Estimation of proximate and chemical composition of locally available tropical tree leaves

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Abstract
Present study was carried out to analyse the proximate and chemical composition of five tropical tree leaves which are locally available in and around Krishna District. The trees selected for analysis were Psidium guajava, Musa paradisiaca, Acacia nilotica, Moringa oleifera, Azadirachta indica. Among the analysed samples Moringa oleifera leaves have highest CP content (20.15%) where as Psidium guajava have lowest CP content (6.92%) on dry matter basis. Phenol, tannin and condensed tannin content of all the leaves were analysed in the present study. Phenol content was ranged from 6.93 to 17.51% in the estimated samples. Among all the tree leaves Psidium guajava leaves have highest condensed tannin (10.7%) content, while Musa paradisiaca has lowest condensed tannin (4.2%) content. From the study it was concluded that these tree leaves were not only rich in crude protein also have high concentrations of secondary metabolites (phenols, tannins, CT) which help in improvement of growth when they are included in the animal diet.

Keywords: Phenol, tannin, condensed tannin, tree leaves

Introduction
As per the livestock census 2016 India has 199 million of cattle and 100 million of buffaloes. To meet the demands of these growing animal population tree leaves provide best alternative source of nutrition as the land availability for cultivation of fodders is declining and tree foliage has become a significant feed source and is considered as fodder bank that continuously supply fodder round the year and significantly contribute to filling feed gap during dry periods in feed resource limited regions of the world (Gutteridge and Shelton, 1998) [9].

In the present study five common trees in Krishna district area were selected and an attempt has been made to find out the proximate principles, and various phenolic fractions of their leaves for assessing their potential in feeding ruminant animals. The tree leaves selected for the study were Psidium guajava, Musa paradisiaca, Acacia nilotica, Moringa oleifera, Azadirachta indica.

Materials and methods
Present study was conducted in Krishna district of Andhra Pradesh, at Livestock farm complex, NTR College of Veterinary science, Gannavaram during 2019 to 2020.

Leaves collection and processing
Trees such as Psidium guajava, Musa paradisiaca, Acacia nilotica, Moringa oleifera, Azadirachta indica were selected for the study. The matured tree leaves were lopped and dried under the shade for 15 days in livestock complex of NTR College of Veterinary Science, Gannavaram. The dried tree leaves were stored in a dry place. A representative sample from each variety was taken for analysis of proximate principles and phenol fractions.

Estimation of proximate principals and phenol fractions
Proximate analysis of tree leaves was carried out as per AOAC 1995. The extraction of phenols and condensed tannins (CT) were done as per Makkar (2000). 10 ml Aqueous acetone (70%) was mixed with 200 mg of finely ground leaf meal and the resultant was centrifuged at 3000g for 20 mts to get the supernatant. Phenol content was estimated using folin-ciocaletue method.

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Total phenolics consist of simple phenolic compounds or non-tannin phenolics and pure tannins or total tannin phenolics. For estimation of tannins in the supernatant PVPP reagent was added which binds the tannins on the sample. Polyvinyl polypyrrolidone (PVPP; Sigma – Aldrich) has the property to bind tannins but not the simple phenolics. Two ml distilled (triple glass) water and 2 ml total phenolics extract were added to the test tube containing 200 mg PVPP and vortexed twice and filtered through Whatman No 1 filter paper. The filtrate was used to estimate nontannin phenolics, which was subtracted from total phenolics to obtain total tannins. The concentration of total phenolics and total tannins were expressed as tannic acid equivalent.

Estimation of CT
Three ml n-butanol – HCl (95:5 v/v) and 0.1 ml ferric ammonium sulphate (1%) were added to the test tube containing 0.5 ml phenolics extract. The test tube was closed with a glass marble and heated in a boiling water bath for 60 min. The absorbance of the red anthocyanidin products (i.e., condensed tannin) was measured at 550 nm and condensed tannin was expressed as leucocyanidin equivalent.

Results and Discussion
The proximate composition and chemical composition (Phenol, Tannin and condensed tannin content) of different tree leaves were analyzed and presented in table1 &2 respectively.

Proximate composition
Crude protein content of tree leaves varied from 6.92% to 20.15% on dry matter basis. Highest CP content was observed in *Moringa oleifera* tree leaves. Among all the leaves analysed *Acasia nilotica* leaves have more crude fibre content(23.93%).

Similar to the results of present study, Bhatta et al. (2005)\(^4\) reported that *Azadirachta indica* leaves contained 14.5% CP, 39.5% NDF, 28.5% ADF, 3.36% EE and 5.12% Ash. According to the reports of Dubey et al. (2011)\(^7\) the leaves of *Psidium guajava* contained 10.54% CP, 10.02% Ash, 3.83% EE, 38.19% NDF and 24.22% ADF. Chemical composition of tree leaves reported in the present study also broadly comparable with the earlier results reported (Senani et al., 1997; Reddy et al., 2008; Dey et al., 2006)\(^{11,12,13}\).

The differences in the chemical composition of various tree leaves could be attributed to the variation in agro-climatic conditions, season, stage of maturity, genetic makeup, soil fertility, harvesting methodology, post harvest storage and processing conditions like drying and/or grinding before analysis (Makkar, 2000, 2003; Min et al., 2003)\(^{14,15}\).

Chemical composition of locally available tree leaves

| S. No | Botanical name          | Phenols | Non tannin phenols | Tannins | HT  | CT   |
|-------|-------------------------|---------|--------------------|---------|-----|------|
| 1     | *Psidium guajava*       | 13.26   | 1.12               | 12.14   | 1.44| 10.7 |
| 2     | *Musa paradisiaca*      | 12.34   | 2.82               | 9.52    | 5.32| 4.2  |
| 3     | *Acacia nilotica*       | 17.51   | 4.24               | 13.27   | 4.87| 8.4  |
| 4     | *Moringa oleifera*      | 6.93    | 0.76               | 6.17    | 1.67| 4.5  |
| 5     | *Azadirachta indica*    | 11.14   | 1.93               | 9.24    | 1.94| 7.3  |

Compared to the present study, Dubey et al. (2011)\(^7\) reported slightly higher values of CT for *Psidium guajava* leaves (11.99%). Rubanza et al. (2005)\(^{15}\) analyzed the tree leaves from six species of *Acacia* and reported that the total phenols were in the range of 9.9-28.1% while, total tannins were found to be in the range of 8.4-25.6%. The observed values in the present study are also within this range. Contrary to present findings phenol, tannin and condensed tannin content of different tree leaves reported by Giridhar et al. (2019)\(^{16}\) and Chander Datt et al. (2008)\(^{17}\) in multipurpose trees in subtropical humid climate of India are lower than the values reported in the present study. Jayanegara et al. (2011)\(^{10}\) and Baruah et al. (2018)\(^{18}\) reported lower values of phenol, tannin and condensed tannins for different tree leaves compared to the values reported in the present study.

Conclusion
From the present study it was concluded that these tree leaves have potential nutrient composition as they are rich in crude protein content and also rich in secondary metabolite like phenols, CT which play an important role in growth improvement in addition to their antioxidant capacity. Hence these tree leaves can be included in the diet of animals to decrease the cost of feeding and also as source of nutrition during scarcity periods.

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