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A COMPARATIVE STUDY ON NUTRITIONAL COMPOSITION OF SOME SELECTED WILD PLANTS OF SEMI-ARID ENVIRONMENT IN PUNJAB, PAKISTAN

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ABSTRACT

Present study was carried out in central Punjab, Pakistan to determine the proximate composition of different wild plants. These plants were collected and subjected to analyses using the Association of Official Analytical Chemists method. The percentage of ash content, moisture content, crude proteins, crude fiber and ether content were determined. The ash percentage varied from 18.35 to 23.5% with highest ash percentage in *U. dioica* and lowest in *P. annua*. Variations were observed in moisture contents, dry matter and dry weight. Two extremes, 18.41% and 21.65%, in crude protein content were observed among all plant species being highest in *A. cana* and lowest in *V. venosa*. All plants were rich in dietary potential and their utilization in well balanced manner could benefit the livestock holders. The research was carried out to ascertain the forage quality and quantity and growth of grazing livestock and their yield.

KEYWORDS: Wild plants, Grazing livestock, Proximate Analysis, Requirement, Punjab, Pakistan

INTRODUCTION

Man's life is closely associated with renewable and non-renewable earth's natural resources [1]. Plant growth and nutritional implication is evaluated by process of proximate and certain nutritional analyses [2]. A series of analysis performed under the umbrella of proximate analysis of given plants source disseminate very immense information on moisture content, crude ash content and some volatile matter content etc. Minerals like ash is measured by the residual water and organic material left by the heating process of proximate analysis that reveals the direct measurements of total amount of minerals in a particular sample [3, 4].The daily food intake has a balanced amount of nutrients and if some nutritional imbalance occurs, then the required amount of nutrients is achieved by adding the missing ingredients to regulate their intake of toxins [5]. Considering the importance of quality of food needed for the proper growth and development of the ruminant, present investigation was conducted. It would help the stockmen to further improve the quality of foodstuff being given to the ruminants for enhancement of yield and growth along with analyzing the dietary potential of wild plants used for livestock. Pakistan has been blessed by the variety of soil, climate, geographical and topographical conditions that support diverse field crops, forage and medicinal plants [6]. Keeping in view the pivotal role of forage crops among the grazing livestock, the study was initiated to ascertain the chemical conformation, dietetic impending and immediate configuration in forage species.

MATERIALS AND METHODS

The study comprised of twenty different types of plants that were collected from diverse sites of Soon Valley keeping in view the best hygienic conditions e.g. Jahlar Lake, Amb Temples, Akrand Cliff Fort Naushahra Village, Uchhali Lake and Khabeki Lake. Following forage plants were collected to be analyzed for proximate composition.

TABLE 1
Plants with scientific, common and family name

S.No.	Plants	Common Name	Family
1	***Collomia grandiflora***	mountain trumpet	*Polemoniaceae*
2	***Viola venosa***	Goosefoot violet	Violaceae
3	***Artemisia cana***	Silver sagebrush	Asteraceae
4	***Salsola kali***	Prickly saltwort	Amaranthaceae
5	***Verbena bracteata***	Bigbract verbena	Verbenaceae.
6	***Urtica dioica***	Common nettle	Urticaceae
7	***Thlaspi arvense***	Penny cress	Brassicaceae
8	***Solanum triflorum***	Cutleaf nightshade	Solanaceae.
9	***Poa annua***	Meadow grass	Poaceae
10	***Cyperus rotundus***	Nut grass	Cyperaceae
11	***Setaria viridis***	Bristle grass	Poaceae
12	***Tinospora malabarica***	Wild tinospora	Menispermaceae
13	***Amaranthus spinosus***	Prickly amaranth	Amaranthaceae
14	***Collinsia parviflora***	Small flowered collinsia	Plantagiaceae
15	***Adiantum capillus-veneris***	Maiden hair fern	Pteridaceae
16	***Heliotropium strigosum***	Heliotrope	Boraginaceae
17	***Galium boreale***	Northern bedstraw	Rubiaceae
18	***Euphorbia glyptosperma***	Ridge-seed Spurge	Euphorbiaceae
19	***Aerva lanata***	Mountain Knotgrass	Amaranthaceae
20	***Conium maculatum***	Conium	Apiaceae

Forage sample collection. Twenty forage plants with five samples of each plant were collected from different sites of Soone Valley and put in labeled bags. The samples were first air dried and then oven dried for 4 days at 70°C. The samples were further ground into powdered form for further analysis.

