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Nutritive evaluation of selected tree leaves as feed resources for ruminants

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Abstract

A study was conducted to evaluate the nutritive composition and anti-nutritional components of eight locally available tree leaves of Jack, Gliricidia, Venga, Agathi, Desmanthus, Calliandra, Subabul and Moringa. The collected tree leaves were, dried, ground and analysed for proximate composition, fibre fractions and plant secondary metabolites. Significant variation ($p \leq 0.001$) was observed in nutrient composition among the evaluated tree leaves. CP content (%) was highest ($p \leq 0.001$) in Moringa (26.94) and lowest in Jack (15.09). NDF content was highest ($p \leq 0.001$) in Desmanthus (48.16) and lowest in Moringa (32.20). ADF and lignin contents were also lowest for Moringa leaves. Anti-nutritional components varied widely among tree leaves, with higher total tannin and condensed tannin contents in the leaves of Calliandra and Jack, while minimal tannin levels were noticed for Moringa and Agathi leaves. Study, concluded that all the evaluated tree leaves possess satisfactory nutritive profiles and can serve as potential feed sources in smallholder ruminant production systems.

Keywords: Tree leaves, nutritive value, fibre fraction, anti-nutritional factor

1. Introduction

Tree leaves have gained substantial attention as alternative fodder resources for livestock due to the persistent shortage of quality feed and escalating prices of conventional concentrate ingredients. In many tropical regions, including India, the intensifying competition between human and livestock food systems has resulted in the diversion of arable land and cereal grains for direct human consumption, thereby restricting the availability of cultivated fodders and compelling livestock producers to rely predominantly on crop residues and agro-industrial by products^[4]. This scarcity is further compounded by seasonal feed fluctuations, particularly during dry periods, when availability of green forages is markedly reduced. In this context, multipurpose trees and their foliages serve as strategic feed resources offering sustainable and nutritionally relevant alternatives within mixed farming systems^[7]. Fodder tree leaves form an integral part of ruminant feeding systems across the world^[21], where they contribute to bridging nutritional gaps and mitigating deficiencies that commonly arise during dry seasons^[23], thereby supporting sustainable ruminant production^[3]. In addition to their crude protein and mineral content, many leguminous tree foliages enhance the utilization of low quality basal diets such as crop residues and other non- conventional feed resources, by improving rumen fermentation efficiency. Their low cost and local availability further rationalize their inclusion as substitute protein supplements^[13, 19], while their accessibility and ability to diversify ruminant diets provide additional practical advantages for smallholder farmers^[11]. Moreover, tree leaves contain a variety of bioactive phytochemicals including phenols, tannins and saponins, which at moderate concentrations may exert beneficial effects such as improved nitrogen utilization, reduced methane emissions and antiparasitic activity in small ruminants. Therefore, systematic nutritive evaluation of locally available tree leaves is vital for determining their feeding value and establishing their potential role in sustainable and cost effective ruminant feeding strategies.

2. Materials and methods

2.1. Collection and processing of tree leaves

Eight tree leaves of multipurpose trees namely Jack (*Artocarpus heterophyllus*), Gliricidia (*Gliricidia sepium*), Venga (*Pterocarpus marsupium*), Agathi (*Sesbania grandiflora*), Desmanthus (*Desmanthus virgatus*), Calliandra (*Calliandra calothyrsus*), Subabul (*Leucaena leucocephala*) and Moringa (*Moringa oleifera*) were collected from in and around the campus of College of Veterinary and Animal Sciences, Mannuthy, Thrissur, Kerala. All the collected tree leaves were dried at 50 °C for 72 hours in a forced hot air oven. Dried tree leaves were ground and passed through 1 mm sieve and were stored in an air tight containers for further chemical analysis

2.2. Chemical analysis

The leaves were analysed for dry matter (DM), crude protein (CP), crude fibre (CF), ether extract (EE), total ash and nitrogen-free extract (NFE) as per AOAC (2016). Cell wall constituents including neutral detergent fibre (NDF), acid detergent fibre (ADF) and acid detergent lignin (ADL) were determined according to Van Soest *et al.* (1991) [25]. Anti-

nutritional factors such as tannin fraction and total phenols were estimated according to Makkar *et al.* (1993) [17].

