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Analysis of herbal feed resources to livestock based on its proximate nutrients

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Abstract
The present study was conducted to evaluate the proximate analysis of herbs viz. tulsi leaves (*Ocimum sanctum)*, moringa leaves (*Moringa oleifera*), curry leaves (*Murraya koenigii*), fenugreek seeds (*Trigonella foenum-graceum*), coriander seeds (*Coriandrum sativum*), turmeric rhizomes (*Curcuma longa*) and ginger rhizomes (*Zingiber officinale*). The herbs collected from various places of Tamil Nadu were shade dried, ground in Wiley mill and stored in air tight container for its proximate analysis. The Crude Protein (CP), Crude Fibre (CF) and Ether Extract (EE) values of herbs were ranged from 7.42 to 27.88, 4.39 to 32.04 and 2.15 to 13.23 percent, respectively. The Total Ash (TA) and Nitrogen Free Extract (NFE) content varied widely from 2.85 to 12.69 percent and 35.53 to 79.33 percent, respectively in the herbs studied. Among the herbs studied, moringa leaf powder contained the highest crude protein level of 27.88 percent followed by fenugreek seed powder (23.09%) and Tulsi leaf powder (20.08%). It was concluded that Tulsi leaf powder, Moringa leaf powder and Fenugreek seed powder were rich sources of crude protein and it might be safely explored to use as phytogenic non nutrient feed additives in livestock and poultry ration.

Keywords: Herbs, proximate nutrients, moringa leaf powder, non-nutrient feed additive

Introduction
Feed additives in the form of antibiotics are being used for more than a decade to augment growth performance as well as to prevent diseases in livestock and poultry feeding. Presence of residues of antibiotics in livestock and poultry products leads to various serious health issues like antibacterial resistance to both livestock as well as human beings. At present, phytogenic feed additives including herbs received much greater attention as alternatives to traditional antibiotics, probiotics and prebiotics due to their growth promoting, antimicrobial, antioxidant and anti-inflammatory functions (Windisch *et al.,* 2008) [1]. Owing to its beneficial effects and diverse properties, the herbs have recently paved the way for incorporating the herbs in livestock and poultry ration as nonnutritive feed additive, which gets momentum to overcome the antibiotic resistance and residues in animal products. To explore the potential use of herbs as an alternative to antibiotic growth promoters, the present study is aimed with the objective of assessing the proximate composition of locally available common herbal feed resources collected from different parts of Tamil Nadu, India.

Materials and Methods
The present investigation was carried out at the Department of Poultry Business Management, TANUVAS-College of Poultry Production and Management, Hosur, Tamilnadu, India. The institute is located 880 meters above mean sea level (MSL) with latitude of 12.74°N and 77.82°E.

Collection and evaluation of herbs for their chemical composition
Seven locally available herbs such as tulsi leaves (*Ocimum sanctum)*, moringa leaves (*Moringa oleifera*), curry leaves (*Murraya koenigii*), fenugreek seeds (*Trigonella foenum-graceum*), coriander seeds (*Coriandrum sativum*), turmeric rhizomes (*Curcuma longa*) and ginger rhizomes (*Zingiber officinale*) were collected from different parts of Tamil Nadu and the collected herbs were pooled and cleaned for any extraneous matter.

The cleaned herbs were then shade dried for 72 hours and ground in a Wiley mill under aseptic conditions (Haniyeh *et al.*, 2010) [2]. to pass through 1 mm sieve to get uniform size and stored in labeled air tight containers for proximate analysis (AOAC, 2007) [3].

Results

The percent proximate composition (on dry matter basis) of the selected herbs like Tulsi leaf powder (*Ocimum sanctum*), Moringa leaf powder (*Moringa oleifera*), Curry leaf powder (*Murrayakoenigii*), Fenugreek seed powder (*Trigonella foenum-graceum)*, Turmeric rhizome powder (*Curcuma longa*), Coriander seed powder (*Coriandrum sativum*), and Ginger rhizome powder (*Zingiber officinale*) is presented in Table 1.

