International Journal of Food, Agriculture and Veterinary Sciences ISSN: 2277-209X (Online)
An Open Access, Online International Journal Available at http://www.cibtech.org/jfav.htm
2017 Vol.7 (2) May-August, pp.66-71/Soni et al.

Research Article

QUANTITATIVE ESTIMATION OF SOME ESSENTIAL MINERALS AND NUTRITIVE VALUE OF SOME ECONOMICALLY IMPORTANT HALOPHYTES OF INDIAN THAR DESERT

Preetpal Kaur[1,2], [*]Vineet Soni[1] and Navdeep Singh Bains[2]
[1]*Department of Botany, Mohanlal Sukhadia University, Udaipur-313001, Rajasthan, India*
[2]*Department of Botany, Govt. Dungar College, Bikaner (Rajasthan) India*
**Author for Correspondence*

ABSTRACT
Haloxylon recurvum, *Haloxylon salicronicum* and *Salsola baryosma* of family Chenopodiaceae, growing in the arid zone of Rajasthan are very useful for human being and cattle as they can be used as food, fodder and source of medicinally important salts and vitamins. In the present study estimation of nutritional value and trace element content of these plants were investigated. The dried and powdered plant parts(root, shoot and leaves) were subjected to various sample preparation stages for the proximate analysis such as fat, moisture, ash and fiber and the dietary minerals such as Phosphorus and Calcium using various biochemical and titration methods under standard laboratory protocols. From the study results, the crude protein values were found in good amounts which is essential for assigning the plants for livestock feed. Good nutritional value of these plant parts indicates that these plantsare not only provide energy and nourishment to the livestock of the area but also calcium and phosphorus rich food (milk and flesh etc.) for human being and for the carnivores animals dependent on the herbivores of the Thar desert, which is a very important event for the flow of energy and recycling of minerals in the food chain and food web of desert ecosystem.

Key words: *Haloxylon recurvum, Haloxylon salicornicum, Salsola baryosma, nutritive value, minerals.*

INTRODUCTION
Plant based ingredients are commonly used as a food source, and mostly the plant based secondary metabolites are taken with the food, which perform therapeutic as well as medicinal role in the body. Especially the Indian food; which is prepared according to the Ayurveda; advocate the inclusion of such plant based ingredients that provide therapeutic inputs to the body along with the nutrition (Verma *et al*., 2014). The Indian desert is confirmed with a major problem of increasing livestock population at a rapid rate. The fodder sources here are much limited. The halophytes growing in the arid zone of Rajasthan are very useful for human being and cattle, as they can be used as food, fodder and source of medicinally important compounds. The quality of a food depends upon the presence of relative concentrations of various nutrients such as protein, carbohydrate, fat, minerals and vitamins. Carbohydrate, fat and proteins are sometimes referred to as proximate principles and form the major portion of the diet while minerals play an important role in regulation of metabolic activities of the body (Gopalan *et al.,* 2004).Mineral elements though usually form a small portion of total composition of most plan materials and of total body weight; they are nevertheless of great physiological importance. Besides several organic compounds, it is now well established that many trace elements play a vital role in general well-being as well as in the cure of diseases. These elements are present at varying concentrations in different parts of the plants, especially in roots, seeds and leaves which are used as a dietary item as well as ingredient in the medicinal preparation (Lokhande *et al*., 2010).
Haloxylon recurvum (Moq.) Bunge ex Boiss , *Haloxylon salicornicum* (Moq.) Bunge in Boiss and *Salsola baryosma* (Roem. et Schult.) Dandy known as Khar, Lana and Lani respectively are important halophytic species (Chenopodiaceae, shrub) of saline areas of The Indian Thar desert. These plants are reported to have therapeutic value in the treatment of a wide variety of disease conditions (Burkill, 1985 and Ahmad *et al.,* 2006). There are prospects for use of these three plants in view of their high protein and

carbohydrate content. The present study has been framed to estimate the nutritive value and mineral elements in *H. recurvum, H. salicornicum* and *S. baryosma*.

