

Comparative Chemical Evaluation of Some High Altitude Tree Fodders of Sikkim

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Tree fodders are commonly used as alternative feed resource for ruminants particularly in lean season during scarcity of other forages. The chemical composition of the fodder tree leaves, their digestibility and the species of animals are some of the factors which determine the nutritive value of a tree fodder. The economic importance of a tree fodder is often restricted by the high content of lignin, tannin or some other incriminating factors. The economic condition of the farmers in general do not allow them to supplement concentrate mixture separately to their animals. Das and De (2001) reported that tree fodder constitute 25 to 60 % green fodder fed to livestock in Sikkim and most of these tree fodder contain 10–14.5 %CP and 40–45% NDF which can meet the maintenance requirement of livestock. In the present study the efforts have been made to evaluate the comparative nutritional status of twenty one locally available tree fodder species of Sikkim, commonly used for feeding of cattle, goat and sheep.

The samples of twenty one commonly available tree fodder species namely *Ficus bengalensis*, *Artocarpus lakoocha*, *Reevesia pubescens*, *Ficus nemoralis*, *Bridelia retusa*, *Premna mucronata*, *Eurya japonica*, *Ficus infectoria*, *Boehmeria macrophylla*, *Castanopsis tribuloides*, *Ficus hirta*, *Litsea polyantha*, *Ampora wallichii*, *Ficus elevata*, *Macranga nepalensis*, *Exbucklandia populnea*, *Ficus benamina*, *Ficus elastica*, *Grevia elastica*, *Albizia lebbek* and *Bauhinia purpurea* were collected from different locations of Sikkim. Samples of different tree fodder were collected from different places and during different seasons. The samples of each species were dried and ground to pass

1 mm sieve size and the stored for further analysis.

Fodder samples were analyzed for Organic matter (OM), Crude protein (CP), Ether extract (EE), Crude fiber (CF), Nitrogen free extract (NFE), Neutral detergent fiber (NDF), Acid detergent fiber (ADF), Cellulose, Acid detergent lignin (ADL), and Total ash. The proximate principles i.e. OM, CP, EE, CF, NFE and total ash were analysed as per AOAC (1984) and the fiber fractions i.e. NDF, ADF, Cellulose, ADL and acid insoluble ash were analyzed as per Goering and Van Soest(1970) and Van Soest (1967). The Proximate composition of the tree fodder analysed in the present study has been presented in Table 1. The overall mean were found to be 89.26 ± 0.77, 13.49 ± 0.79, 2.08 ± 0.24, 30.30 ± 2.38, 43.82 ± 2.92 and 10.26 ± 0.74 % respectively, for OM, CP, EE, CF, NFE and total ash. The fiber fractions present in tree fodder have been presented in Table 2. The overall mean were found to be 49.57 ± 2.28, 22.59 ± 1.26, 12.35 ± 0.61, 10.45 ± 0.83 and 1.10 ± 0.24% for NDF, ADF, Cellulose, ADL and acid insoluble ash, respectively.

The OM content was found to be highest in Melato (95.0) and lowest in Khasre (83.40). The CP content (% of dry matter) ranged from 6.81 in Pipli to 19.43 in Chiple. The CP content in most of the tree fodders was found to be more than 10 %. Crude protein is the most important parameter in evaluation of any feed resource. Out of twenty one tree fodders, seventeen were having CP content more than 10 %. Eight tree fodders namely, Chiple, Gineri Kamle, Khasre, Kutmiro, Lute Khanyam, Melato and Tanki were having CP content 15 per cent or more. Das and De (2001) also reported that most of the tree fodder in Sikkim contained 10–14.5 % CP. Chatterjee *et al* (2003) studied the chemical composition of nine high altitude tree fodder of Arunachal Pradesh and

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Table 1. Proximate Composition of Tree Fodder of Sikkim (% dry matter basis)