3. Results and Discussion

3.1. Chemical composition of tree Leaves

The proximate composition of the evaluated tree leaves showed considerable variation among species (Table 1), indicating interspecies differences ($p \leq 0.001$) in nutritive composition. Such variability in proximate constituents has been widely attributed to differences in genotype, growing environment, stage of maturity and harvesting conditions, which collectively influence leaf biochemical composition [9]. The content (%) of dry Matter (DM) was higher ($p \leq 0.001$) in the leaves of Venga (31.15), Calliandra (29.65), Jack (29.61) and Desmanthus (29.13) when compared with Moringa leaves (25.97). DM content (%) of Gliricidia leaves was also less (27.68) and was comparable ($p \geq 0.001$) with that of Moringa leaves (25.97) however, the value was similar ($p \geq 0.001$) to that of Agathi, Subabul, Calliandra and Desmanthus leaves. Multiple studies have reported similar DM content (%) ranging from 18 to 38 for multipurpose fodder tree leaves [12, 22].

Table 1: Chemical composition of different tree leaves (%)

Tree leaves		Chemical composition					
Local name	Scientific name	DM	CP	EE	CF	Ash	NFE
Jack	<i>Artocarpus heterophyllus</i>	29.61 ^{ab} ±1.41	15.09 ^e ±0.43	2.84 ^{ef} ±0.35	18.72 ^{bc} ±0.33	12.27 ^a ±0.6	51.09 ^b ±0.64
Agathi	<i>Sesbania grandiflora</i>	28.41 ^b ±0.69	24.71 ^b ±0.57	4.01 ^{bc} ±0.15	13.36 ^c ±0.61	9.94 ^c ±0.21	47.98 ^{cd} ±1.12
Gliricidia	<i>Gliricidia sepium</i>	27.68 ^{bc} ±0.84	20.66 ^c ±0.30	3.85 ^{cd} ±0.17	16.01 ^d ±0.34	9.86 ^c ±0.2	49.63 ^{bc} ±0.49
Venga	<i>Pterocarpus marsupium</i>	31.15 ^a ±0.59	16.09 ^e ±0.35	2.62 ^e ±0.11	18.35 ^c ±0.43	8.14 ^{cd} ±0.35	54.80 ^a ±0.58
Subabul	<i>Leucaena leucocephala</i>	28.59 ^b ±0.42	21.45 ^c ±0.39	4.44 ^b ±0.17	14.21 ^e ±0.19	10.13 ^b ±0.19	49.77 ^{bc} ±0.59
Desmanthus	<i>Desmanthus virgatus</i>	29.13 ^{ab} ±0.21	18.06 ^d ±0.46	3.74 ^{cd} ±0.18	20.81 ^a ±0.21	7.28 ^d ±0.24	50.12 ^b ±0.66
Calliandra	<i>Calliandra calothyrsus</i>	29.65 ^{ab} ±0.26	20.70 ^c ±0.24	3.32 ^{cd} ±0.06	19.68 ^b ±0.35	8.27 ^c ±0.10	48.04 ^{cd} ±0.38
Moringa	<i>Moringa oleifera</i>	25.97 ^c ±0.29	26.94 ^a ±0.42	5.12 ^a ±0.20	11.71 ^f ±0.34	10.14 ^b ±0.24	46.09 ^d ±0.61
p value		0.001	0.001	0.001	0.001	0.001	0.001

Average of six values with S.E, expressed on DM basis except for dry matter

Values within a column with different superscripts are significantly different, $p \leq 0.001$

Crude protein (CP) content varied significantly ($p \leq 0.001$) among the tree leaves. CP content (%) was significantly higher ($p \leq 0.001$) in the leaves of Moringa (26.94) when compared with Agathi (24.71), Subabul (21.45), Calliandra (20.70), Gliricidia (20.66), Desmanthus (18.06), Venga (16.09) and Jack (15.09) leaves. The CP (%) of Agathi leaves was also higher ($p \leq 0.001$) than that of Subabul, Calliandra, Gliricidia, Venga, Desmanthus and Jack leaves. Subabul, Calliandra and Gliricidia leaves had similar ($p \geq 0.001$) CP levels. The lowest CP level (%) was observed in Venga (16.09) and Jack leaves (15.09), which agreed with earlier reports [12, 10]. Earlier studies also reported comparable CP content (%) in Desmanthus, Calliandra, Gliricidia, Leucaena, Sesbania and Moringa, generally ranging from 18 to 36, thereby attributing their nutritional relevance in ruminant feeding [12, 20, 22, 26]. Feed resources supplying at least 8 per cent CP are considered sufficient because, this level of dietary protein supports normal rumen metabolic processes and enables efficient fibre degradation by rumen microbes [15]. In the present study, all of the evaluated tree leaves contained CP levels (%) above 9, which is substantial since rumen fermentation efficiency was adversely affected, when protein concentrations was below this level [6]. The CP levels observed in the present study were also superior to those of typical tropical grasses and the results support the use of tree foliage as strategic protein supplements for ruminants during scarcity periods. Ether extract (EE) content (%) was higher ($p \leq 0.001$) in the leaves of Moringa (5.12) followed by