Proximate analysis. A series of analysis was made and the samples were subjected to determine the percentage of moisture content, crude proteins, ash content and crude fiber in the samples according to the Association of Official Analytical Chemists methods [7].

Ash Test. One g of sample was burnt at the temperature of 600 ºC to extract ash contents determined by using following formula:

$$\text{Ash\%} = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100$$

Dry matter. The contents of dry matter were determined by applying the formula:

Dry matter in percentage= 100 - moisture amount

Moisture contents. The percentage of moisture was determine by applying the following formula:

$$\text{Moisture amount} = \frac{\text{Weight of sample before drying - Weight of sample after drying}}{\text{Weight of sample after drying}} \times 100$$

Crude protein. 1g of sample was taken in the flask to digest it with the help of sulphuric acid and potassium sulfate followed by heating, boiling and distillation.

Crude fibers. Crud fiber was determined by the help of acid base digestion method. 1.25% of diluted sulphuric acid and 1.25% of sodium hydroxide were used. Sample was placed in a beaker, then 200 ml of sulphuric acid was added. The samples were boiled for half an hour followed by cooling, filtration, distillation, washing, digestion, heating and cooling.

Ether Extract. A dried sample (2 g) was extracted with petroleum ether (4-60 ˚C) in soxhlet apparatus which enabled the removal of ether soluble components present in it. At the temperature of 70 ˚C, the extracted material was dried to constant weight in an oven.

Statistical analysis. Normality of the data was checked before analyzing the data statistically. Parametric tests were applied on normally distributed data. Two sample t-test was used to compare the concentration of different variables of forage plants in study site. Statistical software SPSS (version 17) was used for analyzing the data. Difference was considered significant at p values less than 0.05.

RESULTS AND DISCUSSIONS

Ash. Ash percentage varied between18.35% to 23.5% with highest ash percentage in *U.dioica* while lowest in *Poa annua* (Figure 1). The level of significance was noted for Ash percentage at ($p<0.05$) (Table 2). Kidney beans were identified as main source of higher ash percentage with the value of 3.85%. Similar results were reported by Qayyum et al. [8]. Ash percentage was also higher than in dark brown fruits of *Gmelina arborea* (8.91%) [9]. In the present study, higher ash contents were recorded which were indicative of high mineral content in plants. Soil properties could be the cause of this increased content which could be further assessed by understanding soil properties of area under study.

Moisture Content. The moisture contents measured in plant samples ranged from 4.67% to 7.09%. The maximum moisture contents were observed in *C. parviflora* and minimum in *Poa annua* plant samples (Fig. 2). The significance levels are depicted in table. 2. The findings of Aykroyd and Doughty [10] were different from current values as those values fell between 7.0 and 10%. Highest moisture content observed in this investigation was similar to the minimum reported value legumes [10]. However, some of the values stayed around the range reported in white melon, water melon and pumpkin, i.e. 5.0 to 10% [11]. Penuel et al. [12] reported moisture content of 5.05% in *Citrullus vulgaris.* Imeh and Khokhar [13] concluded that the moisture content variation was dependent upon diverse and multiple factors like seasons, cultivation regions, storage conditions and soil profiles.

