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Nutritional status of feeds and fodders fed to dairy cattle in South Kashmir

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Abstract
A comprehensive study carried out in five blocks of district Kulgam (DH Pora, Devser, Kulgam, Quimoh and Yaripora) revealed commonly available sources of roughages were paddy straw, maize stover, oat hay and mixed grass hay, while common source of concentrates fed to dairy cattle were rice bran, wheat bran, mustard oil cake and commercial pellet feed. Among the roughages highest DM% was found in paddy straw (87.94%) and among concentrates in rice bran (89.91%). Mixed grass hay was having the highest CP% (6.50%) and EE% (5.53) in roughages and in mustard oil cake (34.98%) and (13.00%) among concentrates. A wide variation in CF% was observed in roughages and ranged from 28.24% (mixed grass hay) to 37.84% (maize stover) and among concentrates CF content ranged between 7.38% (commercial pelleted feed) to 22.95% (rice bran). TA% among the roughages ranged from 8.69% in mixed grass hay to 12.50% in paddy straw and in concentrates TA content ranged between 5.26% in wheat bran to 12.48% in rice bran. Pooled samples of different feeds and fodders were evaluated for Cornell Net Carbohydrate and protein fractions revealed that the fraction A ranged between 10.93% (wheat bran) to 25.72% in MOC. Fraction B1 ranged from 5.90% in oat hay to 34.87% in maize stover. Fraction B2 was found highest in wheat bran (47.45% CP) and lowest in paddy straw (29.37±0.30% CP). Fraction B3 was found highest in paddy straw (23.79±0.12% CP) and lowest in commercial pelleted feed (3.14%CP). Fraction C was also found highest in paddy straw (24.14% CP) and lowest in commercial pelleted feed (5.15% CP). Cornell Net Protein fractions of all feeds and fodders were well within the normal range.

Keywords: South Kashmir, Kulgam chemical composition, feeds and fodders, CNCPS

Introduction
Optimum nutrition plays a pivotal role in development of any healthy livestock programme. Balanced feeding of dairy animals is considered as one of the major inputs for profitable livestock enterprise reflecting the importance of adequacy of all the nutrients in the ration and for efficient production, reproduction and maintenance of normal health in dairy animals, it is essential to provide protein, energy and minerals according to their requirement.
Preliminary index for the assessment of feeds and fodder quality is determined by its chemical composition which in turn reflects productivity and health status of animals of a particular region. Precise information of feed/fodder composition with respect to proximate composition and fibre fractions, fed to dairy cattle is therefore essential to assess the nutritional status of feeds and fodders and of the animals to which these feeds and fodders are fed (Ganai *et al*., 2004) [9]. Proximate composition depicts the major nutrient composition present in any feed stuff/ingredients. Fibre fraction is the depiction of various constituents of fibers present in the feedstuff and contributes the major source of energy in the ruminant diets. Cornell Net Protein and Carbohydrate fractions (CNCP) system is extensively used to get accurate prediction of biological value of forages and performances of animals fed on these forages. The CNCP system accounts for the effects of variation in carbohydrate and protein, their degradation and utilization in the rumen (Fox *et al.,* 2004) [7]. Optimum productive and reproductive efficiency of livestock could be achieved only when the animals are fed with the required quantity of feedstuffs and all nutrients in proper proportion (NRC, 2007) [12]. Therefore the knowledge of chemical characteristics and the nutritional profile of feeds and fodder fed to dairy animals leads enhancement in productivity and on farm returns.

Materials and Methods
The study was carried out in district Kulgam, one of the major livestock rearing districts of

South Kashmir where livestock farming is the primary source of income for 43.12% of farmers (Bhat *et al*., 2021) [4] with total livestock population of 1,52484 heads. The district lies between 33°15´ North latitude and 74^0-35/ East longitude. For the purpose of this study the district was arbitrarily divided into five blocks for of collection of feed samples from the households associated with livestock rearing. A total of 320 feed and fodder samples fed to the dairy cattle were collected in polythene bags from all blocks of the district (Table 1). The samples were pooled block wise and labeled properly and stored in polythene bags for further analysis. The representative feed and fodder samples were dried in a hot air oven at 100±5 ^{0}C overnight, ground, labeled and properly stored in air tight polythene bags for further laboratory analysis.