Common Name	Scientific name	Organic matter	Crude Protein	Ether extract	Crude fiber	Nitrogen free extract	Total ash
Bat	<i>Ficus bengalensis</i>	88.88±12.30	11.90±2.13	2.16±0.03	40.66±5.12	34.16±3.75	11.12±1.89
Barhar	<i>Artocarpus lakoocha</i>	87.2±8.94	13.74±1.61	1.70±0.21	27.58±3.01	44.26±4.52	12.72±1.48
Chiple	<i>Reevesia pubescens</i>	85.29±8.97	19.43±2.04	2.64±0.61	44.5±4.85	18.72±2.01	14.71±1.52
Dudhilo	<i>Ficus nemoralis</i>	88.8±10.26	9.98±1.23	1.06±0.02	16.68±1.82	61.08±6.73	11.2±1.24
Gayo	<i>Bridelia retusa</i>	89.53±9.56	11.99±2.12	1.02±0.21	24.0±2.52	51.32±5.12	10.47±1.25
Gineri	<i>Premna mucronata</i>	91.02±9.98	16.01±1.85	1.64±0.08	32.4±3.65	40.97±4.21	8.98±0.67
Jhingani	<i>Eurya japonica</i>	93.94±10.65	9.66±1.23	4.92±0.82	17.36±1.76	62.0±7.56	6.06±0.08
Kabra	<i>Ficus infectoria</i>	91.24±11.02	14.89±1.89	2.68±0.05	49.84±5.12	23.83±2.12	8.76±0.74
Kamle	<i>Boehmeria macrophylla</i>	85.04±8.87	16.54±2.13	1.36±0.02	36.82±3.84	30.32±3.16	14.96±1.57
Katush	<i>Castanopsis tribuloides</i>	93.78±10.28	11.83±2.05	3.14±0.03	43.90±3.98	34.91±4.12	6.22±0.65
Khasre	<i>Ficus hirta</i>	83.4±9.65	16.8±2.26	1.22±0.04	21.86±2.41	43.52±5.36	16.6±1.87
Kutmiro	<i>Litsea polyantha</i>	92.25±9.54	17.08±3.12	3.90±0.04	21.66±3.12	49.61±6.10	7.75±0.89
Lali	<i>Ampora wallichii</i>	92.77±11.23	11.57±1.25	1.66±0.06	18.98±2.05	60.56±6.24	7.23±0.62
Lute Khanyum	<i>Ficus elevata</i>	85.66±9.12	17.69±2.45	1.04±0.03	28.24±3.10	38.69±3.05	14.34±1.86
Melato	<i>Macranga nepalensis</i>	95.0±10.89	16.75±2.41	2.88±0.02	14.74±1.58	60.63±7.12	5.00±0.56
Pipi	<i>Exbucklandia populnea</i>	92.17±11.24	6.81±1.02	1.74±0.03	20.2±2.13	63.42±6.22	7.83±0.74
Rai Khanyum	<i>Ficus benjamina</i>	87.0±9.82	10.08±2.05	1.52±0.04	43.06±4.35	32.34±3.52	13.0±1.45
Rubber	<i>Ficus elastica</i>	89.9±12.32	7.44±1.04	2.46±0.07	30.02±3.23	49.96±5.32	10.1±1.02
Sial phurse	<i>Grewia elastica</i>	87.84±11.08	12.15±1.13	0.76±0.01	26.24±2.56	48.69±4.25	12.16±1.05
Sirish	<i>Albizia lebbek</i>	83.42±12.53	14.74±2.51	0.74±0.007	40.74±4.23	37.2±5.12	6.58±0.72
Tanki	<i>Bauhinia purpurea</i>	90.3±11.51	16.15±2.07	3.28±0.07	36.76±3.56	34.11±3.28	9.70±1.02
Overall mean ± SE		89.26±0.77	13.49±0.79	2.08±0.24	30.30±2.38	43.82±2.92	10.26±0.74

* Value presented for each parameter for any individual tree fodder is a mean of five observations

Table 2. Fiber fractions in Tree Fodder of Sikkim (% dry matter basis)

