.18
	Rice bran	90.08	12.41	2.46	14.28	11.98	9.73	64.57	31.38	0.56	1.09
	Wheat bran	88.47	13.25	2.51	13.81	7.10	0.68	42.45	9.62	0.66	0.21
	Maize Stover	87.87	2.98	3.14	31.08	13.13	3.18	67.79	45.83	0.56	0.18
	Mixed hay	86.32	5.42	2.23	31.75	12.33	3.20	51.31	12.22	1.12	0.44
	Oat hay	88.58	11.01	2.94	31.24	10.84	3.44	53.69	49.39	0.59	0.77
	Paddy straw	89.05	4.47	4.06	35.49	14.10	4.95	68.55	53.47	0.78	0.35
Lar	Maize	89.82	4.60	3.68	5.25	2.65	1.39	18.02	4.53	0.32	0.45
	MOC	91.27	38.25	12.92	8.65	6.80	0.93	29.52	11.47	0.64	1.04
	Rice bran	90.31	13.40	3.57	13.07	12.58	10.66	65.17	32.26	0.72	1.09
	Wheat bran	88.30	13.55	2.27	13.38	7.22	0.69	40.73	9.25	0.78	0.28
	Maize Stover	87.86	3.17	2.37	31.68	12.22	2.79	70.15	45.89	0.66	0.21
	Mixed hay	87.46	6.38	3.67	31.10	13.54	2.83	55.11	13.24	1.11	0.57
	Oat hay	89.64	9.83	3.70	29.53	9.66	2.71	55.45	56.17	0.55	0.79
	Paddy straw	89.26	6.68	3.58	34.23	12.33	2.20	69.75	55.58	0.50	0.58

*DM= Dry matter, CP= Crude protein, EE= Ether extract, CF= Crude fibre, TA= Total ash, AIA= Acid insoluble ash, NDF= Nutrient Detergent fibre, ADF= Acid detergent fibre, Ca= Calcium and P= Phosphorous

Table 2: Mean chemical composition (% DM) of feeds and fodders of district Ganderbal

Feed / fodder	DM	CP	EE	CF	TA	AIA	NDF	ADF	Ca	P
Maize	88.95 ±0.49	5.07 ±0.13	2.83 ±0.24	4.23 ±0.30	3.09 ±0.14	1.62 ±0.17	17.40 ±0.32	4.53 ±0.39	0.26 ±0.02	0.35 ±0.01
MOC	90.59 ±0.17	36.69 ±0.40	13.12 ±0.22	8.75 ±0.18	7.23 ±0.12	0.67 ±0.07	28.26 ±0.65	12.38 ±0.29	0.62± 0.01	1.09 ±0.03
Rice bran	89.98 ±0.13	12.86 ±0.15	2.83 ±0.19	14.41 ±0.41	12.65 ±0.21	9.88 ±0.21	64.26 ±0.31	31.11 ±0.47	0.63 ±0.02	1.02 ±0.05
Wheat bran	88.92 ±0.27	13.39 ±0.07	2.33 ±0.09	13.57 ±0.12	6.61 ±0.27	0.70 ±0.02	41.54 ±0.25	9.74 ±0.16	0.69 ±0.02	0.31 ±0.04
Maize stover	87.17 ±0.39	3.36 ±0.16	2.50 ±0.17	31.99 ±0.37	13.01 ±0.24	2.63 ±0.20	69.02 ±0.39	46.19 ±0.20	0.58 ±0.02	0.18 ±0.00
Mixed hay	86.51 ±0.28	5.80 ±0.18	2.7 ±0.24	32.42 ±0.51	12.72 ±0.21	2.70 ±0.17	53.25 ±0.57	11.94 ±0.44	1.07 ±0.03	0.51 ±0.02
Oats hay	88.38 ±0.40	10.16 ±0.26	3.28 ±0.12	29.64 ±0.44	10.37 ±0.23	3.03 ±0.10	55.10 ±0.37	47.50 ±0.40	0.59 ±0.01	0.75 ±0.01
Paddy straw	89.01 ±0.13	5.49 ±0.33	3.24 ±0.31	35.31 ±0.30	13.10 ±0.30	3.59 ±0.41	69.19 ±0.46	54.31 ±0.51	0.63 ±0.04	0.46 ±0.03

* MOC= Mustard oil cake, *DM= Dry matter, CP= Crude protein, EE= Ether extract, CF= Crude fibre, TA= Total ash, AIA= Acid insoluble ash, NDF= Nutrient Detergent fibre, ADF= Acid detergent fibre, Ca= Calcium and P= Phosphorous

Table 3: Daily dry matter intakes by adult horses in different blocks of the Ganderbal district