MATERIALS AND METHODS

Plant parts (root, shoot and flowers) were collected from Central Arid Zone Research Institute (CAZRI), Bikaner. These samples were dried, powdered and then used for their nutritional value such as crude protein, ether extract, crude fiber, total carbohydrate, nitrogen free extract, calcium, phosphorus and total ash etc.

Analytical Procedure: The powdered material was subjected to nutritive content analysis by A.O.A.C (1995), Lohan *et al.* (1999), Talpatra *et al.* (1940), Crampton and Haris (1969) and Purohit and Mathur (1970) procedure. For the estimation of nutritive contents of plants five samples of each plant parts were taken for analysis. Analysis was performed with collaboration of laboratory of Food and Nutrition Department of Veterinary College, Bikaner.

Determination of Moisture Content: For determination of moisture content 10 g powdered seedmaterial was kept in pre-weighed watch glass/moisture box and dried at 100 – 105 °C over night in an oven. The sample with watch glass was cooled at room temperature in a desiccator and final weight was taken after achieving constant weight. The weight loss in sample regarded as moisture content. The moisture content was calculated using the formula as follows

$$\% \text{ Moisture} = (\text{Total weight} - \text{Final weight}) / \text{Weight of the sample} \times 100$$

Determination of Crude Protein (Micro-Kjedahl Method): Ten grams of the sample was weighed and transferred into a Kjedahl flask. Four tablets of Kjedahl catalysts (tablet contain 1 g of Na_2SO_4 and 0.5 g of selenium) were added. Concentrated H_2SO_4 (20 ml) and glass beads were introduced to avoid bumping on heating. The flask was set in the fume cupboard; heated gently immediately and then continue heating until a slight charring begin to clear and the mixture become colourless. The heating process was approximately one hour. The flask was allowed to cool to room temperature and slowly washed the long neck flask with 20 ml of distilled water into 500 ml distillation flask.

Distillation: Pieces of hot clips were added into the flask and connected up to the splash head and water cooled condenser. NaOH solution (5%, 4 ml) was added in the dropping funnel and 50 ml of 2% boric acid into the 250 ml receiving flask with methyl red indicator. The dropping funnel tap was opened slowing to allow the 5% NaOH to enter the boiling flask. The distillation flask was heated to boiling with water passing through the condenser. Distillation continued until about 150 ml was collected in the receiving flask. The content of the flask was titrated with 0.1 M HCl until pink end point. The reading was recorded and blank was ran along the same treatment.

$$\text{Nitrogen } \% = (VS - VB \times \text{normality of HCl} \times 0.014 \times 100) / \text{weight of sample in grams}$$

VS = Volume of acid used to titrate sample.
VB = Volume of acid used to titrate blank.
N = 0.1 M of acid.
% crude protein = N% × conversion factor (6.25).

Determination of ether extract: Ether extract or Crude fat were determined by extracting 10 g of moisture free plant material with petroleum ether in a soxhlet extractor for 10-16 hours. This petroleum ether extract that contained crude fat, was taken in a pre-weighed beaker (W1) and petroleum ether was evaporated. The weight of beaker along with the residual extract after evaporation (Crude fat, W2) was taken and crude fat content of the sample was calculated using the formula (Kruczek A, 2005).

$$\text{Percentage of ether extract} = \frac{W_2 - W_1}{\text{weight of sample}} \times 100$$

Determination of Crude Fiber: Two grams of the ground sample was weighed and placed into a conical flask. The sample was extracted by stirring with petroleum ether. 200 ml of 1.25% H2SO4 solution was heated to boiling and transferred to the dried sample. The sample was allowed to settle. The flask was connected immediately to a water-cooled reflux condenser and heated. The flask was boiled gently for 30 minutes and mixed. The flask was removed and filtered using a filter paper held in the funnel and washed with boiing water until no longer acidic to litmus paper. 200 ml of 1.25% NaOH was brought to boiling under a reflux condenser. This alkaline solution was used to wash the sample back into the initial flask and then boiled for 30 minutes under condenser. Again, the flask was removed and immediately filtered. All the insoluble matter was then transferred to the sintered crucible using boiling water. The residue was washed first with boiling water, 1% HCl and boiling water to render the insoluble matter free of acid. The residue was washed three times with alcohol and diethyether and then dried in an oven at 150˚C to a constant weight. The dried sample was also ashed by incineration in a muffle furnace at 560˚C for an hour. The crucible was cooled in desicators and then weighed.