Common Name	Scientific name	Neutral Detergent Fiber	Acid Detergent Fiber	Cellulose	Acid Detergent Lignin	Acid Insoluble Ash
Bat	<i>Ficus bengalensis</i>	46.8±5.82	23.17±2.23	12.96±1.35	10.21±1.02	3.19±0.28
Barhar	<i>Artocarpus lakoocha</i>	50.46±6.21	25.83±2.54	14.05±1.32	11.78±1.12	1.29±0.12
Chiple	<i>Reevesia pubescens</i>	42.48±4.45	21.63±2.05	11.4±1.02	10.25±1.04	1.62±0.15
Dudhilo	<i>Ficus nemoralis</i>	33.8±3.72	16.26±1.63	9.99±0.87	6.27±0.7	0.59±0.06
Gayo	<i>Bridelia retusa</i>	48.25±5.10	26.08±2.52	15.85±1.43	11.77±1.12	1.09±0.92
Gineri	<i>Premna mucronata</i>	65.68±7.03	28.65±3.10	16.4±1.56	12.4±1.10	0.35±0.03
Jhingani	<i>Eurya japonica</i>	35.12±3.81	13.94±1.26	7.78±0.75	6.16±0.56	0.12±0.02
Kabra	<i>Ficus infectoria</i>	58.5±4.52	25.8±2.43	14.02±1.23	11.78±1.10	0.39±0.02
Kamle	<i>Boehmeria macrophylla</i>	56.8±5.13	24.4±2.32	11.39±1.02	13.01±1.26	1.50±0.82
Katush	<i>Castanopsis tribuloides</i>	73.98±7.22	36.26±3.42	17.46±1.65	18.8±1.81	0.24±0.02
Khasre	<i>Ficus hirta</i>	43.64±4.25	18.78±1.52	14.36±1.23	4.42±0.36	2.61±0.12
Kulmiro	<i>Litsea polyantha</i>	51.02±5.11	24.75±2.32	9.20±0.85	15.55±1.45	4.16±0.36
Lali	<i>Ampora wallichii</i>	38.9±3.62	13.51±1.22	9.01±0.84	4.50±0.38	0.52±0.048
Lute Khanyum	<i>Ficus elevata</i>	49.10±5.14	22.19±2.11	10.48±0.98	11.71±1.01	1.88±0.15
Melato	<i>Macranga nepalensis</i>	37.68±3.65	12.08±1.08	11.74±1.03	3.4±0.09	0.17±0.01
Pipli	<i>Exbucklandia populnea</i>	45.36±4.35	18.84±1.66	7.99±0.65	10.15±0.98	0.59±0.04
Rai Khanyum	<i>Ficus benjamina</i>	44.92±4.32	23.86±2.32	12.13±1.22	11.73±1.03	1.05±0.9
Rubber	<i>Ficus elastica</i>	51.66±5.04	22.39±2.12	10.78±1.21	11.61±1.08	0.07±0.01
Sial phurse	<i>Grewia elastica</i>	49.72±4.29	26.42±2.55	14.251.33	12.17±1.25	0.98±0.07
Sirish	<i>Albizia lebbek</i>	52.38±5.16	23.61±2.42	13.65±1.26	9.96±0.96	0.11±0.02
Tanki	<i>Bauhinia purpurea</i>	64.64±6.45	26.1±2.53	14.45±1.38	11.76±1.03	0.51±0.04
Overall mean ± SE		49.57±2.28	22.59±1.26	12.35±0.61	10.45±0.83	1.10±0.24

* Value presented for each parameter for any individual tree fodder is a mean of five observations

reported the CP content to range from 6.9 to 18.4%, which was quite similar to our observation. However, they found only one tree fodder (*Quercus wallichiana*) to have CP content more than 15%. EE content (% of dry matter) was found to be highest in Jhingani (4.92) and lowest in Sirish (0.74). In most of the tree fodder species, it varied from 1-2%. CF content ranged from 14.74 (Melato) to 49.84 (Kabra) percent where as NFE content ranged from 18.72 (Chiple) to 63.42 (Pipli). NFE is the readily available energy source for livestock.

The NDF content ranged from 33.8 (Dudhilo) to 73.98 (Katush). Most of the tree fodder contained 35-55 percent NDF in this particular study. Das and De (2001) reported that most of the tree fodder in Sikkim contained 40-45% NDF. Chatterjee *et al* (2003) earlier reported the NDF content in high altitude tree fodder of West kameng district, Arunachal Pradesh to range from 36.36 to 75.49%, which was quite similar to our observation. The mean ADF content ranged from 12.08 (Melato) to 36.26 (Katush) per cent. Chatterjee *et al* (2003) reported much higher range of ADF in tree fodder of Arunachal Pradesh. High ADF content badly affect the nutritional quality of a particular feed as the digestibility of ADF is lower than other nutrients. The cellulose content varied from 7.78 (Jhingani) to 16.4 (Gineri).

The concentration of incriminating factors like acid detergent lignin is very important in evaluating the digestibility of a particular feed resource. The concentration of ADL (% of dry matter) ranged from 4.42 (Khasre) to 18.8 (Katush). The value for mean ADL content was 10.45 ± 0.83 which was much lower than that reported by Chatterjee *et al* (2003) in tree fodder of Arunachal Pradesh. The acid insoluble ash (% of dry matter) ranged from 0.07 in Rubber to 4.16 in Kutmiro.

An overall comparison of these twenty one tree fodder samples considering all the chemical constituents leads to the conclusion that Melato, Chiple, Khasre, Tanki, Sirish, lute Khanyum and Lali were relatively better source of nutrients in comparison to others. Chiple, Kutmiro, Melato and Tanki were found to be good source of both CP and EE. Pipli, Rubber and Katush were found to have very low nutrient value. Most of these tree fodders contained 11-18% CP which can meet the maintenance requirement of livestock. However any final conclusion in this regard needs further study in terms of palatability, digestibility, nitrogen balance and anti-quality factors

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