PROXIMATE ANALYSIS OF PLANTS OF FAMILY ZYGOPHYLLACEAE AND EUPHORBIACEAE DURING WINTER

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ABSTRACT

The aim of this study was to find out the nutritional value of some selected plants of family Zygophyllaceae and Euphorbiaceae which are traditionally used in different parts of Pakistan. The five plants Fagonia cretica L., Peganum harmala L., Tribulus terrestris L., Chrozophora tinctoria (L.) Raf. and Ricinus communis L., were collected from Peshawar and Attock Hills during winter, 2009. In the present study it was found that the mean values exhibited that Peganum harmala excelled in high moisture contents, fat, carbohydrate, protein than Fagonia cretica and Tribulus terrestris L. Peganum harmala might be considered a good nutritive plant followed by Fagonia cretica that contained the highest fibre. The T. terrestris also contained maximum protein and gross energy. The differences found in the proximate composition of these medicinal plants might be attributed to the habitat, environment and time of harvest. Chrozophora tinctoria and R. communis revealed variation in various analysed biochemicals. The mean values showed that C. tinctoria had high moisture, ash, fibre and carbohydrate than its counterpart R. communis. Ricinus communis had more protein, fats and gross energy than C. tinctoria. The cultivation of R. communis should be encouraged on large scale for the development of biodiesel that will help people. Its seeds can be helpful for pharmaceutical, insecticidal and food industries.

Keywords: **Medicinal plants, proximate analysis, biochemicals**, **gross energy**

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INTRODUCTION

Medicinal plants play a significant role in providing primary health care services to rural people and are used by about 80% of the marginal communities around the world. Each medicinal plant species has its own nutrient composition besides having pharmacologically important phytochemicals. These nutrients are essential for the physiological functions of human body. Such nutrients and biochemical's like carbohydrates, fats and proteins play an important role in satisfying human needs for energy and life processes (Adnan *et al*., 2010). Several workers reported the proximate analysis of various medicinal plants (*Amaranthus viridis* Falade *et al*., 2004; *Sonchus eruca*, *Withania coagulans* and *Fagonia indica*, Hussain *et al.*, 2010; *Zingiber officinale*, *Allium sativum* and *Parkia biglobosa* Odebunmi *et al*., 2010).

Fagonia cretica is an annual while *Peganum harmala* is a perennial plant with corymbosely branched; *Tribulus terrestris* is an annual or biennial herb (Shah and Khan 2006; Hussain *et al*., 2011). *Fagonia* species are used as antitumor, antioxidant, analgesic, febrifuge and prophylactic against small-pox agents, fever, asthma, urinary discharges, toothache and kidney diseases (Alam, 2011).

Chrozophora tinctoria is an annual herb**.** It is used to treat warts, used as an emetic, cathartic, and for the treatment of fever in Iran (Delazar *et al*., 2006). *Ricinus communis* is a soft wooden small tree developed throughout tropics and warm temperature regions. Its leaf, root, and seed oil represent a therapeutic potential including inflammation treatment, liver disorders, hypoglycemic and laxative (Zarai *et al*., 2012). These plants are being used for the treatment of different diseases in the country. As medicinal plant species are also used as food along with their medicinal benefits, evaluating their nutritional significance can help to understand the worth of these plants species **(**Hussain *et al*., 2011). Few studies are available on the proximate analysis of *Fagonia cretica* L., *Tribulus terrestris* L., and *Ricinus communis* L., only and no study has been done so far to show the proximate composition of these plants regarding seasonal variation.

MATERIALS AND METHODS

The plant parts of *Fagonia cretica* L., *Peganum harmala* L., *Tribulus terrestris* L., *Chrozophora tinctoria* (L.) Raf. and *Ricinus communis* L., were collected during winter, 2009 from Peshawar and Attock Hills. They were washed in tap water, cleaned and air-dried. The dried samples were powdered for the determination of nutritive value. Powdered sample (10g) was processed for various parameters such as crude proteins, crude fibre, crude fat or ether

extracts, ash contents, moisture contents, carbohydrate contents, gross energy and the methods used to study these parameters were followed after the Association of Official Analytical Chemists methods (AOAC 2000).

