Nutritional Evaluation of *Cenchrus ciliaris L.* from Cholistan Desert, Pakistan

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Cenchrus, minerals; nitrogen; protein; carbohydrates; phytochemicals.

ABSTRACT

The present study evaluates the nutritive value of different accessions of perennial range grass *Cenchrus ciliaris* collected from Choilsitan Desert, Pakistan. Different standard methods (Benedict's quantitative reagent for carbohydrates, crude protein and nitrogen by Kjehldahl method, mineral analysis by flame photometer and estimation of crude fiber by using acid base treatment) are utilised for nutritive analysis. Proximate analysis of plant sample determines that maximum crude protein is present in the range of (13 to 17.5%) and nitrogen contents are in the range of (2.8 to 2.24%). Crude fiber in the range of (24.34 to 39.48%) and crude lipids in the range of (2.3 to 3.2%) are present in the *Cenchrus ciliaris*. Whereas minerals such as sodium is present in the range between (0.2 to 0.7%), potassium in the range of (3.6 to 6.0%) while lithium was absent. Similarly, reducing sugar present in the range from (2.8 to 4%), non reducing sugar in the range of (2.12 to 3.31%) and total sugars are present in the range of (3.16 to 9.8%). In conclusion, it could be suggested that *Cenchrus ciliaris* has great medicinal and nutritional importance that could be good sources of some important nutrients for humans and can become a source of poverty alleviation of poor local community of the area.

التقييم الغذائي لنبات العهبة بصحراء كوليستان في باكستان

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نبات العهبه، معادن، النتروجين، البروتين، الصوديوم، الكربوهيدرات

المُستلخص

تقيم هذه الدراسة القيمة الغذائية لمجموعة مختلفة الأعمار من نبات العهبه *Cenchrus ciliaris* التي قد تم جمعها من صحراء كوليستان في باكستان. تم في الدراسة استخدام طرق قياسية مختلفة منها طريقة كاشف بندكت الكمي Benedict للكربوهيدرات، البروتين الخام والنيتروجين بطريقة كيلدهلKjehldahl ، وتحليل المعادن عن طرق قياس طرق الطيفي اللهبي ومن ثم تقدير ألياف الخام باستخدام الحامض والقاعدة. أوضحت النتائج ان نسبة البروتين الخام كانت تتراوح بين 13 %-17.5 % كحد اقصى، و نسبة النايتروجين في حدود 2.8 %-2.24 %، ألياف الخام تتراوح بين 24.34 % -39.48 %، والدهون بمعدل 2.3 % -3.2 %، بينما المعادن الغذائية مثل الصوديوم بنسبته تتراوح مابين0.2 % إلى 0.7 %، والبوتاسيوم بنسبة 3.6 % إلى 6.0 % بينما انعدم تواجد عنصر الليثيوم. تتروح نسبة السكر المختزل مابين 2.8 % إلى4 % وتتراوح نسبة السكر غيرالمختزل ما بين 2.12 % إلى3.31 %، ونسبة السكر الكلي 3.16 % إلى 9.8 %. يستنتج من الدراسة بأن لنبات العهبه *Cenchrus ciliaris* أهمية غذائية ودوائية كمصدر جيد ورئيسي لغذاء الإنسان وبالتالي للتخفيف من حدة الفقر لمجتمع هذه المنطقة.

Introduction

Phyto-diversity is considered to be the world's heritage and also the vital source of living on this earth Ahmad *et al.* (2007). Goel (2002) recognized the present age as the age of biological extinction due to anthropogenic habitat loss of pants. These anthropogenic activities are causing enormous changes in the natural composition of species and managed ecosystem. The changes consequently affect the ecological factors that have direct relationship with the ecosystem processes (Stuart Chapin 2001).

Pakistan lies between 24°–37° North latitude and 61°–75.5° East longitude, covering an area of 796,095 km². Out of this area, 468,000 km² is in the north and west in the form of mountainous land and plateau, while the remaining 328,000 km² comprises the plains. Environmental variability in Pakistan is enormous, ranging from high snowy Himalayan peaks in the north to the hot humid climate of shores of the Arabian Sea in the South.