Table 1: Number of feed and fodder samples collected from different blocks of district

Block	Paddy straw	Maize stover	Oat hay	Mixed grass	Rice bran	Wheat bran	Pelleted feed	MOC
DH Pora	03	04	04	04	03	03	03	03
Devser	10	06	06	06	05	05	05	05
Kulgam	34	24	20	14	15	10	10	09
Quimoh	30	10	10	10	05	09	05	05
Yaripora	05	05	03	04	02	02	02	02
Total	82	49	43	38	30	29	25	24

MOC = Mustard oil cake, DH Pora = Damhal Hanjipora

The composite feed and fodder samples collected from each blocks were analyzed for proximate principles as per AOAC, (2005) [2] and fiber fraction as per Van Soest *et al.,* (1994) [16]. While as composite feeds and fodders samples from each block were further pooled and a single representative sample from whole district was analyzed for Cornell Net Carbohydrate and protein fractions as per standard method given by (Fox *et al.*, 2004) [7].

Results and Discussions

Feed stuffs are usually evaluated on the basis of their chemical composition and by their nutritional value. To develop the balanced rations farmers are required to have precise information about the nutritive value of feeds and fodders they feed to their animals. Information on the composition of a feedstuff is acquired through chemical analysis and most commonly includes such parameters as dry matter, protein content, fiber fractions, organic matter and fat content. The chemical composition (% DM basis) of roughage and concentrate feedstuffs offered to the dairy cattle in different blocks of the district Kulgam are presented in Table 2 and Table 3, respectively.

Among the roughages crude protein content was found 3.77±0.12, 4.62±0.17, 4.78±0.15, 6.50±0.30% DM in paddy straw, maize stover, oat hay and wild mixed grass hay. Ether extract content in paddy straw, maize stover, oat hay and wild mixed grass hay was recorded 2.50±0.18, 2.03±0.10, 3.62±0.15 and 5.53±0.15% DM, respectively. Crude fibre content in roughages ranged between 28.24±0.35% DM in mixed grass hay to 37.84±0.37% DM in maize stover. Acid detergent fiber was found highest in paddy straw (54.06±0.38% DM) and lowest in mixed grass hay (42.58±0.33% DM). Similar trend was observed for neutral detergent fibre percent among roughages. Total ash percent was found 12.50±0.26, 10.22±0.26, 9.85±0.24 and 8.69±0.41% DM in paddy straw, maize stover, oat hay and mixed grass hay.

Table 2: Chemical composition of roughages fed to dairy cattle in district Kulgam