Determination of Protein

The dried ground sample 0.5 g was taken in a Kjeldahl flask. Added to it 18 ml of H_2SO_4 and 1g of $CuSO_4$ and 20-25 ml of conc. H_2SO_4. It was digested in Kjeldahl digestion unit for 6 hours. The mixture was cooled down to room temperature. It was transferred about 50ml of 4% boric acid solution in a receiving flask and added to it 3-5 drops of mixed indicator and placed it under the condenser of Kjeldahl. Distillation unit making sure that the condenser tube extends beneath the surface of the acid, in the flask, now added to the Kjeldahl flask 50 ml water and 60 ml of 32% NaOH solution. Distilled so that a volume of 200 ^oC is collected in the receiving flask, remove the flask for titration. Take 0.1 N HCl in burette and titrate the content of the flask against it. Note down the reading and determine the percentage of protein in it as follows.

% Protein = % Nitrogen x 6.25.

Determination of Fiber

Weigh and transfer quantitatively an exact quantity (about 1.0 g = W0) of a sample into a clean filter crucible. Placed the crucible in the crucible stand and added a few drops of octanol to prevent foaming and heated to boiling for 30 min. it was filtered and washed three times with hot water from spray device (30 ml of water) and such as dry as possible. Added to each sample 150 ml of KOH solution preheated in the second reagent system. Add a few drops of octanol and boil as above for another period of 30 min.

$$\% \text{ Crude fibre} = \frac{W_1 - W_2 \times 100}{W0}$$

Determination of Fat

Soxhelt's apparatus was used in this method and first weigh 2-4 g of extraction thimble. The thimble was plugged with absorbent cotton wool. The thimble was placed in extraction chamber. A cleaned and dried 250 ml round bottom flask was weighed and filled up 1/3 of this flask with solvent and connected it with the extraction tube. Put the sample fasten in filter paper. Then set the whole apparatus and turn on the flow of tap water and burner. The extraction continued for 5-6 hrs and siphoning would occur after 5-6 min at the condensation rate of 3-4 drops per second. After completion of the process; remove the thimble from the extractor and heated the flask so that all the solvent can be collected for future. Then the flask was dried at 105 ^oC. Finally, it was cooled and weighed again.

$$\% \text{ Crude fat} = \frac{\text{Weight of flask with fat - weight of empty flask x 100}}{\text{Weight of original sample}}$$

Determination of Ash

It was done while holding a clean flat bottomed silica dish in a hot burner flame for 1 min, transferred it to a desiccators and then cooled, and weight it (W). Weight out a suitable quantity of the plants parts (sample) into a dish (W_1) and heated it gently on the Bunsen burner and charred mass was in a suitable condition for transfer to a muffle furnace at 550 ^{o} C. (AOAC, 2000). The heating continued until all the carbon has been burnt away. Transferred the dish plus ash to a desiccators, cool, and weight it (W_2)

Weight of the empty dish = W

Weight of the empty dish + sample = W_1

Weight of the empty dish + ash = W_2

$$\% \text{ of Ash} = \frac{W1 - W2 \ X \ 100}{\text{Wt of the sample}}$$

Determination of the Moisture

Weight accurately 1-2 g (W) of sample in a clean weighed Petri-dish (W_1), placed the Petri-dish partially covered with lid in an oven at 105 ^{o} C, for 4-6 hours, until constant weight in obtained. Then removed the petri-dish covered with the lid, and placed it in desiccators for 30 min in order to cool it. After cooling weigh the dish (W2). Percent moisture was calculated as follows:

$$\% \text{ Moisture} = \frac{W1 - W2 \ X \ 100}{W}$$

Carbohydrates Content

Carbohydrate can be determined by subtracting the weights of crude protein, crude fats, crude fibre, ash, and moisture content from 100 (100 – moisture + ash+ fibre+ fat+ protein).