There is great variation in the topography of its four provinces Muneer *et al.* (2006). Cholistan is an extension of the Great Indian Desert (Figure1), which includes the Thar Desert in Sindh province of Pakistan and the Rajasthan Desert in India, covering an area of 85000 km^2, it lies within Southeast quadrant of Punjab province between 27º42' and 29º45' North latitude and 69º52' and 73º05' East longitude (FAO 1994, Arshad *et al.* 2007, Jowkar *et al.* 1996, Ahmad 1999, Ahmad and Sameera 2007). Among the arid regions of Pakistan, Cholistan desert is a very important segment that covers a large area (85000 km^2) in the Bahawalpur Division of Punjab, Pakistan. This region demands an immediate attention of plant scientists and Government funding agencies for rehabilitation. The desert temperature shoots up to 52°C during summer and average rainfall is 120 to 200 mm, which aggravate the problems of aridity (Naeem *et al.* 2000). Cholistan vegetation is facing severe problem of drought, salinity and overgrazing by livestock. But shortage in fodder/ grasses for grazing occurs during summer in Cholistan and other parts of the country.

Figure 1: Location of Cholistan Desert in Pakista (*27º42' and 29º45' North latitude/ 69º52' and 73º05' East longitude*)

The climate of the area is an arid subtropical, continental type, characterized by low and sporadic rainfall, high temperature, low relative humidity, high rate of evaporation and strong summer winds (Ahmad 2002). Aridity is one of the most striking features of the Cholistan desert with wet and dry years occurring in clusters (FAO 1994, Akbar *et al*. 1996). The entire area of this desert is rain dependant for its ground water recharge and drinking water being stored in dug-out ponds (Tobas). Underground water is at the depth of 30-40 m and mostly is brackish having salt concentration 9000-24000 mg/l (FAO 1994). The mean annual temperature of the area is 27.5ºC, whereas mean summer temperature is 35.5ºC, and winter temperature is 18ºC. The average maximum summer temperature goes up to 46ºC (Figure 2) and average minimum winter temperature falls up to 7ºC. The month of June is the hottest and daily maximum temperature normally exceeds 45ºC and sometimes crosses 50ºC (Ahmad 2002). The daily maximum temperature comes down in July due to monsoon rainy season in the country. There is always an abrupt fall in temperature during the nights. Mean annual rainfall varies from less than 100 mm in the west to 200 mm in the east. Rainfall is usually received during monsoon (July through September) and in winter and spring (January through March) (Mughal 1997, Arshad *et al*. 2006). About half of the total rainfalls come under threshold category while, others do not create

runoff however, on the whole create a favourable environment for the growth of vegetation (Abdullah *et al.* 1990, Akbar and Arshad, 2000).

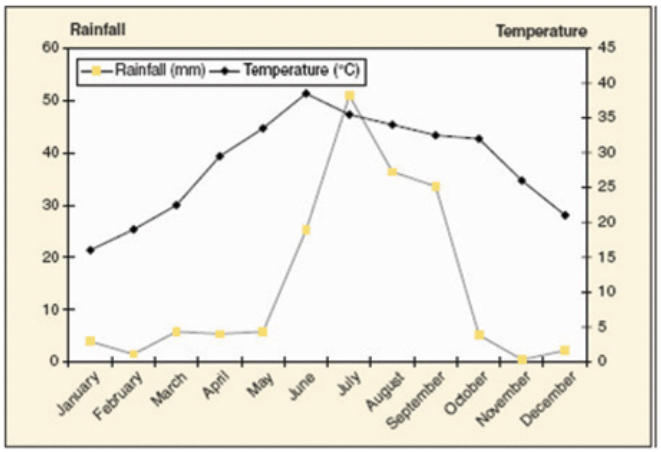

Figure 2: Ombrothermal Degram of Cholistan Desert in Pakistan
(*Annual Rainfall and Temperature*)

Geomorphologically the area presents quite a complex pattern of alluvial and Aeolian deposition which was flowed by:

(a) Wind resorting of the sediments into various forms of sand ridges.
(b) Wind resorting and dune formation.
(c) Resorting and further deposition in spill channels.
(d) Deposition of sediments clayey flats.