Dry matter

The percent Dry Matter (DM) content of herbs ranged from 87.86 to 97.18. Among the three leafy herbs studied, Tulsi leaf powder had the highest DM percent (92.29%) followed by Curry leaf powder and Moringa leaf powder. However, among the seedy herbs the DM content of Fenugreek seed powder is comparatively higher (91.94 percent) than coriander seed powder with 90.38 percent.

The results also revealed that among the rhizome studied, Turmeric rhizome powder had highest DM (97.18 percent) content than Ginger rhizome powder (87.86 percent). Over all among the seven herbs studied, the highest and lowest DM content is observed in Turmeric rhizome powder and Ginger rhizome powder, respectively.

Crude protein, crude fibre and ether extract

The Crude Protein (CP), Crude Fibre (CF) and Ether Extract (EE) values ranged from 7.42 to 27.88, 4.39 to 32.04 and 2.15 to 13.23 percent, respectively. Among the seven herbs (phytobiotic) studied, the Moringa leaf powder contained the highest crude protein level of 27.88 percent followed by Fenugreek seed powder (23.09%) and Tulsi leaf powder (20.08%). Turmeric rhizome powder and Ginger rhizome powder contained the lowest crude protein level of 7.42 percent each, respectively. Crude protein content of coriander seed powder was moderate (13.97 percent) compared to leaves and rhizomes of herbs studied.

Among the herbs studied, the highest 32.04 percent and lowest 4.39 percent crude fibre content were observed in Coriander seed powder and Turmeric rhizome powder, respectively. The highest 13.23 percent and lowest 2.15 percent ether extract value was observed in Coriander seed powder and Turmeric rhizome powder, respectively. The herbs Moringa leaf powder and Curry leaf powder contained the ether extract value of 5.25 percent each, respectively. Among the rhizomes, Ginger rhizome powder contained highest 4.60 percent compared to Turmeric rhizome powder.

Total ash and Nitrogen Free Extract

The Total Ash (TA) and Nitrogen Free Extract (NFE) content varied widely from 2.85 to 12.69 percent and 35.53 to 79.33 percent, respectively in the herbs studied. Among the herbs studied the highest total ash content of 12.69 percent and lowest 2.85 percent was observed in Tulsi leaf powder and Fenugreek seed powder, respectively.

The NFE is one of the carbohydrate fractions of the proximate composition and the results of the current study indicated that the highest 79.33 percent NFE was observed in Ginger rhizome powder and lowest 35.53 percent was observed in Coriander seed powder.

Discussion

Dry matter, Crude protein, crude fibre and ether extract

The study revealed that among the seedy herbs the DM content of coriander seed powder is 90.38 percent and the result was in accordance with the findings of Hosseinzadeh *et al.* (2014) [4].

The data observed in the present study revealed that highest crude protein level (27.88 percent) is present in Moringa leaf powder. The results obtained in this study are slightly higher than the observation of Makkar and Becker (1996) [5] who reported 25.1 percent in Moringa leaves. The result also indicated that the herbs with lesser crude fibre content had higher crude protein content and vice versa except curry leaf powder and ginger rhizome powder. Bamishaiye *et al.* (2011) [6] also reported that the crude protein content of 28.08 percent and crude fibre content of 8.08 percent in Moringa leaves which were almost in accordance with the findings in the present study.

Contrary to the present findings, Gohel *et al.* (2019) [7] reported that crude protein and crude fibre content of tulsi leaf powder was 5.07 and 6.20 percent, respectively. Lowest crude protein content is observed in Turmeric rhizome powder and Ginger rhizome powder (7.42% each) in the present study. The crude protein content of 20.08 percent in Tulsi leaf powder obtained in this study is also comparable with the findings of Vidhani *et al.* (2016) [8] who reported 20.64 percent crude protein.