Gross Energy

The formula used for gross energy is as follows:

GE (Kcal/g) = 5.72 x (protein) + 9.5 (fat) + 4.79 (fibre) + 4.03 (carbohydrate) = Gross Energy Value and Garrett and Johnson (1983).

RESULTS AND DISCUSSION

In the present study it was observed that the moisture contents were higher (10.3%) in the stem and lowest (8.3% each) in fruits of *Fagonia cretica* (Table 1). These findings agree with (Hussain *et al*. 2009; Hameed *et al*. 2008) who observed similar results in *Rumex hastatus* and *Vitis venifera*. It was highest (9.7%) in stem and lowest (8.6%) in leaves of *Peganum harmala* and it was also highest (9.2%) in stem and lowest (7.8%) in roots of *Tribulus terristris* (Tables 2, 3). It was maximum (10.1%) in stem and minimum (6.1%) in roots of *Chrozophora tinctoria* while it was highest (10.3%) in stem and lowest (8.1%) in roots of *Ricinus communis* (Tables 4, 5). The mean value of moisture content varied from 8.42 (*Tribulus terristris*) to 9.5% in (*Ricinus communis*) (Tables 3, 5). Tholkappiyan *et al*., (2011) reported 25.66% moisture content in the dry fruits of *Tribulus terristris* which was higher than the present study.

Table 1. ***Proximate composition of Fagonia cretica L. during winter.***

Plant	Parts	Moisture contents (%)	Ash content (%)	Protein contents (%)	Fat contents (%)	Fibre contents (%)	Carbohydrate (%)	Gross Energy (Kcal/g)
Fagonia cretica L.	Roots	8.5	7.5	8.4	7.6	56.8	11.2	437.3
	Stems	10.3	12.0	9.8	9.9	50.8	7.2	422.8
	Leaves	9.3	16.0	7.7	10.4	25.1	31.5	389.9
	Fruits	8.3	10.0	13.2	12.5	28.6	27.4	341.5
	Mean	9.1	11.4	9.8	10.1	40.3	19.32	397.8

Ash was highest (16.0%) in leaves and lowest (7.5%) in roots of *Fagonia cretica* (Table 1). It agrees with Cakilcioglu and Khatun (2011) who reported similar ash value in *Tragopogon aureus.* It was maximum (15.3%) in leaves and minimum (8.1%) in roots of *Peganum harmala* (Table 2). Vermani *et al.*, (2010) stated that the amount of ash varies according to the part of the plant, age, and treatment. The constituents of the ash also change with time and from organ to organ. It represents the inorganic part of the plant. Ash contents were high (15.7%) in leaves and low (6.7%) in roots of *Tribulus terrestris* (Table 3). Vermani *et al*., (2010) also reported higher ash in leaves of *Sesbania cannabina*. In the present case ash was highest (16.0%) in leaves and lowest (8.3%) in roots of *Chrozophora tinctoria*. It was also highest (16.2%) in leaves and lowest (9.7%) in roots of *Ricinus communis* (Tables 4, 5). The mean value of total ash content varied from 11.4% (*Fagonia cretica* & *Tribulus terrestris*) to 13.8% (*Chrozophora tinctoria*) (Tables 1, 3, 4).

Table 2. ***Proximate composition of Peganum harmala L. during winter.***

Plant	Parts	Moisture contents (%)	Ash content (%)	Protein contents (%)	Fat contents (%)	Fibre contents (%)	Carbohydrate (%)	Gross Energy (Kcal/g)
Peganum harmala L.	Roots	9.3	8.1	20.3	8.9	26.6	26.8	436.0
	Stems	9.7	11.2	11.2	11.8	21.1	35.0	418.1
	Leaves	8.6	15.3	19.8	14.4	11.0	30.9	427.2
	Fruits	8.9	11.7	13.2	12.3	9.7	44.2	416.8
	Mean	9.1	11.5	16.1	11.85	17.1	34.22	424.4