The soils of area have been developed by two type of materials *i.e.* river alluvium and Aeolian sands (Ahmad 2002). The alluvium consists of mixed calcareous material, which was derived from the igneous and metamorphic rocks of the Himalayas and was deposited by the Sutlej and abandoned Hakra Rivers most probably during different stages in the sub-recent periods. The Aeolian sands have been derived mainly from the Rann of Kutch and the sea coast and partly from the lower Indus Basin. Weathered debris of the Aravalli has also contributed. The material was carried from these sources by the strong South-Western coastal winds (FAO 1994). Based on differences in topographic form, parent material, soils and vegetation, Cholistan desert can be divided into two main geomorphic regions: Northern region, known as Lesser Cholistan, which constitutes the desert margin and consists of a series of saline alluvial flats alternating with low sand ridges/dunes; and Southern region, known as Greater Cholistan, a wind resorted sandy desert comprising of a number of old Hakra River terraces with various forms of sand ridges and inter-ridge valleys (Tahir *et al.* 1995). Mega Land Systems (Lesser and Greater Cholistan) are split into eight Macro Land Systems (Figure 3), based on geomorphology which controls soils, moisture and eventually vegetation – an important component of range ecosystem, upon which pastoralism depends.

The area is consisting of main four soil types *i.e.* dune land with topography ranging between undulating and steep slopes. The sand dunes lie parallel to each other connected by small streamers and are very excessively drained, coarse textured, structure less derived from Aeolian material, deposited by strong winds. Sandy soils are nearly level to gently sloping, deep to very deep, excessively drained, calcareous, coarse textured. Loamy soils are level to nearly level with hummocks of fine sand on the surface, moderately deep, somewhat excessively drained to well drained, calcareous, moderately coarse textured to medium

textured (FAO1994). Clayey soils are mostly level, moderately deep, poorly drained, calcareous, saline-sodic (Table 1), moderately fine textured to fine textured, pH ranges between 8.6 and 10.0 (Baig *et al.* 1980). The soils are either saline or saline-sodic, with pH ranging from 8.2 to 9.6 (Akbar and Arshad 2000). The soils of Cholistan desert are generally poor, lacking organic matter, saline alkaline, gypsiferous and often duned. The dune reaches up to an average height of 100-150 m (Rao and Arshad 1991, Akbar *et al*. 1996, Akhter and Arshad 2006). Rainwater harvested in low-lying areas or dug-out ponds (Tobas) is used by the humans and their livestock. Underground water is mostlybrackish containing salt 9000-24000 mg/l (Anon 1993, Akhter and Arshad 2006).

