Original Article

Nutritional study of some medicinal plants as a possible source of feed material

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ABSTRACT

Objective: The objective is to study the evaluation of nutritive value of *Berberis lycium*, *Citrullus colocynthis,* and *Plumbago zeylanica*. **Materials and Methods:** The nutritional composition of the plants was determined using ultraviolet visible spectroscopy and chemical assay methods. Two lots of each plant in duplicate were evaluated for the parameters protein, fiber, fat, carbohydrate, calcium, and phosphorus. **Results:** *B. lycium* was found to contain protein content 8.8–10.0%, fiber 36.65–40.05%, carbohydrate 18.36–20.62%, calcium 0.37–0.44%, total ash 4.5–5.2%, and phosphorus 0.54–0.94, whereas *C. colocynthis has* the protein content 13.72–14.65%, fiber 33–38%, carbohydrate 11.04–13.9%, total ash 17–19%, calcium 0.5–0.73%, and phosphorus 0.97–1.31. *P. zeylanica* was found to contain protein content 4.99–5.3%, fiber 33–38%, carbohydrate 10.96–13.46%, total ash 8.41–8.85%, calcium 1.3–1.48%, and phosphorus 0.21%. **Conclusion:** These medicinal plants show high nutritive value and could be a potential source of feed material for animal health care.

Keywords: *Berberis lycium, Citrullus colocynthis*, fiber, *Plumbago zeylanica*, protein

Introduction

The effectiveness of plants is mainly because of primary and secondary plant metabolites present in the plants. The medicinal plants from decades used for the treatment of various diseases in animals and human beings. Nowadays, utilization of these medicinal plants is increasing. At present, plants are used as one of the prominent sources of nutritional supplement for animal feed. The alarming condition of excessive demand of grains globally requires an alternate solution as a feed material for animal health care. In addition, diminution of soil quality, water scarcity, and weather fluctuations continue to affect production capacity of crops and forage plants, impacting adversely the animal productivity. There are a number of plants still to be explored for their nutritive value and carrying the potential of replacing grains and other materials.

Therefore, it is essential for animal nutrition scientists to introduce and promote alternative feed resources that carry potential nutritive value and are adapted to harsh environmental conditions. There are numerous under-utilized plants which can withstand harsh conditions and are available today which have tremendous potential as livestock feed. The ignorance of potentially excellent animal feed resources also results in loss of plant biodiversity. The cultivation and judicious use of such plants as feed resources is expected to enhance plant biodiversity.[1]

Ethnoveterinary usage and phytochemical composition of three medicinal plants, i.e., *Berberis lycium, Plumbago zeylanica,* and *Citrullus colocynthis* persuaded us to evaluate their nutritional constituent which can possibly be used as feed material for the better livestock health care [Figure 1].

B. lycium also known as Indian barberry belongs to family Berberidaceae. It is an evergreen deciduous shrub. It occurs in subtropical and temperate regions from Kashmir to Uttaranchal on the outer northern-western Himalayas.[2] The preliminary phytochemical investigation confirmed the presence of alkaloids, terpenoids, tannins, flavonoids, fat, and other constituents from the herb. Fruit and leaves are the good sources of protein, calcium, fat, fiber, sulfur, and Vitamin C. Every part of the plant is used in many classical ayurvedic formulations. In the Unani system of medicine, plant is used in the treatment of leprosy. The plant is extensively used in the treatment of jaundice, piles, and menorrhagia.[3] It is also used in diarrhea, intestinal colic, and dysentery.[4] The plant is also reported to possess antibacterial and antifungal activity [Figure 2].[5]

P. zeylenica root is used in multiple disorders such as laxative, expectorant, tonic, abortifacient, and good appetizer. It is also beneficial in rheumatism, laryngitis, scabies, and disease of spleen.[6]

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The plant is used in the treatment of refractory prostate cancer[7] and antifertility activity, antihyperlipidemic activity,[8] antiestrogenic activity[9] to kill intestinal parasites, treat rheumatism, anemia due to "stagnant blood," external and internal trauma, toxic swelling and malignant furunculous scabies,[10] antiplasmodial,[11] antimicrobial,[12] antifungal,[13] anti-inflammatory,[14] antibacterial,[15] and hypolipidemic and antiatherosclerotic activities [Figure 3].[16]

C. colocynthis family Cucurbitaceae, commonly known as colocynth, is one of the most important medicinal plants worldwide. It is used as antirheumatic, purgative, antiasthmatic, anti-arthritic, and abortifacient,[17] and it is also used in the treatment of arterial hypertension and diabetes.[18] The colocynth is indicated in the remedy of cancer, adenopathy, anemia, fever, ulcers, anti-inflammatory, and bronchitis.[19,20]

Material and Methods

Apparatus

Kjeldahl assembly was used for the estimation of proteins; ultraviolet absorbance was taken on SHIMADZU UV 1700 UV VIS spectrophotometer.

Reagents and material

Chemicals and reagents used were of analytical and laboratory grade.