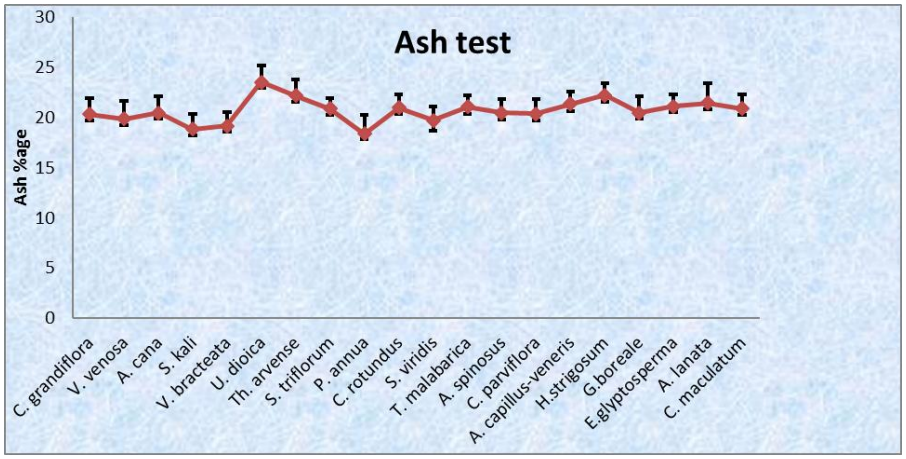

FIGURE 1
Ash concentration fluctuations in different plant species

TABLE 2
Analysis of variance of data for Ash, Moisture content, dry matter, crude proteins,crude fibers and ether extract concentration in plant species

Source of Variation	Degree of Freedom	Mean Squares					
		Ash	Moisture	Dry matter	Crude Proteins	Crude Fiber	Ether Extract
Plant Species	19	4.273**	1.286***	1.281***	3.355***	8.822***	.006**
Error	40	2.153	.160	.162	.867	.617	.003

*** = significant at 0.001
**=significant at 0.05

Dry matter. The figure 3 depicts clear variation in dry matter, ranging from 92.9 to 95.32% in the due course of plants species under consideration. *Poa annua* revealed maximum dry weight value while *C. parviflora* showed minimum value. Elemo et al. [14] reported highest value of dry matter content in African locust bean (88.79%) however Mutayoba et al. [15] revealed 87.20%. Similarly, 96.79% dry matter was reported in *Moringa oleifera* by Ogbe et al. [16].

Crude Proteins. The present study revealed a range of 18.41 and 21.65% among all plant species depicting the highest value in *A. cana and* lowest in *V. venosa* (Fig. 4). Variation for crude protein was highly significant ($p < 0.001$) in all plant species under investigation (Table 2). Penuel et al. [12] reported protein content value of 36.58% in *Citrullus vulgaris* while 25.8%-38.1% range was reported in certain varieties of melon family [17]. Some of the values in present study were in agreement with reported limits in kidney beans [8]. Present investigation showed that protein content was quite adequate in all the plants and these plants could potentially fulfill the requirements of all the ruminants.