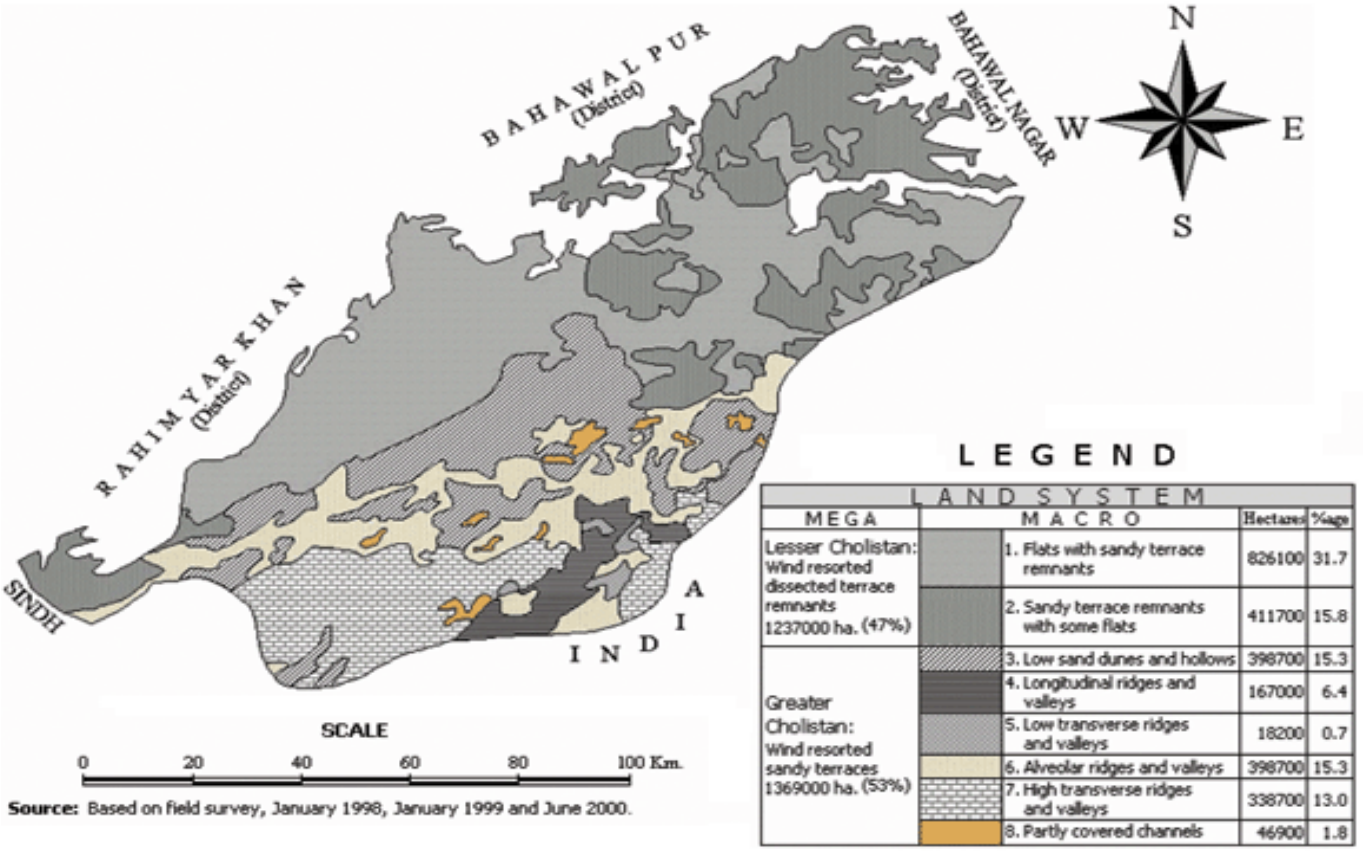

Figure 3: Land System of Cholistan Desert in Pakistan
(*Geomorphologically of Zone 27°42' and 29°45' North latitude/69°52' and 73°05' East longitude*)

Table 1: Types of Soil and Wind Erosion, Cholistan Desert in Pakistan

Types of Soil	**Extent (Hec.)**	**%**	**Wind Erosion**	**Extent (Hec.)**	**%**
Saline clayey (*Dhrs*)	441.900	17.0	Non or slight	441.900	17.0
Loamy soils	058.700	2.0	Moderate	58.700	2.0
Sand dunes	1.133.900	44.0	Severe	2.079.400	81.0
Sandy soils	945.500	37.0			
Total	2.580.000	100	Total	2.580.000	100

(*Source: After Pakistan Desertification Monitoring Unit, 1986*)

Unpredictable rainfalls support only leafless and spiny scrub jungle with stunted and half nibbled shrubs with a few trees. These plant species, though very slow growing, respond very well to the favourable climatic conditions and provide ample biomass for consumption by livestock and wildlife. Important genera of perennial grasses and sedges include *Lasiurus, Cenchrus, Panicum, Ochthochloa, Sporobolus, Aeluropus, Cymbopogon* and *Cyperus*. Forage shrubs include *Calligonum, Haloxylon, Salsola, Suaeda*, *Acacia, Leptadenia* and *Capparis*. *Prosopis, Tamarix, Acacia* and *Zizyphus* are notable forage tree species of the area (Rao and Arshad 1991, Akbar and Arshad 2000, Arshad *et al*. 2006). These plant species are very site specific, based on availability of soil moisture, salinity and plant characteristics (Arshad and Rao, 1994, Arshad *et al*. 1999)

Cenchrus ciliaris L., is an important perennial range grass species of Cholistan desert, belongs to family poaceae which is locally known as "Dhaman" and is the first choice of grazing animals. At maturity, it ranges in height from 10-150 cm (averaging 70cm) tall. The leaf blades are bluish-green 5 to 30 cm long and 2.5 to 11 mm wide with the upper surface soft and hairy (Figure 4).

Figure 4: *Cenchrus ciliaris* Collected from Cholistan Desert, Bahawalpur, Pakistan.