The protein was highest (13.2%) in fruits and lowest (8.4%) in roots of *Fagonia cretica* .It was maximum (20.3%) in roots and lowest (11.3%) in stem of *Peganum harmala***.** Protein was highest (13.1%) in leaves and lowest (5.2%) in stem of *Tribulus terrestris* (Tables 1-3). It was maximum (10.5%) in leaves and minimum (3.0%) in roots of *Chrozophora tinctoria*. Protein (17.2%) was highest in fruits and lowest (8.0%) in roots of *Ricinus communis* (Tables 4,5). The mean value of protein content varied from 6.8% (*Chrozophora tinctoria*) to 16.1% (*Peganum*

harmala) (Tables 2,4). Ashok *et al.* (2010) reported high total protein in leaves of *Oxalis corniculata*. Bukhsh *et al.* (2007) stated that crude protein varies with plant parts and it supported the present study. In the present investigation the plants parts (roots, stem, leaves and fruits) of *F. cretica, T. terrestris, C. tinctoria* and *Ricinus communis* were collected from Peshawar and *Peganum harmala* was collected from Attock Hills during winter, 2009.

Table 3. ***Proximate composition of Tribulus terrestris L. during winter.***

Plant	Parts	Moisture contents (%)	Ash content (%)	Protein contents (%)	Fat contents (%)	Fibre contents (%)	Carbohydrate (%)	Gross Energy (Kcal/g)
Tribulus terrestris L.	Roots	7.8	6.7	8.0	8.9	56.0	12.5	448.7
	Stems	9.2	12.1	5.2	13.3	55.2	5.0	440.7
	Leaves	8.7	15.7	13.1	9.9	15.5	37.2	393.1
	Fruits	8.0	11.0	11.2	13.4	37.1	19.3	446.7
	Mean	8.42	11.4	9.4	11.3	40.95	18.5	432.3

The fat content was highest (12.5%) in fruit and lowest (7.6%) in roots of *Fagonia cretica* (Table 1). The findings agree with Adnan *et al*. (2010) who reported higher fat contents in *Valeriana officinalis*. The fat was highest (14.4%) in leaves and lowest (8.9%) in roots of *Peganum harmala***.** It was highest (13.4%) in fruits and lowest (8.9%) in roots of *Tribulus terrestris* **(**Tables 2, 3). It was highest (13.0%) in leaves and lowest (8.5%) in stem & roots of *Chrozophora tinctoria*. It was also highest (38.1%) in fruits and lowest (8.2%) in roots of *Ricinus communis* (Table 4, 5).The mean value of fat content ranged from 9.4% (*Chrozophora tinctoria*) to 17.1% (*Ricinus communis*) (Tables 4, 5). Abidemi *et al*., (2013) reported less fat contents in *Euphorbia hirta* and *Croton zambesicus* compared to the present study.

Table 4. ***Proximate composition of Chrozophora tinctoria (L.) Raf during winter***

Plant	Parts	Moisture contents (%)	Ash content (%)	Protein contents (%)	Fat contents (%)	Fibre contents (%)	Carbohydrate (%)	Gross Energy (Kcal/g)
Chrozophora tinctoria (L.) Raf	Roots	6.1	8.3	3.0	8.5	56.3	17.8	439.1
	Stems	10.1	15.7	6.9	8.5	30.9	27.9	380.6
	Leaves	9.7	16.0	10.5	13.0	6.7	44.1	393.2
	Fruits	8.0	15.3	6.8	7.6	7.2	55.1	367.4
	Mean	8.45	13.8	6.8	9.4	25.27	36.2	395.0

Epidemological evidences revealed that use of reasonable amount of dietary fibre (20-35g/day) lower risk of diverticular disease, coronary heart disease, obesity, type 2 diabetes mellitus and irritable bowel syndrome (Ishida *et al*., 2000; Abidemi *et al*., 2013).