$$\text{Percentage of crude fiber} = \frac{\text{weight of insoluble matter - weight of ash}}{\text{weight of sample}} \times 100$$

Determination of Ash Content: For the estimation of ash 5 gm dried plant parts were taken in weighed crucibles and were placed in a muffle furnace for ashing at 600°C. When the contents attained a uniform ash colour (free of black particles) the crucible were cooled in a desiccator and weighed. Percentage of ash was calculated by following formula:

$$\text{Percentage of Ash} = \frac{W2 - W1}{W} \times 100$$

Where, W_1 = Weight of crucible (gm)
W_2 = Weight of crucible + ash (gm)
W = Weight of dried sample (gm)
This ash was used in analysis of mineral contents.

Determination of Nitrogen Free Extract: The substraction method of Crampton and Haris (1969) was followed for the calculation of nitrogen free extract. It was calculated by the following formula:
Percentage of nitrogen free extract= 100-(%CP+%EE+%CF+%Ash)
Organic matter: The organic matter of each dried plant parts was estimated by following formula:
% of organic matter= CP+EE+CF+NFE
Total Carbohydrate: The total carbohydrate of each dried plant parts is equal to the sum of crude fiber and nitrogen free extract [% of total carbohydrate = CF+NFE].
Mineral Contents: For the estimation of calcium and phosphorus 100 ml of 50% hydrochloric acid was added to the ash in crucible and contents were heated in water bath for 10 minutes. The contents were transformed to 250 ml beaker along with the washing till the crucible was free of acid. The contents were heated for 30 minutes and after cooling filtered through ash less Whatman's filter paper number 42. The volume of filtered solution was made to 250 ml with distilled water and kept as a stock solution for the analysis of calcium and phosphorus (Talpatra *et al.,* 1940).
Determination of Calcium: For the estimation of calcium method given by Purohit and Mathur (1970) was followed. 25 ml of stock solution was taken in 250 ml beaker. 50 ml of distilled water and 10 ml of saturated ammonium oxalate was added. Two drops of alcoholic methyl red and 10 ml of concentrated hydrochloric acid were also added. Acidity of solution was adjusted at the pH 4.6 by adding concentrated ammonia solution drop by drop till a brown colored precipitate began to appear and then dilute ammonia solution was added till white colored, precipitate appeared.

The content of the beaker were kept overnight allowing the precipitate to settle down on the next day the solution was filtered through Whatmann filter paper number 40. The precipitate was washed several times with hot distilled water to remove excess oxalate. Precipitate was dissolved in 100 ml of distilled water and 10 ml of concentrated sulphuric acid. This solution was heated at 60°-70°C for 30 minutes and titrated against N/10 potassium permanganate solution. The titration was carried out until a stable pink colour appeared. The calcium contents were calculated as follow:

$$\text{Percentage of Calcium} = \frac{\text{ml of N/10 KMnO4} \times 10 \times 0.002}{\text{gm of sample taken for ashing}} \times 100$$

Where 10 is the dilution factor.