This is a widely distributed grass and is resistant to a number of harsh environmental conditions. It can withstand strong winds, low annual rainfall, acute erosion and a nutrient depleted soil profile (Ziegler *et al.* 2000). *Cenchrus ciliaris* has also been used as folk medicine for kidney pain, tumors, sores and wounds. It can be used as anodyne (pain reliever), lactogogue (increase milk flow), and diuretic and as anemollient (Duke 1983). It is very important species for the grazing cattles and is considered that the milk production of the cows is increased when they graze on this grass species. It is very well distributed in sandy and sandy loam areas of this desert (Rao and Arshad, 1991, Arshad *et al*. 1999). *Cenchrus ciliaris* L., has sufficient variability in the form of different agro-ecotypes. This vast genetic resources adapted in multiple stress environment of Cholistan desert could be utilized for higher productivity potential. Noor (1991) determined the comparative performance of 10 ecotypes of *Cenchrus ciliaris* under rainfed conditions and recorded a high amount of ecotypic variation. Rai *et al*. (1982) observed significance variation in forage yield of 8 strains of *Cenchrus ciliaris.* Agarwal *et al*. (1999) evaluated 55 accessions of perennial range grass *Dicanthium annulatum* L., (Stapf) on the basis of agromorphological attributes and observed a wide diversity among the accessions.

No important work has been conducted on nutritional value of the important range plants in the Cholistan Desert, Pakistan. Keeping in view the importance of plant *Cenchrus ciliaris,* this research was done to evaluate the nutritional value of the *Cenchrus ciliaris* in the Cholistan Desert as well as to study the vegetation characteristics of study area. Such information as well as information on forage quantity are essential for sustainable use of rangelands and providing available forage supplements for livestock in times when they are needed.

Material And Methods

(1) Site Selection and Sampling

Desert grass *Cenchrus ciliaris* L. collecting expeditions were executed in 2009 and 2010 in different habitats of Cholistan desert by the Department of Chemistry, Islamia University, Bahawalpur, Pakistan and different accessions of *Cenchrus ciliaris* L., were collected from a range of sites. Field survey of valley was performed for this purpose, which comprised of the following three aspects: selection of sites, collection of data, and analysis of data. On the findings of a preliminary survey, ten study sites namely, Lal Suhanra, Kalay Paharr, Derawar Fort and Sheikh Zaid Enclosure were selected mainly on the basis of variation in their ecological attributes, especially topography, vegetation type and soil composition. Information about the ecology, brief geological position and soil properties of these sites are presented in (Table 2). Plant samples were collected concurrently. Plant samples (green leaves or leaflets and immature pods) of available plant *Cenchrus ciliaris* were collected from the ten sites. A total 250 plant samples were collected from these ten sites. These collected samples were then dried under shade and crushed in grinder then finally used for further analyses.

(2) Digestion

Dried ground material (0.5 g in each tube) was taken in digestion tubes and 5 mL of concentrated H_2SO_4 were added to each tube (Wolf 1982). All the tubes were incubated overnight at room temperature. Then 0.5 mL of H_2O_2 (35%) was poured down the sides of the digestion tube, ported the tubes in a digestion block and heated at 350oC until fumes were produced. They were continued

to heat for another 30 minutes. The digestion tubes were removed from the block and cooled. 0.5 mL of H2O2 was slowly added to each tube and placed the tubes back into the digestion block. The above step was repeated until the cooled digested material was colorless. The volume of the extract was made up to 50 mL. The extract was filtered and used for determining K, Ca, Na and Cl.

Table 2: (Selection Criteria) for Ten Sampling Sites in Cholistan Desert, Pakistan

Acc. No.	Coll. No.	Name of the Site	Soil Texture	Habitat Description	Vegetation Type
1	LS1/3	Lal Suhanra	Sand stone with clayed sand	Plain surface in the periphery	Dominant grasses and shrubs
2	LS1/2	Kalay Paharr	Sand stone, lime stone	Plain surface in the periphery	Dominant herbs with grasses and few shrubs
3	KP1/2	Kalay Paharr	Sandy clay	Inside desert	Dominant grasses with herbs
4	KP1/3	Kalay Paharr	Sandy clay	Inside desert	Dominant large shrubs with grasses
5	KP2/2	Kalay Paharr	Red sandy clay with sand stone	Inside Desert	Small shrubs and herbs with grasses
6	KP2/4	Kalay Paharr	Mostly sand stone	Inside Desert	Mixture of grasses and herbs
7	DR2/3	Derawar Fort	Sandy clay	Moderate slope	Sedges and small shrubs
8	SZE1/15	Sheikh Zaid Enclosure	Lime stone, sand stone	Steep slope	Dominant grasses with large and medium shrubs
9	SZE1/13	Sheikh Zaid Enclosure	Lime stone with sand stone	More or less flattered peripheral area	Dominant grasses with herbs
10	SZE1/9	Sheikh Zaid Enclosure	Sand stone with clay stone	Uneven peripheral area	Dominant grasses and shrubs