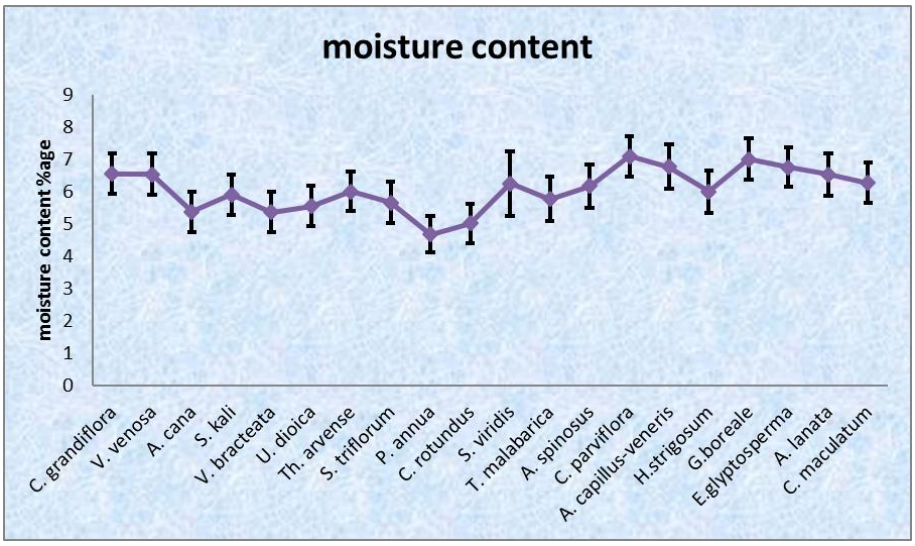

FIGURE 2
Moisture content fluctuations in different plant species

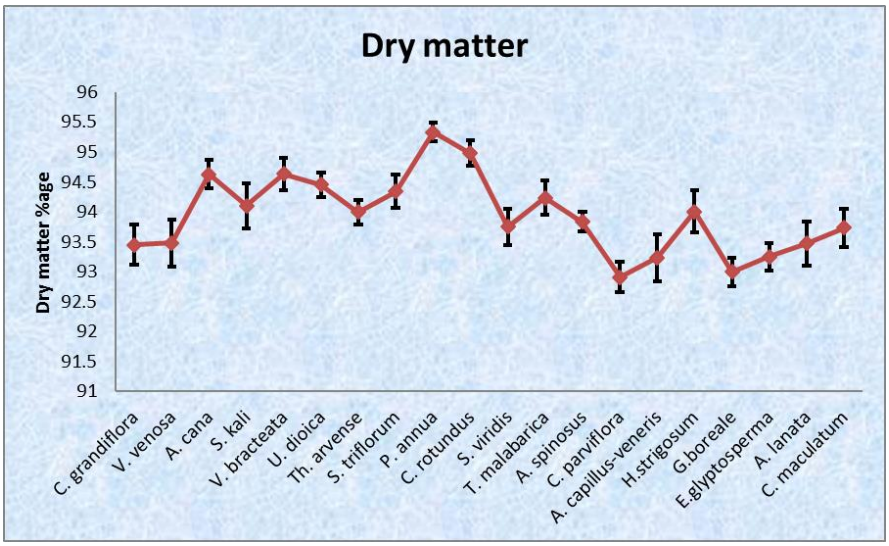

FIGURE 3
Dry matter percentage fluctuations in different plant species

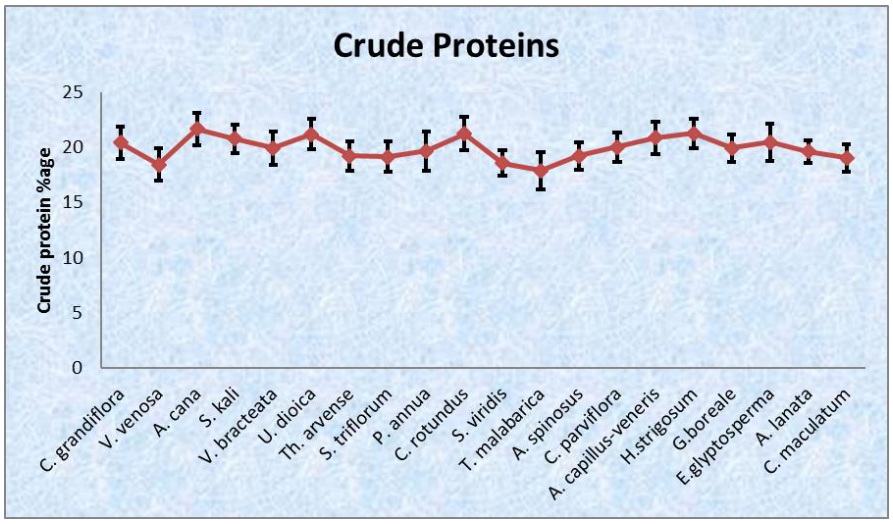

FIGURE 4
Crude protein percentage fluctuations in different plant species

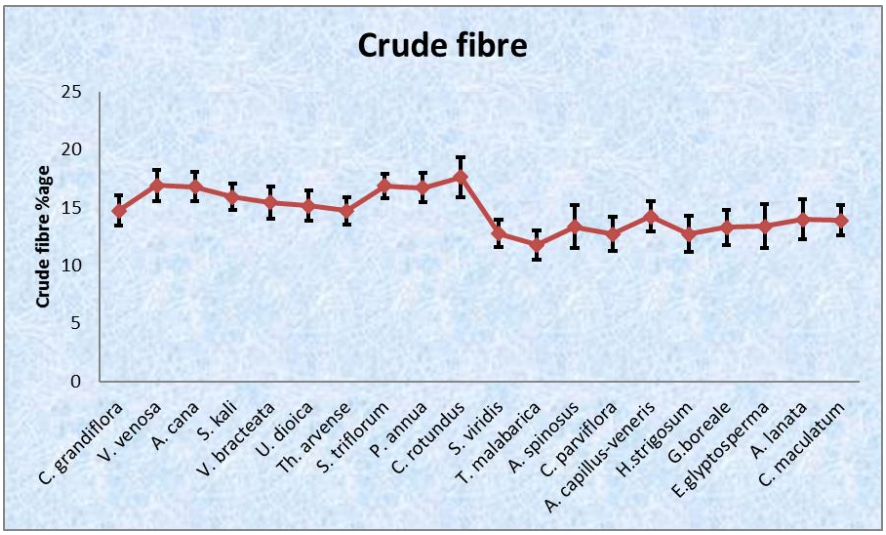

FIGURE 5
Crude fiber percentage fluctuations in different plant species

Crude Fiber. Figure 5 shows diversity in results delineated in case of crude fiber ranging from 11.77 to 17.61% in all plant species under observation. The maximum value was reported in *C. rotundus* while the minimum value was observed in *T. malabarica* plant samples. The analysis of variance revealed highly significant ($p< 0.001$) differences in crude fiber content (Table 2). Penuel et al. [12] concluded the crude fiber content in *Citrulus vulgaris* to range from 4.0 and 6.0%. However, crude fiber content given in Egusi melon was 12% as reported by Ojieh et al. [18].