Parameter/block	BLOCK			
	Ganderbal n=30	Kangan n=30	Lar n=30	Mean n=90
Dry matter DMI R(kg)	3.25^{a}±0.10	3.63^{b}±0.07	3.48^{b}±0.05	3.45±0.04
DMI C(kg)	3.52^{a}±0.07	3.51^{a}±0.07	3.52^{a}±0.07	3.52±0.04
TDMI kg/day	6.77^{a}±0.11	7.15^{b}±0.09	7.00^{ab}±0.08	6.97±0.05
DMI (% BW)	2.91^{a}±0.10	3.29^{b}±0.11	3.03^{ab}±0.10	3.08±0.06
Requirements (NRC, 2007)	4.18±0.13 to 8.37±0.26	3.91±0.12 to 7.82±0.25	4.14±0.11 to 8.29±0.23	4.08±0.07 to 8.16±0.23
% excess/ deficit	Optimum	Optimum	Optimum	Optimum
Digestible energy DE intake (Mcal)	18.24^{b}±0.29	16.55^{a}±0.23	17.61^{b}±0.24	17.47±0.16
Requirements (NRC, 2007)	15.14±0.47	14.13±0.46	14.99±0.43	14.75±0.26
% excess/deficit	+3.10	+2.41	+2.61	+2.71
Crude protein CP Intakes (g/day)	540.44^{a}±8.96	553.34^{a}±8.66	553.86^{b}±9.14	549.21±5.31
Requirements (NRC, 2007)	481.12±15.13	449.16±14.68	476.37±13.75	468.88±8.43
% excess/deficit	+12.32	+23.19	+16.26	+17.13
Calcium Ca I (g/day)	31.14^{c}±0.53	29.33^{b}±0.37	27.68^{a}±1.88	29.38±0.28
Requirements (NRC, 2007)	21.06±0.66	19.66±0.64	20.85±0.60	20.52±0.36
% excess/deficit	+47.86	+49.18	+32.75	+43.17
Phosphorus P I (g/day)	29.92^{b}±0.49	25.69^{a}±0.33	29.81^{b}±0.41	28.48±0.31
Requirements (NRC, 2007)	14.12±0.44	13.18±0.43	14.22±0.41	13.84±0.24
% excess/deficit	Optimum	Optimum	Optimum	Optimum

*DMI= Dry matter intake, TDMI= Total dry matter intake, R= Roughage, C= Concentrate, BW= Body weight, DE= Digestible energy, CP= Crude protein, Ca= calcium, P = Phosphorous, *abc= Mean within the same row with different superscripts differ significantly($P<0.05$)

Table 4: Daily dry matter intakes by foals in different blocks of the Ganderbal district

Parameter/block	BLOCK			
	Ganderbal n=8	Kangan n=8	Lar n=8	Mean n=24
Dry matter DMI R(kg)	1.26^{a}±0.07	1.34^{a}±0.07	1.48^{a}±0.15	1.36±0.06
DMI C(kg)	1.39^{a}±0.05	1.32^{a}±0.07	1.38^{a}±0.07	1.37±0.03
TDMI kg/day	2.65^{a}±0.12	2.67^{a}±0.10	2.86^{a}±0.16	2.73±0.07
DMI as % BW	1.57^{a}±0.09	1.66^{a}±0.09	1.74^{a}±0.10	1.66±0.05
Requirements (NRC, 2007)	3.42±0.01 to 5.13±0.20	3.26±0.18 to 4.89±0.27	3.32±0.19 to 4.99±0.29	3.33±0.09 to 5.00±0.14
% excess/ deficit	-22.51	-18.09	-13.85	-18.01
Digestible energy DE intake (Mcal)	7.17^{a}±0.31	7.13^{a}±0.29	7.59^{a}±0.39	7.29±0.19
Requirements (NRC, 2007)	6.48^{a}±0.26	6.18^{a}±0.34	6.30^{a}±0.37	6.32±0.18
% excess/deficit	+10.64	+15.37	+20.47	+15.34
Crude protein CP Intakes (g/day)	270.96^{a}±11.37	260.84^{a}±11.55	297.74^{a}±14.31	276.51±7.61
Requirements (NRC, 2007)	292.21±16.50	292.21±16.50	297.81±17.79	294.08±9.36
% excess/deficit	-7.27	-10.73	-0.02	-5.97
Calcium Ca I (g/day)	16.51^{b}±0.77	12.69^{a}±0.51	17.64^{b}±1.07	15.61±0.63
Requirements (NRC, 2007)	12.95±0.50	12.08±0.68	12.31±0.73	12.34±0.36
% excess/deficit	+27.49	+5.04	+43.29	+26.94
Phosphorus P I (g/day)	14.95^{ab}±0.66	13.76^{a}±0.56	16.88^{c}±0.98	15.34±0.52
Requirements (NRC, 2007)	10.26±0.41	9.79±0.55	9.98±0.59	10.01±0.29
% excess/deficit	+45.71	+40.55	+69.13	+53.24