(3) Proximate Analysis

The study involved destructive sampling. The samples were washed under running water and blotted dry. The moisture content of the leaf samples was determined at 60°C (AOAC 2009). The dried matter obtained was ground to a fine powder and stored at 5°C in air-tight containers prior to further analysis. Different standard methods described in (AOAC 2009) were used for nutritive analyses. Benedict's quantitative reagent (BQR) was utilized for carbohydrates. Crude protein and nitrogen was determined by Kjehldahl method. Mineral analyses were carried out by using flame photometer. Extraction of crude protein was carried out by Soxhlet apparatus and estimation of crude fiber was carried out by using acid base treatment. The details of these procedures and formulae are described below;

(3.1) Moisture Content

The moisture content of the collected samples were determined by using the following formula:

$$\text{Moisture Content\%} = \frac{\text{Initial weight of Sample} - \text{Final weight of Sample}}{\text{Initial weight of sample}} \text{X100}$$

(3.2) Crude Fiber

A known weight of sample was treated under boiling conditions initially with 1.25% sodium hydroxide (NaOH) and subsequently with 1.25% sulphuric acid (H_2SO_4) to dissolve alkali and acid soluble components present in it. The residue containing crude fiber was dried to a constant weight. The loss of weight on ignition in muffle furnace at 500 °C was calculated to express it as crude fiber.

$$\text{Crude Fiber\%} = \frac{\text{Loss in weight on ignition}}{\text{Weight of the sample}} \text{X100}$$

(3.3) Estimation of Crude Protein

The total nitrogen content of the samples was determined by micro Kjeldahl method. Finely ground material (1g) was taken in a digestion flask with 3g of digestion mixture [mercury sulfate ($HgSO_4$) + potassium sulphate (K_2SO_4) at the

ratio of 1:9] and 20 mL concentrated H_2SO_4. The samples were boiled in digestion apparatus for about two hours untill the contents became clear. The digested material was diluted to 250 mL. An aliquot 10 mL of it was transferred to the micro-Kjeldahl distillation apparatus and distilled in the presence of 50 mg of zinc (Zn) dust and 10 mL NaOH (40%). The distillate was collected in a receiver containing 5 mL boric acid (2%) and methyl red as indicator solution. The contents of the receiver were titrated against standard sulfuric acid (N/10 H_2SO_4) to light pink color end point. From the volume of acid, percentage nitrogen was estimated and protein was determined by using the formulae;

$$\text{Nitrogen\%} = \frac{\text{Vol. used of 0.1NH2SO4} \times 0.0014 \times 250}{\text{Weight of sample} \times 10} \text{ X100}$$

$$\text{Protein\%} = \text{N} \times 6.25$$

(3.4) Mineral Matter/Total Ash

A dried 1g sample was carbonized on oxidizing flame until no fumes came out. It was then ignited at 600◦C temperatures in muffle furnace to burn off all organic matter.

$$\text{Ash\%} = \frac{\text{Weight of ash}}{\text{Weight of sample}} \text{ X100}$$

(3.5) Fat Percentage

A dried sample (2g) was extracted with petroleum ether (40◦C–60◦C) in soxhlet apparatus to remove the ether soluble component present in it. The extracted material was dried to a constant weight in an oven at 70◦C. The fat% was calculated as given under.

$$\text{Fat\%} = \frac{\text{Weight of ether extract}}{\text{Weight of sample}} \text{ X100}$$

(3.6) Dry Matter

The dry matter of the samples was determine by using the following formula;

Dry matter% = 100 − Moisture content

(3.7) Nitrogen Free Extractable Substances (N.F.E.S.)

The NFES was calculated by using the formula

NFES% = 100 − (CP + MM + Fat + Fiber)

(3.8) Determination of Na^+ and K^+

Na^+ and K^+ cations were determined with a flame photometer (Jenway, PFP-7). A graded series of standards (ranging from 5 to 25 mg L^{-1}) of Na+, K+ and Ca2+ were prepared and standard curves were drawn. The values of Na+, K+ and Ca2+ from flame photometer were compared with standard curves and total quantities were computed.

(4) Statistical Analysis

Each experiment was repeated three times. The results are presented with their means and standard error. The results were prepared by using MS Excel 2003 version.