Feed ingredient	Block	DM%	CP%	EE%	CF%	ADF	NDF	TA
Paddy straw	DH Pora	88.23±1.14	3.73±0.24	2.23±0.32	35.00±0.40	53.23±0.62	73.76±0.40	13.06±0.35
	Devser	87.83±1.09	3.73±0.24	2.40±0.41	33.60±0.66	54.93±0.12	72.56±0.20	12.33±0.44
	Kulgam	86.76±0.77	3.70±0.36	3.20±0.17	35.86±0.26	55.33±0.34	74.50±0.20	12.73±0.35
	Quimoh	89.70±0.32	3.60±0.32	1.86±0.31	36.23±0.24	54.96±0.49	74.96±0.24	11.20±0.34
	Yaripora	87.16±1.21	4.10±0.32	2.83±0.44	34.20±0.20	51.86±0.14	71.60±0.17	13.16±0.79
	Mean	87.94±1.21	3.77±0.12	2.50±0.18	34.98±0.30	54.06±0.38	73.48±0.34	12.50±0.26
Maize stover	DH Pora	86.47±0.25	4.53±0.49	1.70±0.28	39.70±0.26	50.86±0.48	70.56±0.32	10.63±0.60
	Devser	88.44±1.04	4.00±0.26	2.13±0.14	37.60±0.49	51.96±0.35	71.40±0.17	9.13±0.14
	Kulgam	89.03±0.65	4.60±0.37	2.40±0.20	37.26±0.37	52.56±0.60	69.20±0.15	10.80±0.20
	Quimoh	88.20±0.72	4.70±0.28	1.96±0.32	38.73±0.44	52.96±0.12	72.40±0.20	9.23±0.20
	Yaripora	87.00±0.92	5.30±0.23	1.96±0.17	35.90±0.41	48.23±0.75	66.20±0.41	11.33±0.27
	Mean	87.82±0.38	4.62±0.17	2.03±0.10	37.84±0.37	51.32±0.49	69.95±0.58	10.22±0.26
Oat hay	DH Pora	86.75±0.76	5.10±0.17	3.56±0.31	28.50±0.43	47.50±0.56	54.36±0.21	10.43±0.37
	Devser	86.38±0.73	4.63±0.38	3.80±0.37	29.06±0.37	47.76±0.26	53.23±0.18	9.13±0.40
	Kulgam	87.90±0.40	5.03±0.40	3.86±0.26	29.40±0.64	49.23±0.31	52.50±0.17	10.63±0.38
	Quimoh	85.43±0.26	4.50±0.46	3.23±0.26	28.70±0.61	48.73±0.26	55.46±0.21	8.83±0.43
	Yaripora	86.81±0.23	4.66±0.31	3.63±0.58	26.00±0.43	46.36±0.26	51.56±0.26	10.23±0.26
	Mean	86.65±0.29	4.78±0.15	3.62±0.15	28.33±0.37	47.92±0.29	53.42±0.37	9.85±0.24
Mixed grass hay	DH Pora	86.46±0.34	8.16±0.26	5.76±0.32	27.80±1.40	42.90±0.15	55.56±0.28	7.66±0.43
	Devser	81.43±1.59	5.36±0.29	5.03±0.33	28.53±1.02	41.90±0.61	56.43±0.14	8.93±0.43
	Kulgam	85.13±0.46	6.46±0.34	5.73±0.49	28.66±0.42	43.53±0.17	57.60±0.15	11.20±0.34
	Quimoh	86.70±0.36	5.86±0.77	5.86±0.29	28.06±0.84	43.86±0.43	58.46±0.38	6.86±0.23
	Yaripora)	84.93±0.18	6.66±0.40	5.26±0.20	28.16±0.37	40.73±0.37	56.70±0.20	8.80±0.20
	Mean	84.93±0.58	6.50±0.30	5.53±0.15	28.24±0.35	42.58±0.33	56.95±0.28	8.69±0.41

DH Pora = Damhal Hanjipora, DM = Dry matter, CP = Crude protein, EE = Ether extract, CF = Crude fiber, ADF = Acid detergent fiber, NDF = Neutral detergent fiber and TA = Total ash

Table 3: Chemical composition of concentrates fed to dairy cattle in district Kulgam