The fibre was highest (56.8 %) in roots and lowest (25.1%) in leaves of *Fagonia cretica* in the present study (Table 1). According to Shad *et al*., (2002) who also reported highest fibre contents in the roots of *Fagonia arabica*. It was highest (26.62%) in roots and lowest (9.7 %) in fruits of *Peganum harmala***.** It was highest (56.0%) in roots and lowest (15.5%) in leaves of *Tribulus terrestris* (Tables 2, 3). It was highest (56.3%) in roots and lowest (6.7%) in leaves of *Chrozophora tinctoria* while the fibre content was highest (46.2%) in stem and lowest (23.8%) in leaves of *Ricinus communis* (Tables 4, 5). Gharibzahedi *et al*., (2011) reported similar results. Akande *et al*., (2012) also reported similar crude fibre values for large seed variety of *Ricinus communis*. The mean value of fibre content varied from 17.1% (*Peganum harmala*) to 40.95% (*Tribulus terrestris*) (Tables 2, 3).

Table 5. ***Proximate composition of Ricinus communis L. during winter.***

Plant	Parts	Moisture contents (%)	Ash content (%)	Protein contents (%)	Fat contents (%)	Fibre contents (%)	Carbohydrate (%)	Gross Energy (Kcal/g)
Ricinus communis L.	Roots	8.1	9.7	8.0	8.2	34.0	23.8	382.3
	Stems	10.3	10.1	8.4	9.2	46.2	15.8	420.2
	Leaves	9.8	16.2	16.2	12.9	23.8	21.1	414.1
	Fruits	10.1	11.7	17.2	38.1	24.4	2.7	587.98
	Mean	9.5	11.9	12.45	17.1	32.1	20.2	447.0

Carbohydrates play several vital roles in living organisms. They can be oxidized to yield energy, their polymers act as energy storage molecules and their derivatives are found in a number of biological molecules including coenzymes and the nucleic acids **(**Hasan *et al*., 2011). Carbohydrates were highest (31.5%) in leaves and lowest (7.2%) in stem of *Fagonia cretica* (Table 1). Carbohydrates (44.2%) were highest in fruits and lowest (26.8%) in roots of *Peganum harmala* (Table 2). This agrees with Aberoumand (2011); Hasan *et al*. (2011) who reported similar high carbohydrate contents in fruits of *Myrtus communis* and *Cordia myxa***.** Vunchi *et al*. (2011) stated that most fruits had high carbohydrate content depending on the fruit type, maturity and environment. Carbohydrate was highest (37.2%) in leaves and lowest (5.0%) in stems of *Tribulus terrestris* (Table 3). Rajkala *et al*. (2011) agrees with the present results. It was also highest (55.1%) in fruit and lowest (17.8%) in root of *Chrozophora tinctoria*. It was highest (23.8%) in roots and lowest (2.7%) in fruits of *Ricinus communis* (Tables 4, 5). The mean value of carbohydrate content varied from 18.5% (*Tribulus terrestris*) to 34.22% (*Peganum harmala*) (Tables 2, 3).

Energy and nutrient values of medicinal plant samples are mainly used to translate medicinal samples intakes as intakes of food components. The gross energy was highest (437.3 Kcal/g) in roots and lowest (341.5 Kcal/g) in fruits of *Fagonia cretica* (Table 1). It was highest (436.0 Kcal/g) in roots and lowest (416.8 Kcal/g) in fruits of *Peganum harmala* (Table 2). Logeswari *et al*., (2012) reported high gross energy of the roots of *Sida rhombifolia*. It was also highest (448.7 Kcal/g) in roots and lowest (393.1Kcal/g) in leaves of *Tribulus terrestris* (Table 3). It was highest (439.1 Kcal/g) in roots and lowest (367.4 Kcal/g) in fruits of *Chrozophora tinctoria* while it was highest (587.98 Kcal/g) in fruits and lowest (382.3 Kcal/g) in roots of *Ricinus communis* (Tables 4, 5). Akande *et al*., (2012) reported gross energy values of 6.59 kcal/g and 6.89kcal/g for large seed variety and small seed variety of *Ricinus communis* which was low than the present investigation. The mean value of gross energy varied from 395.0Kcal/g (*Chrozophora tinctoria*) to 447Kcal/g (*Ricinus communis*) (Tables 4, 5).

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