Results

Results of crude fiber, lipids, sodium, potassium, nitrogen and protein concentrations in different accessions of *Cenchrus ciliaris* plant samples are presented in (Table 3). Maximum lipid concentration (5.3g/100g) was recorded in the accession number KP2/4 while the minimum (2.7g/100g) was observed at KP2/2 collected from Kalay Paharr Cholistan desert. Different accessions of *Cenchrus ciliaris* with regard to crude protein contents was analysed and its range was found between 13 to 17.5g/100g. The highest crude fiber (39.48g/100g) in the accession number SZE1/9 collected from Sheikh Zaid Enclosure (Table 3).

Table 3: Crude Fiber, Lipids, Sodium, Potassium, Nitrogen and Protein Concentrations in Different Accessions of *Cenchrus*

Acc. No.	Site names	Lipids	Fiber	Sodium	Potassium	Nitrogen	Protein
LS1/3	Lal Suhanra	3.2±0.1	37.34±0.3	0.2±0.09	4.7±0.1	2.8±0.1	17.5±0.3
LS1/2	Kalay Paharr	3.2±0.2	24.34±0.4	0.5±0.08	5.8±0.2	2.42±0.2	15.1±0.1
KP1/2	Kalay Paharr	3.0±0.2	27.55±0.2	0.6±0.07	3.8±0.2	2.24±0.1	14.0±0.2
KP1/3	Kalay Paharr	3.2±0.2	32.6±0.5	0.3±0.06	5.0±0.1	2.14±0.2	13.4±0.2
KP2/2	Kalay Paharr	2.7±0.1	30.7±0.3	0.3±0.10	4.1±0.2	2.42±0.2	15.1±0.3
KP2/4	Kalay Paharr	5.3±0.2	37.13±0.4	0.4±0.08	5.8±0.1	2.42±0.1	15.1±0.1
DR2/3	Derawar Fort	2.8±0.1	38.39±0.3	0.4±0.09	6.0±0.2	2.8±0.1	17.5±0.2
SZE1/15	Sheikh Zaid Enclosure	3.1±0.2	27.6±0.2	0.7±0.08	5.9±0.2	2.14±0.2	13±0.2

Concentration of minerals in *Cenchrus ciliaris* is found to be very low. Maximum concentration of sodium (0.7g/100g) is noted in the accession no SZE1/15 collected from Sheikh Zaid Enclosure while minimum concentration (0.2g/100g) was found in the accession no LS1/3 collected from Lal Suhanra site. Similarly, maximum concentration of reducing sugars is ranged from 2.85 to 4g/100g and non reducing sugars is 2.11 to 5.31g/100g and total sugars from 3.16 to 9.8g/100g and maximum concentration of starch i.e. (9.5g/100g) was almost some in all accession numbers (Table 4).

Table 4: Carbohydrates Concentration in Different Accessions of *Cenchrus ciliaris*

SN	Accession	Site name	Reducing sugar	Non-reducing	Total sugars	Starch
1	LS1/3	Lal Suhanra	4.00±0.2	5.80±0.3	9.8±0.4	9.50±0.5
2	LS1/2	Kalay Paharr	2.85±0.1	5.31±0.3	8.16±0.4	9.50±0.5
3	KP1/2	Kalay Paharr	4.00±0.2	2.11±0.1	6.12±0.4	9.50±0.4
4	KP1/3	Kalay Paharr	3.33±0.1	5.80±0.3	5.44±0.3	6.78±0.3
5	KP2/2	Kalay Paharr	4.00±0.2	4.80±0.2	9.80±0.5	9.50±0.4
6	KP2/4	Kalay Paharr	5.00±0.3	3.16±0.1	9.80±0.4	9.50±0.5
7	DR2/3	Derawar Fort	4.00±0.2	4.16±0.2	3.16±0.2	6.80±0.3
8	SZE1/15	Sheikh Zaid Enclosure	4.00±0.2	4.16±0.2	8.16±0.5	9.50±0.4
9	SZE1/13	Sheikh Zaid Enclosure	4.00±0.2	2.12±0.1	6.12±0.2	9.50±0.4
10	SZE1/9	Sheikh Zaid Enclosure	4.00±0.2	5.80±03	9.80±0.4	7.91±0.3