Methodology for the estimation of crude fiber

Defat the sample with petroleum ether (60–80°C) and reflux the marc sequentially in 0.255 N H_2SO_4 and 0.313 M NaOH. Wash with 1.25% H_2SO_4, water, and ethyl alcohol. Dry and ignite the residue in a silica crucible at 600°C for 30 min. Cool the crucible in a desiccator and weigh for a constant weight and carry out the calculations.[21]

$$\text{Crude fiber } (\%\ \text{w/w}) = \frac{(\text{üüü=üü})\quad (\qquad)}{\text{Weight of sample taken in Gram}} \times 100$$

Methodology for the estimation of protein

Digest the sample with potassium sulfate and copper sulfate in 9:1 ratio in a digestion tube using concentrated H_2SO_4 at 400°C for 35 min. Cool and add 100 ml of distilled water, transfer in an radial basis functions (RBF), and add 35% NaOH. Color of the solution becomes blue. Add boiling chips and attach the RBF to Kjeldahl distillation apparatus, the outlet of the apparatus is attached with conical flask having a boric acid solution with the indicator. The distillation outlet tube is dipped in the boric acid solution. Distill the RBF mixture until the volume of the conical flask containing boric acid becomes more than 150 ml. Titrate the distillate with 0.1N hydrochloric acid solution.[22]

$$\%\ \text{age of Nitrogen} = \frac{\left[\begin{array}{l}(\text{ml})\ \text{of 0.1N HCl for sample} - \\ (\text{ml})\ \text{of 0.1N HCl for blank}\end{array}\right]}{\text{Quantity of sample } [\text{in g}]} \times 1.4007 \times \text{Normality of HCl}$$

$$\%\ \text{age of Protein} = \text{Nitrogen content} \times 6.25$$

Figure 1: *Berberis lycium*

Figure 2: *Plumbago zeylanica*

Figure 3: *Citrullus colocynthis*

Methodology for the estimation of ash

Ignite a known amount of sample placed in silica crucible in a muffle furnace at 600°C for 5 h and cool. Weigh the crucible till constant weight and calculate the percentage ash.[23]

Table 1: Nutritional content of *B. lyceum*, *P. zeylanica*, and *C. colocynthis*

Nutritional parameters	*B. lycium* (%)	*P. zeylanica* (%)	*C. colocynthis* (%)
Crude fiber	36.65–40.05	26.5–31.5	33–38
Total ash value	4.5–5.2	8.85–9.28	17–19
Calcium	0.37–0.44	0.81–0.91	0.5–0.73
Phosphorus	0.54–0.94	0.23–0.25	0.97–1.31
Carbohydrate	18.36–20.62	10.96–13.46	11.4–13.9
Protein	8.8–10	4.99–5.3	13.72–14.65

B. lyceum: Berberis lycium, *C. colocynthis*: *Citrullus colocynthis, P. zeylenica: Plumbago zeylanica*

Methodology for the estimation of carbohydrate

Digest the sample with 2.5 N HCl. Develop the color using anthrone reagent and take absorbance at 630 nm using glucose as standard. Calculate the result using linear regression curve plot.[24]

Methodology for the estimation of calcium

Digest the ash of accurately weighed sample with concentrated HCl for 10 min and prepare the sample in HPLC grade water. Carry out the complexometric titration with 0.05 M ethylenediaminetetraacetic acid using hydroxy naphthol blue indicator with color point pink to blue.[25]

Methodology for the estimation of phosphorus

Digest the sample with sulfuric acid. Cool and add nitric acid, boil till a colorless solution is obtained. Develop the color with molybdovanadate reagent and take optical densities. Calculate the result using linear regression curve plot[26] taking absorbance at 430nm.

Result and Discussion

The medicinal plants and herbs have been used from the decades in the treatment of various ailments in animals as well as human beings. Nowadays, application of medicinal plants as animal feed is increasing enormously.

All the three plants are known for diverse medicinal properties such as a laxative, expectorant purgative, antiplasmodial, and antifungal. The nutritional contents of the two batches of each plant in duplicate were evaluated for the parameters protein, fiber, fat, carbohydrate, calcium, and phosphorus (Table 1).

B. lycium has the protein content 8.8–10%, fiber 36.65–40.05%, carbohydrate 18.36–20.62%, calcium 0.37–0.44%, phosphorus 0.54–0.94%, ash value 4.5–5.2%. *P. zeylanica has* the protein content 4.99–5.30%, crude fiber 26.5–31.5%, calcium 0.81–0.91%, carbohydrate 10.96–13.46%, phosphorus 0.23–0.25%, and ash value 8.85–9.28%. *C. colocynthis* shows the protein content 13.72–14.65%, crude fiber 33–38%, calcium 0.5–0.7%, phosphorus 0.97–1.31%, carbohydrate 11.4–13.9%, and protein 13.72–14.65%.

The data clearly reveal that the above-cited medicinal plants are rich in protein and fiber content which can become the potential alternative source of feed material for animals.

Conclusion

Based on the different parameters, all the three plants proved to be a good source of nutrition in addition to the pharmacological efficacy. Moreover, there are ample opportunities to replace classical feed material with medicinal plants bearing efficient nutritive value.

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