Subabul (4.44), Agathi (4.01), Gliricidia (3.85), Desmanthus (3.74), Calliandra (3.32), Jack (2.84) and Venga leaves (2.62). The EE content (%) of Subabul was comparable with that of Agathi leaves however, significantly higher ($p \leq 0.001$) than that of leaves of Gliricidia, Desmanthus, Calliandra, Jack and Venga. Gliricidia and Desmanthus leaves demonstrated similar EE values ($p \geq 0.001$). The lowest EE content (%) was recorded for Venga and Jack leaves, which remained comparable with each other ($p \geq 0.001$). The results of the present study were comparable with earlier reports, which documented EE contents (%) ranging from 2.50 to 6.00 in the leaves of Venga, Jack, Calliandra, Desmanthus, Gliricidia, Agathi, Subabul and Moringa [12, 20, 22]. The relatively higher EE content observed in Moringa was consistent with earlier reports describing this species as a foliage rich in lipid soluble nutrient, contributing to improved energy density of the diet [22]. The EE levels recorded for Gliricidia and Calliandra leaves were comparable with values previously reported for these species under tropical conditions, reflecting their moderate lipid fraction typical of leguminous tree leaves [12, 22]. Crude fibre (CF) content (%) differed significantly among the tree leaves ($p \leq 0.001$), with higher values for Desmanthus (20.81), followed by Calliandra (19.68), Jack (18.72), Venga (18.35), Gliricidia (16.01), Subabul (14.21) Agathi (13.36) and Moringa (11.71). The CF content (%) of Calliandra and Jack leaves was similar however, that of Venga was lower ($p \leq 0.001$) than that of Calliandra but was comparable with that of Jack ($p \geq 0.001$). Subabul and Agathi leaves also

exhibited statistically similar crude fibre values ($p \geq 0.001$). The lowest CF content (%) was recorded in Moringa leaves (11.71). The lower CF content observed in Moringa, may be due to higher proportion of cell contents, as reported earlier [12, 22]. In contrast, higher CF levels in the leaves of Desmanthus, Calliandra and Jack reflected greater deposition of structural carbohydrates [22, 26]. Ash content (%) was higher ($p \leq 0.001$) in the leaves of Jack (12.27) when compared with Subabul (10.13), Moringa (10.14), Agathi (9.94), Gliricidia (9.86), Calliandra (8.27), Venga (8.14) and Desmanthus leaves (7.28). The ash content (%) of Subabul and Moringa leaves remained comparable ($p \geq 0.001$) with each other, while Agathi, Calliandra and Gliricidia leaves also exhibited similar values ($p \geq 0.001$). Calliandra and Venga leaves showed comparable ash content ($p \geq 0.001$). The lowest ash content (%) was observed in Desmanthus leaves (7.28) and with that of Venga leaves (8.14) the value was comparable ($p \geq 0.001$). The current findings of the study were in line with previously documented ash contents (%) ranging from 6.84 to 13.45 in the leaves of Desmanthus, Venga, Calliandra, Gliricidia, Agathi, Moringa, Subabul and Jack [12, 20, 22]. Nitrogen free extract level (%) in leaves also showed notable variability, ranging from 46.09 (Moringa) to 54.80 (Venga). Similar variability in soluble carbohydrate fractions has been documented for tropical foliage [20, 22]. Collectively, these findings indicate that locally available tree foliages possess balanced nutrient profiles suitable for supplementation, particularly as protein sources to support the microbial growth when fed with basal crop residues.