Feed ingredient	Block	DM%	CP%	EE%	CF%	ADF	NDF	TA
Rice bran	DH Pora	89.46±0.50	11.13±0.17	3.80±0.43	23.96±0.14	34.80±0.20	60.70±0.50	12.33±0.23
	Devser	90.16±0.75	13.20±0.23	4.26±0.21	22.66±0.29	35.53±0.23	62.46±0.99	10.90±0.43
	Kulgam	90.38±0.61	12.06±0.37	5.10±0.20	24.80±0.30	33.63±0.55	62.63±0.49	13.80±0.11
	Quimoh	90.68±0.84	13.33±0.32	4.76±0.26	23.16±0.34	36.20±0.17	64.63±0.34	14.43±0.24
	Yaripora	88.85±0.71	10.96±0.32	3.66±0.31	20.16±0.44	32.63±0.26	60.60±0.64	10.96±0.37
	Mean	89.91±0.31	12.14±0.28	4.32±0.18	22.95±0.43	34.56±0.36	62.20±0.46	12.48±0.40
Wheat bran	DH Pora	87.75±0.20	13.16±0.23	3.33±0.24	13.20±0.15	13.56±0.49	40.46±0.59	6.96±0.31
	Devser	89.71±0.38	12.23±0.24	4.10±0.15	11.30±0.25	12.96±0.14	40.96±1.09	4.76±0.18
	Kulgam	87.83±0.33	13.16±0.23	4.50±0.17	12.30±0.20	14.00±0.28	42.23±0.18	5.23±0.62
	Quimoh	90.09±0.38	14.13±0.26	4.20±0.20	13.06±0.46	13.16±0.23	44.66±0.34	4.50±0.45
	Yaripora	89.27±0.31	12.30±0.41	3.40±0.32	11.36±0.35	12.63±0.65	40.70±0.40	4.83±0.12
	Mean	88.93±0.28	13.00±0.21	3.90±0.15	12.24±0.24	13.26±0.19	41.80±0.47	5.26±0.12
Pelleted feed	DH Pora	85.56±0.29	20.22±1.73	12.13±0.18	7.50±0.66	14.20±0.51	24.86±0.56	10.66±0.52
	Devser	84.43±0.78	16.65±2.18	12.90±0.40	6.80±0.32	13.53±0.29	24.16±0.54	11.80±0.98
	Kulgam	82.00±0.98	20.78±0.95	13.76±0.34	8.03±0.23	13.00±0.70	25.06±0.12	12.96±0.66
	Quimoh	86.20±1.11	22.53±0.30	14.36±0.26	6.80±0.77	13.30±0.83	25.10±0.26	14.26±0.24
	Yaripora	83.10±1.76	13.69±3.11	10.33±0.37	7.80±0.70	12.20±0.75	22.30±0.25	10.96±0.43
	Mean	84.26±0.58	18.77±1.03	12.70±0.39	7.38±0.25	13.24±0.30	24.30±0.31	12.13±0.42
MOC	DH Pora	89.90±0.30	34.30±0.23	12.93±0.17	10.60±0.30	14.13±0.48	23.80±0.47	7.60±0.23
	Devser	88.86±0.32	35.46±0.28	12.20±0.23	7.60±0.36	13.56±0.17	23.10±0.17	8.13±0.40
	Kulgam	89.66±0.58	34.83±0.52	13.16±0.32	9.43±0.26	14.43±0.20	23.16±0.27	8.00±0.23
	Quimoh	89.13±0.84	37.00±0.37	14.20±0.26	11.00±0.26	14.30±0.75	24.96±0.29	6.60±0.41
	Yaripora	88.73±1.24	33.33±0.43	12.50±0.47	8.13±0.18	12.53±0.54	20.70±0.34	8.00±0.32
	Mean	89.26±0.30	34.98±0.35	13.00±0.21	9.35±0.37	13.79±0.26	23.14±0.39	7.66±0.19

DH Pora = Damhal Hanjipora, DM = Dry matter, CP = Crude protein, EE = Ether extract, CF = Crude fiber, ADF =Acid detergent fiber, NDF = Neutral detergent fiber and TA = Total ash

In concentrates DM content in rice bran, wheat bran, commercial pelleted feed and mustard oil cake was found 89.91±0.31, 88.93±0.28, 84.26±0.58 and 89.26±0.30%, respectively. CP content in concentrates ranged between 12.14±0.28 in rice bran to 34.98±0.35% DM in mustard oil cake. Highest percent EE was found in mustard oil cake (13.00±0.21%DM) and lowest in wheat bran (3.90±0.15%DM). CF content was found 22.95±0.43, 12.24±0.24, 7.38±0.25 and 9.35±0.37% DM in rice bran, wheat bran, commercial pelleted feed and mustard oil cake. ADF was found higher in rice bran (34.56±0.36) and lowest in commercial pelleted feed (13.24±0.30% DM). NDF in rice bran, wheat bran, pelleted feed and MOC was found 62.20±0.46, 41.80±0.47, 24.30±0.31 and 23.14±0.39% DM, respectively. TA in concentrates was found 12.48±0.40, 5.26±0.12, 12.13±0.42 and 7.66±0.19% DM in rice bran, wheat bran, commercial pelleted feed and MOC, respectively. The chemical composition of feeds and fodders was found within normal range (ICAR, 2013) [11], with slight variations which may be due to varietal differences of the plant species, edaphic practices, climatic, seasonal and geographical distribution of the area. The results of the present study corroborate with the earlier reports of Sheikh *et al*. (2019) [14], and Ali (2020) [3] in Bandipora, Anantnag and Kargil districts. These results are also supported by the earlier findings of Ganai *et al.* (2006) [8].