Ether Extract. Figure 6 reveals ether extract percentage ranging from 0.799 (*S. viridis*) to 0.932% (*S. kali*). Analysis of variance showed that ether percentage was significant at ($p<0.05$) (Table 2). Fat content (ether extract) was well below 1.58%, as reported in *Blighia sapida* [19]. However, crude fat value of 0.81% reported in lentils [8] lied within the range of present investigation. Gordon and Kessel [20] concluded that low fat foods were highly significant to cure the higher level of cholesterol level. Ether content is basically lipid content and a power house for energy conservation and maintenance of body functions. It is also an important phenomenon that the right proportions of every nutritive diet or dose would be helpful to the body to regulate the metabolic effects.

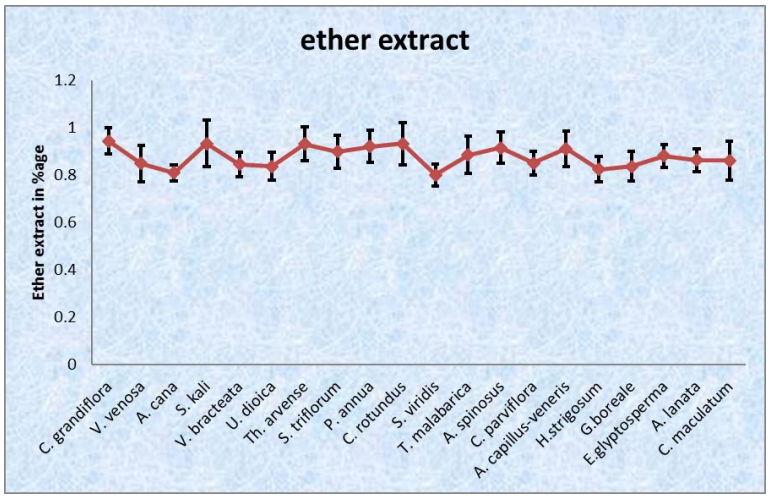

FIGURE 6
Ether extracts fluctuations in different plant species

CONCLUSIONS

The experiment was conducted on an important site "Soon valley, District Khushab, Punjab, Pakistan" aiming the proximate composition of the forage samples of twenty different plant species which were indicative of high inorganic mineral and other nutritive values. The results depended upon the multiple factors like season, region, storage conditions and soil profile.

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