*DMI= Dry matter intake, TDMI= Total dry matter intake, R= Roughage, C= Concentrate, BW= Body weight, DE= Digestible energy, CP= Crude protein, Ca= calcium, P = Phosphorous,*abc= Mean within the same row with different superscripts differ significantly($P<0.05$)

Presuming the daily minimum requirements of CP for an equine of 235-250 kg body weight in heavy exercise group as 448-790g (NRC, 2007), CP intakes were optimum in all the study blocks of the district in adult horses and foals, however, CP intake in lactating mares were found below the requirements. Our results fall in line with the earlier reports of Southwood *et al.* (1993), Honroe *et al.* (1994), Riond *et al*. (2000), Hassan *et al.*, (2018 and 2019). Average CP intake by adult equines was found to be in excess by 17.13% than requirements (NRC, 2007). The daily average CP intake by foals was found deficient by 5.97% than requirements, Contrarily, daily CP intake by lactating mares revealed a deficiency of 16.76% and 0.94% in the Ganderbal and Kangan area, respectively with an overall CPI deficiency of 9.20%.On average, the mean daily intake of Ca was either optimum or above the recommendation (NRC 2007) for adult equines, lactating mares, and foals in all the study areas of district Ganderbal. Similarly, Phosphorous intake was found well above normal requirements in all the categories of equines. Our results regarding Ca and P intake fall in line with the reports of Southwood *et al.,* (1993), Honroe *et al.* (1994), Hassan *et al.* (2018 and 2019) and Bhat *et al*. (2021).

Table 5. Daily dry matter intakes by lactating mares in different blocks of the Ganderbal district

Parameter/block	BLOCK			
	Ganderbal n=6	Kangan n=6	Lar n=0	Mean n=12
Dry matter DMI R(kg)	2.80±0.15	3.42±0.62	NA	3.11±0.12
DMI C(kg)	3.44±0.07	3.69±0.05	NA	3.57±0.05
TDMI kg/day	6.25±0.22	7.12±0.10	NA	6.68±0.17
DMI as % BW	2.35±0.08	2.96±0.18	NA	2.65±0.13
Requirements (NRC, 2007)	4.66±0.29 to 9.32±0.23	4.26±0.47 to 8.52±0.38	NA	4.46±0.42 to 8.92±0.24
% excess/ defecient	Optimum	Optimum	NA	Optimum
DE intake (Mcal)	17.05±0.56	16.83±0.24	NA	16.94±0.29
Requirements (NRC, 2007)	15.92±0.40	14.57±0.66	NA	15.24±0.42
% excess/defecit	+7.09	+15.51	NA	+10.66
CP Intakes (g/day)	649.54±19.54	707.20±10.95	NA	678.37±13.63
Requirements (NRC, 2007)	780.35±19.92	713.94±32.52	NA	747.15±20.75
% excess/deficit	-16.76	-0.94	NA	-9.20
Ca I (g/day)	38.60±1.47	47.70±0.74	NA	43.15±1.58
Requirements (NRC, 2007)	37.55±0.55	34.35±1.56	NA	35.95±0.99
% excess/deficit	+2.79	+38.86	NA	+20.02
P I (g/day)	27.05±0.90	25.41±0.37	NA	26.23±0.52
Requirements (NRC, 2007)	15.71±0.40	14.62±0.66	NA	15.16±0.40
% excess/deficit	Optimum	Optimum	NA	Optimum

*DMI- Dry matter intake, TDMI- Total dry matter intake, R- Roughage, C- Concentrate, BW- Body weight, DE- Digestible energy, CP- Crude protein, *abc- Mean within the same row with different superscripts differ significantly (P<0.05), NA- Not available

The average daily intake of calcium by adult horses was found above requirements by 47.86%, 49.18%, and 32.75%, in Ganderbal, Kangan, and Lar blocks, respectively. Calcium intake by foals revealed excess by 27.49%, 5.04%, and 43.29% respectively, in Ganderbal, Kangan, and Lar blocks. The daily intake of calcium by lactating mares was found above requirements by 2.79% and 38.86%, in Ganderbal and Kangan blocks, respectively with overall excess of calcium intake of 20.02%. Average phosphorous intake by all the classes of equines was found to be either optimum or above the requirements (NRC, 2007) in all the study areas of the district. The results fall in line with the earlier observation of Hassan *et al*. (2018 and 2019), Bhat *et al*. (2021).

Conclusion

It was concluded that horse owners had limited options for feed ingredients for equine ration formulations, which could be explained by inadequate availability of feed/fodder resources, as equines/ponies are on the third tier of feeding priorities, contributing to deficiency of DM and CP particularly in foals.

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