Cornell Net Carbohydrate fractions of feeds and fodders with respect to carbohydrate fractions are presented in Table 4. Fraction A was recorded highest in rice bran (37.46±0.34) and lowest in paddy straw (3.77±0.03). Likewise, Fraction B1 was recorded highest in rice bran (30.62±0.34) and lower values were recorded in paddy straw (20.88±0.44). Fraction B2 in different feed and fodder samples of district Kulgam was recorded as 60.85±0.21 in paddy straw, 56.24±0.53 in oat hay, 57.24±0.29 in maize stover, 53.64±0.44 in mixed hay, 10.59±0.41 in rice bran, 34.81±0.10 in wheat bran, 25.89±0.59 in MOC and 22.85 in commercial compound pellet feed, with higher values in paddy straw and lowest values were recorded in rice bran. Fraction C in paddy straw, oat hay, maize stover, mixed hay, rice bran, wheat bran, MOC and commercial pellet compound feed was found 20.18±0.69, 11.18±0.02, 10.97±0.13, 9.56±0.37, 18.76±0.29, 9.63±0.14, 13.98±0.13 and 12.21±0.16, respectively with highest values in paddy straw and lower values in mixed hay. These results are in agreement with the earlier reports of Ahmad (2017) [1] and Danish Masood (2019) [5] for feedstuffs of Budgam and Bandipora districts, respectively; however, variation in the results of present study was observed in comparison with the reports of Prusty *et al.,* (2013) [13] and Singh *et al.,* (2011) [15] which may be due time and season of harvesting.

Table 4: Cornell net carbohydrate fractions[1] of available feed and fodder

Ingredients*	NSC (%CHO)	Starch,% NSC	CA (%CHO)	CB1 (%CHO)	CB2 (%CHO)	CC (%CHO)
Paddy straw	17.49±0.09	64.37±0.36	3.77±0.03	10.88±0.44	60.85±0.21	20.18±0.69
Oat Hay	30.83±0.25	49.36±0.53	14.01±0.10	16.10±0.55	56.24±0.53	11.18±0.02
Maize stover	24.56±0.14	45.16±0.06	11.85±0.03	11.28±0.11	57.58±0.29	10.97±0.13
Mixed hay	33.91±0.55	44.62±0.12	19.45±0.34	15.99±0.14	53.64±0.44	9.56±0.37
Rice bran	66.52±0.15	45.11±0.12	37.46±0.34	30.62±0.34	10.59±0.41	18.76±0.29
Wheat bran	49.11±0.10	47.90±0.13	23.42±0.27	20.85±0.21	34.81±0.10	9.63±0.14
MOC	51.06±0.18	34.21±0.50	34.37±0.37	22.73±0.46	25.89±0.59	13.98±0.13
Compound feed	48.93±2.62	31.91±0.91	32.43±0.18	19.41±0.87	22.85±0.16	12.21±0.16

[1]Cornell Net Carbohydrate and Protein fractions scheme (CNCPS) Fox *et al*., 2004 [7].