Shalini Hooda and Sudesh Jood (2003) [9], Kirubakaran *et al.* (2016) [10] and NIN (1987) [11] also reported similar crude protein, ether extract and crude fibre levels in fenugreek seed powder which were in consonance with the findings in the present study. The crude fibre and ether extract content in Coriander seed powder was too high containing 32.04 and 13.23 percent, respectively. The lowest crude fibre (4.39%) and ether extract (2.15%) content was reported in Turmeric rhizome powder respectively. The crude protein and crude fibre content of coriander seed powder in the present study was in accordance with the findings of Naeemasa *et al.* (2015) [12], Chenna Reddy (2017) [13] and Hosseinzadeh *et al.* (2014) [4].

The crude fibre content of Ginger rhizome powder in the present study was similar to the findings of Nweze *et al.* (2014) [14] and Ogbuewu *et al.* (2014) [15]. In contrast to the findings in the present study, very low levels of crude fibre (2.5%) and very high levels of ether extract (11%) in Turmeric rhizome powder were reported by Choudhury (2019) [16].

Total ash and nitrogen free extract

The total ash content of Tulsi leaf powder studied in this study has shown higher value compared to other herbs, which is almost comparable with the findings of Gohel *et al.* (2019) [7]. The lowest NFE content (35.53%) and the lowest total ash content (2.85%) were observed in Coriander seed powder and Fenugreek seed powder, respectively. Thirty five percent lesser NFE was observed in the herb Tulsi leaf powder, which was not comparable with the findings of Gohel *et al.* (2019) [7]. The NFE content of 71.95 percent in Ginger rhizome powder in this study indicated they were rich in carbohydrates which are comparable with the findings of Ajayi *et al.* (2017) [17] who also reported high

carbohydrate content in Ginger rhizome powder. The variation in the chemical composition could be attributed to the genetic variation, variation in chemical composition, geographical origin, soil type, crop management, harvesting season, harvesting methods, post harvesting handling practices and cultivation practices like fertilizer application, water management, stage of maturity at harvesting and post-harvest storage (Ibrahim *et al.*, 1988 [18]; Hossain and Ishimine, 2005 [19] and Windisch *et al.*, 2008 [1]).

Table 1: Proximate composition of locally available herbs collected from different parts of Tamil Nadu on % Dry Matter Basis (Mean ± SE)

Herbs	Dry matter (%)	Crude Protein (%)	Crude fibre (%)	Ether extract (%)	Total Ash (%)	Nitrogen Free Extract (%)
Tulsi leaf powder (*Ocimum sanctum*)	92.29± 0.01	20.08±0.02	13.62±0.02	3.32±0.02	12.69±0.01	50.29±0.06
Moringa leaf powder (*Moringa oleifera*)	90.37± 0.01	27.88±0.01	8.88±0.02	5.25±0.01	8.95±0.01	49.04±0.01
Curry leaf powder (*Murraya koenigii*)	91.64±0.01	15.68±0.01	15.10±0.02	5.25± 0.01	9.77±0.01	54.20±0.02
Fenugreek seed powder (*Trigonella foenum-graceum*)	91.94± 0.01	23.09± 0.01	7.63±0.02	6.42±0.04	2.85±0.01	60.01±0.02
Coriander seed powder (*Coriandrum sativum*)	90.38±0.03	13.97±0.01	32.04±0.01	13.23±0.01	5.23±0.01	35.53±0.01
Turmeric rhizome powder (*Curcuma longa*)	97.18±0.01	7.42±0.01	4.39±0.02	2.15±0.01	6.71±0.01	79.33±0.02
Ginger rhizome powder (*Zingiber officinale*)	87.86±0.02	7.42±0.01	9.00±0.01	4.60± 0.03	7.03± 0.01	71.95±0.03

Each value is a mean of six observations

Conclusion

Among the seven herbs studied for proximate nutrients, Tulsi leaf powder, Moringa leaf powder and Fenugreek seed powder were rich sources of crude protein. Coriander seed powder is a rich source of crude fat and poor source of soluble carbohydrates. It was concluded that herbs studied may vary in its proximate composition and it may be explored as a potential source of phytogenic non nutrient feed additives in livestock and poultry ration.

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