Discussions

According to the results presented in the present study, significant differences among accessions for nutritive and minerals indices were evident. However, not all the parameters studied appeared to be equally useful for screening of the accessions of the plant for sensitivity to nutritive values. As Cook and Stubbendieck (1986) reported the chemical content of plant species may differ because of an inherent ability to withdraw certain nutrients from the soil and to concentrate them in tissues. Plants may also vary in susceptibility to leaching, or may produce different proportions of leaves,
stems, and flower stalks at various stages of maturity or because of previous grazing treatments (Arzani *et al*. 2001, Arzani *et al*. 2004). Grass species showed relatively lower forage quality compared to other species. This agrees with findings reported by several authors (Ghadosi and Azrani 1997, Norton 1982, Ghourchi 1995). *Cenchrus ciliaris* show consistently high crude protein, variable but relatively low fat and relatively high carbohydrates. Plant is significantly higher in total protein (17.5%) than are local agricultural plants like *sorghum* (11.4% protein), *millet* (11.9% protein), and *manioc* (0.9% protein). According to Smith *et al.* (1986) grasses lose quality when they become mature, tropical grasses more so than temperate ones. They also believed that legumes do not lose quality with maturity nearly as fast as grasses do. Feed quality of legumes is generally high except when compared to very young grasses. Holechek *et al.* (2001) reported much greater declines in nutritive quality of annual grasses than for perennial grasses. They stated tall grasses typically cure out with lower levels of nutrients than do short grasses; because tall grasses have lower leaf to stem ratios than those of short grasses. Additionally, investigations are consistent in showing actively growing material of forbs highest, shrubs intermediate, and grasses lowest in concentrations of CP, P, and cell solubles (Krysl *et al.* 1984).

In the this study, lipids are not only the source of energy but are responsible for performing many important functions in the animal body. A minimum intake of lipids is essential in order to meet the requirements of essential fatty acids (Sawhney and Singh 2000). Maximum lipid concentration (5.3g/100g) was recorded in the accession number KP2/4 collected from Kalay Paharr Cholistan desert. Overall mean of CP content is shown in (Table 3). Different accessions of *Cenchrus ciliaris* with regard to crude protein contents was in the range from 13 to 17.5 g/100g, the differences

between minimum and maximum were significant (P<0.05). Means of CF content for *Cenchrus ciliaris* is shown in (Table 3). The highest crude fiber (39.48g/100g) in the accession number SZE1/9 collected from Sheikh Zaid Enclosure while lowest was 24.34g/100g was found in the accession number LS1/2 collected from Kalay Paharr, which the differences between them were significant (P<0.05). It Seems that CF contents in all species positively correlated with CP content, this is agreed with finding of Ramirez *et al.* (2004).

Minerals are important constituents of plants and play a vital role in the animal life. Maximum concentration of sodium (0.7g/100g) was noted in the accession no SZE1/15 collected from Sheikh Zaid Enclosure (Table 3), indicated that the soil of Cholistan desert are poor in Sodium concentration (Ashraf *et al.* 1990). Low concentration of minerals in *Cenchrus ciliaris* may be due to the reason that the Cholistan desert soils particularly the sand dunes are very poor in such mineral composition (Ashraf *et al.* 1990). As the minerals move from the soil into plants, if they are not replaced by decaying organic matter, the soils will be gradually reduced in mineral value and unable to support lush plants growth (Ganskopp and Bohnert 2001).

Carbohydrates provide a major fraction of the animals energy needs. Maximum concentration of reducing sugars is ranged from 2.85 to 4g/100g and non reducing sugars is 2.11 to 5.31g/100g and total sugars from 3.16 to 9.8g/100g and maximum concentration of starch i.e. (9.5g/100g) was almost some in all accession numbers (Table 4). In addition to calories carbohydrates also provide fiber in the animal diet. Carbohydrates are most common source of energy and easily converted to glucose (Stewart 2005).

Conclusions

This study suggests that *Cenchrus ciliaris* is a valuable grass and set to the relished camles, sheep and cattle. Its high concentration confirms that this grass is highly nutritive grass of the area and variation in protein contents is helpful in selecting the good accessions of this grass for its growth in the desert area (Gul-e-Rana 1990). Its great medicinal and nutritional importance could be good sources of some important nutrients for humans and can become a source of poverty alleviation of poor local community of the study area. Moreover, the precious ethno botanical knowledge about underutilized plants is disappearing very fast, however this study could be helpful in conserving the precious knowledge.

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