*NSC- Percentage of non-structural carbohydrate in the feedstuff; Starch-Percentage of the starch in the non-structural carbohydrate; CA-Percentage of the carbohydrate that is sugar; CB1-Percentage of the carbohydrate that is starch and non-structural pectin; CB2-Percentage of the carbohydrate that is available fibre; CC-Percentage of carbohydrate that is unavailable fibre

Cornell Net Protein fractions of different feeds and fodders with respect to protein fractions are presented in Table 5. Fraction A ranged between 10.93±0.15 to 25.72±0.87% and was found highest in MOC (25.72±0.87% CP) and lowest in wheat bran (10.93±0.15% CP). Fraction B1 ranges from 5.90±0.30% to 34.87±0.47% and was found highest in oat hay (5.90±0.30% CP) and lowest in maize stover (34.87±0.47% CP). Fraction B2 was found highest in wheat bran (47.45±0.20% CP) and lowest in paddy straw (29.37% CP). Fraction B3 was found highest in paddy straw (23.79±0.12% CP) and lowest in commercial pelleted feed (3.14±0.04% CP). Fraction C was also found highest in paddy straw (24.14±0.32% CP) and lowest in commercial pelleted feed (5.15±0.09% CP). These values of the present study are similar to the findings of Bisitha (2013) [5] but Gupta *et al.* (2011) [10] observed higher values than reports of present observations. These variations could be due different topography and also soil composition. Although scanty literature is available with regards to CNCP composition of temperate feedstuffs; however, the findings of the present study fall in close line with the reports of Ahmad (2018) [1] and Danish Masood (2019) [6] in district Budgam and Bandipora, respectively of Kashmir valley.

Table 5: Cornell net protein fractions[1] of feed and fodders available in Kulgam district

Ingredients*	NDIP,% CP	SOLP,% CP	NPN,% SOLP	PA% CP	PB1% CP	PB2% CP	PB3% CP	PC% CP
Paddy straw	47.69±0.33	23.64±0.26	72.24±1.90	18.65±0.26	6.53±0.29	29.37 ±0.30	23.79±0.12	24.14±0.32
Oat Hay	23.83±0.60	44.50±0.68	31.21±0.39	15.73±0.39	34.87±0.47	34.14±0.91	17.51±0.24	7.05±0.54
Maize stover	34.26±0.34	26.73±1.11	82.14±0.37	21.08±0.40	5.907±0.30	38.07±0.82	19.12±0.28	16.48±1.39
Mixed hay	23.60±0.31	41.50±0.36	38.22±0.39	17.21±0.68	26.267±0.55	30.06±0.79	14.94±0.24	7.62±0.21
Rice bran	14.81±0.08	39.99±0.78	67.12±0.83	20.83±0.51	11.76±0.65	45.94±0.10	9.51±0.01	10.00±0.05
Wheat bran	24.14±0.26	25.58±0.34	50.12±0.66	10.93±0.15	11.79±0.10	47.45±0.20	22.06±1.02	4.08±0.03
MOC	9.10±0.07	45.77±0.23	62.25±0.16	25.72±0.87	18.21±0.17	46.41±0.27	3.77±0.11	7.19±0.36
Compound feed	12.30±0.09	40.98±0.47	55.80±1.16	22.66±0.06	17.62±1.04	42.87±0.16	3.14±0.04	5.15±0.09

[1]Cornell net carbohydrate and protein fractions scheme (CNCPS) Fox *et al.*, 2004 [7].

*NDIP-Neutral detergent insoluble protein, SOLP-Soluble protein, NPN-Non protein nitrogen; PA-Percentage of crude protein in the feedstuff that is non-protein nitrogen; PB1-Percentage of crude protein that is rapidly degraded protein; PB2-Percentage of crude protein that is intermediately degraded protein; PB3-Percentage of crude protein that is slowly degraded protein; PC-Percentage of crude protein that is bound protein.

Conclusion

The farmers of district Kulgam had narrow limits of feed selection, therefore need proper formulation and balancing of rations for their livestock. Further the chemical composition of all feeds and fodders of district with regard to macro-nutrients *viz*., proximate principles, fibre fractions, Cornell Net Protein and Carbohydrate fractions of different feeds and fodders were within the normal range.

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