3.2. Fibre fractions of tree leaves

The fibre fractions of the tested tree leaves exhibited considerable variability among tree leaves (Table 2). Neutral detergent fibre (NDF) content differed significantly among the tree leaves. NDF content (%) was higher ($p \leq 0.001$) in the leaves of Desmanthus (48.16) when compared with Jack (44.60), Calliandra (42.54), Venga (42.29), Subabul (39.00), Gliricidia (37.93), Agathi (37.63) and Moringa leaves (32.20). NDF content (%) recorded for Desmanthus leaves (48.16) was comparable with values reported earlier for the species (46 to 50) grown under tropical conditions, and higher cell wall fractions were attributed to greater structural carbohydrate deposition and seasonal influences [26]. Similarly, the NDF content (%) observed in Jack leaves (44.60) was comparable to previously reported [12] values (43 to 47). The NDF content (%) of Calliandra and Venga leaves remained comparable ($p \geq 0.001$) with each other, and were also consistent with earlier findings (40-45) reflecting substantial structural carbohydrate deposition in the leaves of these species [12, 20]. Subabul, Gliricidia and Agathi leaves also recorded similar ($p \geq 0.001$) NDF values. Comparatively moderate level (%) of NDF was observed in leaves of Subabul (39.00), Gliricidia (37.93) and Agathi (37.63), these results are in agreement on earlier observations with regard to NDF content (%) of these leaves (35-40) [12, 20, 22]. The lowest NDF content (%) was observed in Moringa leaves (32.20), the lower NDF content of Moringa leaves aligned with previously reported values of approximately 30 to 34 per cent [22].

Table 2. Fibre fraction of different tree leaves (%)

Tree leaves	Fibre Fraction				
	NDF	ADF	Hemicellulose	ADL	Cellulose
Jack	44.60 ^b ±0.81	31.49 ^a ±1.07	13.11 ^{bc} ±0.68	8.12 ^b ±0.27	23.38 ^a ±1.05
Agathi	37.63 ^d ±0.36	24.68 ^c ±0.54	12.95 ^{bc} ±0.49	4.65 ^c ±0.10	20.81 ^b ±1.24
Gliricidia	37.93 ^d ±0.59	26.50 ^b ±0.53	11.43 ^c ±0.97	8.78 ^a ±0.13	17.73 ^c ±0.51
Venga	42.29 ^c ±0.64	30.31 ^a ±0.18	11.99 ^c ±0.6	8.95 ^a ±0.17	21.36 ^{ab} ±0.32
Subabul	39.00 ^d ±0.26	26.78 ^b ±0.81	12.21 ^c ±0.94	8.72 ^a ±0.29	18.06 ^c ±0.79
Desmanthus	48.16 ^a ±0.34	30.25 ^a ±0.28	17.90 ^a ±0.53	8.45 ^{ab} ±0.16	21.80 ^{ab} ±0.37
Calliandra	42.54 ^c ±0.17	30.38 ^a ±0.31	12.16 ^c ±0.34	7.88 ^b ±0.23	22.51 ^{ab} ±0.27
Moringa	32.20 ^e ±0.57	17.65 ^d ±0.19	14.55 ^b ±0.57	5.10 ^c ±0.14	12.55 ^d ±0.21
p value	0.001	0.001	0.001	0.001	0.001

Average of six values with S.E, expressed on DM basis

Values within a column with different superscripts are significantly different, $p \leq 0.001$.

Acid detergent fibre (ADF) content differed significantly among the evaluated tree leaves ($p \leq 0.001$). ADF content (%) was higher ($p \leq 0.001$) in the leaves of Jack (31.49), Calliandra (30.38), Venga (30.31) and Desmanthus (30.25) followed by Gliricidia (26.50), Subabul (26.78), Agathi (24.68) and Moringa leaves (17.65). The ADF content (%) of Jack, Calliandra, Venga and Desmanthus leaves remained comparable ($p \geq 0.001$) with each other. Gliricidia and Subabul leaves also exhibited similar ($p \geq 0.001$) ADF values. The lowest ADF content (%) was recorded in Moringa leaves (17.65). The ADF content (%) observed in the present study were in agreement with earlier reports, documenting ADF contents ranging from 18 to 32 in Calliandra, Moringa, Subabul and Jack leaves [12, 20, 22]. Concurrently, hemicellulose content (%) was higher ($p \leq 0.001$) in the leaves of Desmanthus (17.90) when compared with Moringa (14.55), Jack (13.11), Agathi (12.95), Subabul (12.21), Calliandra (12.16), Venga (11.99) and Gliricidia leaves (11.43). The hemicellulose content (%) of Jack and Agathi leaves remained comparable ($p \geq 0.001$) with each other. Subabul, Calliandra, Venga and Gliricidia leaves also exhibited similar ($p \geq 0.001$)