Determination of Phosphorus: From the stock solution of acid soluble ash 25 ml aliquot was taken in 250 ml beaker in which 10 ml of concentrated nitric acid and 10 ml of freshly prepared saturated ammonium molybdate solution were added for precipitation. Yellow colored precipitation of phosphor-ammonium-molybdate began to appear. The beaker was kept overnight allowing the precipitate to settle down. Next day supernatant was filtered through whatmann filter paper number 42. The precipitate was washed with 2 percent nitric acid and then several times with 3 percent potassium nitrate solution for the removal of acid. The precipitate was dissolved in 25 ml of N/10 Sodium hydroxide solution and excess of sodium hydroxide was titrated against N/10 standard nitric acid solution. Phenolphthalein was used as indicator phosphorus contents were calculated as follows:

$$\text{Percentage of Phosphorus} = \frac{\text{ml of N/10 NaOH used} \times 10 \times 0.0001347}{\text{gm of sample taken for ashing}} \times 100$$

Where 10 is the dilution factor. Nutritive contents of five samples for each plant part of *H. recurvum*, *H. salicornicum* and *S. baryosma* were carried out and mean value expressed in percentage on dry matter basis.

RESULTS AND DISCUSSION

The average or mean values of the nutritive contents in three test plant spp. *H. recurvum, H. salicornicum* and *S. baryosma* were analysed. Dry matter was found almost equal in all plant parts selected for the present study of all the three plants. However, maximum dry matter content was present in the shoot of *H. recurvum* (95.66%) and minimum was in flower of *H. salicornicum* (94.84%). It was observed to be higher in the root, shoot and flower of *H. recurvum* as compared to other two plants. The maximum amount of crude protein was detected in flower of *H. salicornicum* (18.72%) and minimum amount in the root of *S. baryosma* (7.66%). The ether extract amount showed considerable variation in the plant species studied. Maximum ether extract was observed in the shoot of *H. salicornicum* (3.97%) as compared to shoots of other two species (1.27% in *H. recurvum* and 2.41% in *S. baryosma*), whereas in the flower of *H. salicornicum* ether extract amount (1.98%) was lower as compared to other two species (2.01% in *H. recurvum* and 3.86% in *S. baryosma*). Minimum amount of ether extract was present in the root of *H. recurvum* (0.58%). The quantitative estimation of the crude fibre may suggest that it can be a diet source which provides good digestion and palatability (Hannah *et al.,* 2015). The crude fiber content was much higher in the flower of *H. salicornicum* (63.58%) as compared to other plant parts selected for the present studies of same plant and other two plant species and minimum in the shoot of *H. recurvum* (22.94%). A little variation showed in the total ash value between the plant species observed in present investigation. Maximum ash value was observed in *S. baryosma* shoot (18.34%) and minimumin root of *H. salicornicum* (5.48%). The amount of nitrogen free extract was higher in root and shoots of *H. recurvum* as compared to *H. salicornicum* and *S. baryosma*. Whereas in flower of *S. baryosma* the amount of nitrogen free extract (10.11%) was higher as compared to *H. salicornicum* (7.70%) and *H. recurvum* (8.83%). Concentration of organic matter was observed higher in root, shoot and flower of *H. salicornicum* as compared to other two plant species. It was found maximum in the root of *H. salicornicum* (94.52%) and minimum in the shoot of *S. baryosma* (81.66%).

Table 1. Nutritive contents (Average values) of root, shoot and fruit of *H.recurvum*, *H.salicornicum* and *S.baryosma*

Parts of plants	Name of plant sps.	Dry matter	Crude protein	Ether extract	Crude fiber	Total ash	N_2 free extract	Organic matter	Total carbohy drates	Cl	P
Root	*H. salicornicum*	95.06	9.87	1.12	50.55	5.48	32.98	94.52	83.53	1.04	0.56
	H. recurvum	95.66	11.68	0.58	44.07	6.25	37.42	93.67	81.49	1.28	0.64
	S. baryosama	95.21	7.66	1.87	49.33	8.87	32.27	91.13	81.60	0.92	0.41
Shoot	*H. salicornicum*	95.33	12.43	3.97	33.80	10.03	39.77	89.97	73.57	2.91	0.14
	H. recurvum	95.66	12.87	1.27	22.94	15.40	47.52	84.60	70.46	0.96	0.18
	S. baryosama	95.20	11.92	2.41	23.98	18.34	43.35	81.66	67.33	1.70	1.41
Flower	*H. salicornicum*	94.84	18.72	1.98	63.58	12.18	7.70	87.82	73.28	4.03	0.58
	H. recurvum	94.92	16.82	2.01	55.42	16.92	8.83	83.08	64.25	1.88	0.87
	S. baryosama	94.96	13.56	3.86	56.67	15.80	10.11	84.20	67.78	2.28	0.47