hemicellulose values. These findings were consistent with earlier reports that documented hemicellulose contents (%) ranging from 11.43 to 18.50 in the leaves of Gliricidia, Venga, Subabul, Calliandra, Agathi, Jack, Moringa and Desmanthus [12, 20, 22]. Cellulose content also showed significant interspecies variation ($p \leq 0.001$). Cellulose content (%) was higher ($p \leq 0.001$) in the leaves of Jack (23.38) when compared with Agathi (20.81), Gliricidia (17.73), Subabul (18.06) and Moringa (12.55) leaves. The cellulose content (%) of Calliandra (22.51), Desmanthus (21.80) and Venga (21.36) remained comparable ($p \geq 0.001$) with Jack leaves. Gliricidia and Subabul leaves exhibited similar ($p \geq 0.001$) cellulose values and the lowest cellulose content (%) was observed in Moringa leaves (12.55). Consistent with the present findings, previous studies reported, cellulose content (%) ranging from 12.00 to 25.00 in the leaves of Venga, Jack, Calliandra, Desmanthus, Gliricidia, Agathi, Subabul and Moringa [12, 20, 22]. These variations reflected considerable differences in moderate fibre fractions among species.

Lignin is a key constraint to rumen fibre digestibility due to its cross-linkages with cellulose and hemicellulose. Acid

detergent lignin (ADL) concentration differed significantly ($p \leq 0.001$) among tree leaves, ADL content (%) was higher ($p \leq 0.001$) in the leaves of Venga (8.95), Gliricidia (8.78), Subabul (8.72) and Desmanthus (8.45) when compared with, Jack (8.12), Calliandra (7.88), Moringa (5.10) and Agathi leaves (4.65). The ADL content (%) of Desmanthus leaves remained similar ($p \geq 0.001$) with Venga, Gliricidia, Subabul, Jack and Calliandra leaves. Venga, Gliricidia and Subabul leaves exhibited similar ($p \geq 0.001$) ADL values. Similarly, Leaves of Jack and Calliandra had identical ($p \geq 0.001$) ADL content (%) while the lowest value was observed in Agathi leaves (4.65). These values were consistent with previously reported lignin contents for tropical tree leaves, with higher lignification in Venga and Jack, and lower lignin levels in Agathi, Moringa and Subabul, indicating species specific differences in fibre deposition [12, 20].

3.3. Anti-nutritional Components

The concentration of anti-nutritional components varied markedly among the evaluated tree leaves (Table 3). Total phenolic content (%) differed significantly ($p < 0.001$), and was higher ($p \leq 0.001$) in the leaves of Jack (8.25) and Venga (8.12) when compared with Calliandra (7.65), Subabul (5.63), Desmanthus (4.01), Gliricidia (3.27), Agathi (1.66) and Moringa leaves (1.57). Agathi and Moringa leaves exhibited similar ($p \geq 0.001$) total phenol values. The lowest total phenol content (%) was observed in Moringa leaves (1.57). Variation in phenolic content among tropical tree foliage has been widely reported and reflects inherent differences in plant metabolism and secondary compound synthesis [12, 20, 22].

Table 3: Anti nutritional components of different tree leaves (%)

Tree leaves	Anti-nutritional components				
	Total Phenol	Non Tannin Phenol	Total Tannin	Condensed Tannin	Hydrolysable Tannin
Jack	8.25 ^a ±0.11	1.93 ^a ±0.20	6.33 ^b ±0.12	3.72 ^a ±0.09	2.61 ^b ±0.09
Agathi	1.66 ^f ±0.06	1.01 ^{de} ±0.05	0.65 ^b ±0.05	0.03 ^f ±0.01	0.62 ^{ef} ±0.05
Gliricidia	3.27 ^c ±0.11	1.21 ^d ±0.15	2.06 ^a ±0.05	0.59 ^c ±0.06	1.48 ^c ±0.09
Venga	8.12 ^a ±0.08	3.53 ^a ±0.10	4.59 ^a ±0.14	3.29 ^b ±0.13	1.30 ^{cd} ±0.22
Subabul	5.63 ^c ±0.07	3.09 ^b ±0.09	2.55 ^c ±0.05	2.14 ^d ±0.08	0.41 ^e ±0.13
Desmanthus	4.01 ^d ±0.08	0.69 ^e ±0.12	3.32 ^a ±0.05	2.55 ^c ±0.05	0.77 ^e ±0.07
Calliandra	7.65 ^b ±0.14	1.04 ^{de} ±0.12	6.61 ^a ±0.04	3.20 ^b ±0.04	3.41 ^a ±0.02
Moringa	1.57 ^f ±0.06	0.33 ^f ±0.11	1.24 ^a ±0.08	0.14 ^f ±0.01	1.11 ^d ±0.07
p value	0.001	0.001	0.001	0.001	0.001

Average of six values with S.E, expressed on DM basis. Values within a column with different superscripts are significantly different, $p \leq 0.001$

Total tannin content also differed significantly among tree leaves ($p < 0.001$). Total tannin content (%) was higher ($p \leq 0.001$) in the leaves of Calliandra (6.61) when compared with Jack (6.33), Venga (4.59), Desmanthus (3.32), Subabul (2.55), Gliricidia (2.06), Moringa (1.24) and Agathi (0.65) leaves. The lowest total tannin content (%) was observed in Agathi leaves (0.65) and the higher total tannin content in leaves of Calliandra and Jack agreed with earlier findings that identified these species as tannin rich browses due to their greater accumulation of phenolic compounds, particularly condensed tannins [12]. Low tannin content observed in Moringa and Agathi also supported earlier reports, describing these species as low tannin, highly digestible tree leaves suitable for higher inclusion in ruminant diets [22]. Condensed tannin (CT) content also showed a similar pattern of variation ($p \leq 0.001$). CT content (%) was higher ($p \leq 0.001$) in the leaves of Jack (3.72) when compared with Venga (3.29), Calliandra (3.20), Desmanthus (2.55), Subabul (2.14), Gliricidia (0.59), Moringa (0.14) and Agathi (0.03) leaves. The condensed

tannin content (%) of Venga and Calliandra leaves remained comparable ($p \geq 0.001$) with each other. The lowest condensed tannin content was observed in Agathi and Moringa leaves, which remained similar ($p \geq 0.001$). The higher condensed tannin content in Jack, Venga and Calliandra observed in the present study was consistent with earlier findings [12, 22]. Conversely, the low tannin profile of Moringa and Agathi supported earlier reports indicating minimal plant secondary metabolites in these foliage [22]. Hydrolysable tannin (HT) content (%) was higher ($p \leq 0.001$) in the leaves of Calliandra (3.41) when compared with Jack (2.61), Gliricidia (1.48), Venga (1.30), Moringa (1.11), Desmanthus (0.77), Agathi (0.62) and Subabul leaves (0.41). The HT content (%) of Venga and Moringa leaves remained comparable ($p \geq 0.001$) with each other. Agathi and Desmanthus leaves also exhibited similar ($p \geq 0.001$) hydrolysable tannin values. The lowest HT content (%) was recorded in Subabul leaves (0.41), however, was comparable with that of Agathi leaves (0.62). The findings of the present study were consistent with earlier reports that documented HT contents (%) ranging from 0.40 to 4.50 in the leaves of Subabul, Agathi, Desmanthus, Moringa, Venga, Gliricidia, Jack and Calliandra [12, 20, 22].

Tannin content in tree leaves is known to depend on soil fertility, environmental conditions, harvesting season, leaf maturity and sample processing [16]. The wide variation in polyphenolic compounds observed in the present study may be attributed to differences in plant type, photosynthetic capacity, season, rainfall, and temperature. Condensed tannin levels below 5 percent is considered beneficial, as it improve feed utilization by reducing excessive ruminal protein degradation and increasing amino acid availability in the small intestine [13, 18]. In contrast, condensed tannin concentrations exceeding 5 per cent on DM basis may inhibit microbial activity, depress DM digestibility [14], and reduce voluntary feed intake in ruminants.

4. Conclusion

The present study demonstrated species-wise variation in the nutritive value and anti-nutritional components among the evaluated tree leaves. Moringa, Agathi and Subabul leaves exhibited higher crude protein contents with comparatively lower fibre and lignin fractions, indicating a higher nutritive profile and supporting their use as effective protein sources in smallholder production systems. In contrast, leaves of Desmanthus, Venga and Jack showed relatively higher structural fibre fractions and lower crude protein content. Tannin fractions varied markedly among species, with higher total and condensed tannin contents observed in leaves of Calliandra and Jack, whereas leaves of Moringa and Agathi contained minimal levels of tannin. Condensed tannin concentrations in all tree leaves remained within the acceptable limits, indicating potential benefits for protein utilization without adverse effects on rumen function. Overall, the findings of the study indicated that, the locally available tree leaves evaluated in this study can serve as potential feed resources for ruminants, particularly when raised on inferior quality forage and zero input based feeding systems.

Conflict of interest

Not available

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Not available

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