Total carbohydrate value observed maximum in the root of *H. salicornicum* (83.53%) and minimum in the flower of *H. recurvum* (64.25%). The amount of calcium was maximum in the flower of *H.salicornicum* (4.03%) and minimum in the root of *S. baryosma* (0.92%). Monitoring of Phosphorus levels in plants is a lot of essential for plant growth. Phosphorus content gives stimulation to photosynthesis process (Sushma D Guthe *et al.,* 2017). The shoot of *S. baryosma* contained highest amount (1.41%) of the phosphorus while the shoot of *H. salicornicum* have minimum amount of it (0.14%).
From these results, it is obvious that *H. recurvum*, *H. salicornicum* and *S. baryosma* growing in arid zone of Rajasthan have sufficient amounts of nutritive contents which are useful for the cattle as well as for humen being as nutritive food.

ACKNOWLEDGEMENT
First author of this study is highly grateful to Dr. Tribhuwan Sharma, Head, Department of animal nutrition and college of Veterinary and Animal Science, Bikaner for his encouragement and facilities. Thanks are also due to Dr. J.P. Singh, Sr. Scientist, Central Arid Zone Research Institute, Bikaner for procurement of plant material.

REFERENCES
Ahmad S, Maharavi GM, Ahsraf M, Riaz N, Afza N, Khan KM, Khan M S, Jabbar A and Janbaz K H (2006). Phytochemical studies on *Salsola baryosma*. *Journal of Chemical Society Pakistan* **28**(2) 76-178.
A O A C (1995). Method of chemical analysis. Association of official agricultural chemists. Washington, D.C., U.S.A., 16th Ed. I and II Cunnift, P.A. (Ed.).
Burkill, H. M. (1985). The useful plants of west tropical Africa, Vol. **1**, Royal Botanical Gardens, Kew.
Crampton EW and Harris LE (1969). The use of feed Stuffs in the formulation of livestock rations. *Applied Animal Nutrition*by S. Chand and Comp. Ltd., New Delhi, pp. 45-48.
Gopalan C, Sastri and Balasubramanian SC (2004). Nutritive value of Indian foods. National Institute of Nutrition, Indian Council of Medical Research, Hyderabad 500 007. India. pp:2-3.
Hannah MAC, Krishnakumari S(2015). Analysis of mineral elements, proximate and nutritive value in *Citrullus vulgaris* Schrad. (Watermelon) seed extracts. *The Pharma Innovation Journal* **4**(8) 07-11.

Lohan OP, Chahal SM and Nand Kishore (1999). Feed quality evaluation techniques. Department of animal feed technology college of animal Science. CCS Haryana Agriculture University, Hisar. March. pp. 35.
Purohit GR and Mathur CS (1970). Nutritive value of Murat (*Panicum turgidum*) grass. *Annals Arid Zone* **9** 261-264.
Lokhande R, Singare P, Andhale M (2010). Study on mineral content of some ayurvedic Indian medicinal plants by Instrumental Neutron Activation Analysis and AAS Techniques. *Health Science Journal* **4**(3) 157-168.
Guthee SD and Deshmukh RR (2017). Estimation of phosphorus content in leaves of plants using PLSR and SVMR: a review**.** *International Journal of Advanced Research in Computer Science* **8**(5) 132-135**.**
Talpatra SK, Ray SL and Sen KC (1940). Estimation of phosphorus; calcium; sodium and potassium in food stuffs. *Indian Journal Veterinary Science* **10** 243.
Verma KS, Pandey Rand Ayachi A (2014). Nutritional assessment of different parts of *acacia catechu* wild collected from central India. *International Journal of Pharmaceutical Science and Research* **5**(7) 2980-86.