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Proximate composition of forage plants of Chakesar Valley, District Shangla, Pakistan

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Qualitative and quantitative determination of chemicals and nutritional composition of some selected forage plants were investigated which were collected in tehsil Chakesar, District Shangla. Various bioactive chemicals compounds have been found to be linked with ethnomedicinal properties of plants. These plants are conventionally grazed by the animals and are also utilized by the local community. The aims of the present study was to ascertain the nutritional aspect of some selected plants use by the local inhabitants in various conditions. Different techniques were adapted to investigate the different parameters like ash, moisture, fiber, protein, fats, carbohydrate, hemicellulose, neutral detergent fiber, acid detergent lignin, acid detergent fibers, and nitrogen free extract. The result suggests that different organic CHN contents are stochastically related to the above mentioned plant composition. The proximate composition varies not only with species of plant but also with age structure. An obvious differences were noted in the phenological stages. These plants are not only overcome the nutritional deficiency of local animals but also used for neutraceutical purposes in combating different diseases. It is because, these plants are associated with rich phytochemicals and metabolites like phenol, alkaloids, flavonoids, essential lipids and glycosides. These results thus suggested that some of the reported biochemical properties of the plants favour them to be used by the cattle and human.

Keywords: Forage plants, Proximate analysis, Neutral detergent fiber, Acid detergent lignin, Acid detergent fibers, Nitrogen free extract

INTRODUCTION

Proximate composition of plants provides valuable information about its medicinal and alimental quality. Many aspects such as moisture content, ash content, protein, fiber, and oil can be tenacious. Ash is the inorganic residue that is a quantification of total amount of minerals within the pabulum and plant. Total ash contents may vary widely among the plants and plant components. The resoluteness of ash contents is consequential because mineral contents may be the cause of a pharmacological effect (Lee, 2005). Leaves of *Brachiaria reptans* are crush, constricted and the juice obtained is utilized for remedying anemia (Patil and Patil, 2007). Decoction of the *Fimbristylis squarrosa* is utilized to assuagement sore throat in Nepal (Manandhar, 1989). *Hypericum perforatum* is utilized as astringent, anthalmintic and diuretic (Hussain et al. 2006). Leaves juice of *Solanum nigrum* is subsidiary in skin disease cleaning and washing wounds (Razaq et al.2010). *Ajuga bracteosa* is utilized as acerbic, astringent, tonic, additionally for hypertension, jaundice, while leaves of *Rumex dentatus* are diuretic, utilized as cooling agent and refrigerant (Hussain et al. 2006). The underground runners of *Cenchrus ciliaris* are

utilized in Zulu traditional medicine for ailments including `body pain', menstrual disorders and urinary infections (Light et al. 2002). *Amaranthus viridis* is used as pot herb and fodder and *Setaria viridis* is used as dry and fresh fodder (Ibrar et al. 2007). Decoction of *Rumex hastatus* roots and *Quercus leuctrichophora* bark cooked with wheat flour, sugar and ghee is given twice a day for 4-5 days during asthma, backache, rheumatism and impuissance in cattle (Abbasi et al. 2010). *Bromus pectinatus* is used as fodder plant (Saqib and Sultan, 2005). The root of *Polygonum glabrum* is reported to be used in piles, jaundice, debility and consumption (Sivakumar et al. 2011). Folarin and Igbon (2010) reported moisture, ash, crude protein, crude fiber, oils and carbohydrate from *Enterolobium cyclocarpum* seed. Nzikou et al. (2007) stated that oil from seeds of *Solanum nigrum* were opulent in protein and carbohydrates. It had 7.18% ash and 3.86% moisture contents. Sultan et al. (2010) determined the nutritive value of *Indigoferra gerardiana, Myrisine africana, Impatiens bicolor* and *Adhatoda vasica.* Hameed and Dastagir (2009) determined the proximate composition of *Rumex hastatus*, *R. dentatus* and *Rumex nepalensis.* Zia-ul-Haq et al. (2014) reported protein, fiber, fat, carbohydrate and ash in *Vigna mungo*. Hameed and Hussain (2015) reported moisture, ash content, protein, fiber, fat, carbohydrate in root, stem, leaf, flower and fruit of some medicinal plants of Family Solanaceae. The review suggests that no reference on the proximate composition of these culled plants, consequently the present study was conducted to envisage the neutraceutically paramount compounds in three different phenological stages. The findings will avail in understanding the cause of medicinal utility and provide a base for future investigation by scientists

MATERIALS AND METHODS

Collection of plant materials

The plants were identified with help of Flora of Pakistan (Ali and Qaiser, 2000). The voucher specimens were deposited in the Herbarium, Department of Botany, University of Peshawar, for future reference. Plant materials were washed with water, separated and dried in shade for 15 days and powdered.

Procedures

Moisture content was determined by oven dehydration method at 105^0C following Hussain (1989). Crude fats were determined by ether extract method using Soxhtec apparatus, ash was investigated by heating samples in muffle furnace at 660^0C and carbohydrate was determined by subtracting the sum of percentage value of moisture, ash, fat, fiber, protein from 100 following AOAC (2000). Crude protein was determined by estimating nitrogen which was then multiply by 0.65 using Kjeldhal apparatus, crude fiber was determined by acid and alkali digestion method following Khalil and Saleemullah (2004), nitrogen free extracts were determined by difference the sum of percentage of moisture, ash crude fiber, fat and protein from 100 following Iqtidar and Saleemullah (2004). The proximate composition at four phenological stages was determined for different parts of plants (AOAC, 2000). The data was statistically analyzed using ANOVA to see the significance levels among the phenological stages and plant parts (2004).

RESULTS AND DISCUSSION

Moisture (%)

The moisture contents in the analyzed species varied from 7 – 30 % in vegetative stage, 5.5 – 23.5 % in reproductive stage and 5.3 – 20.6 % in post reproductive stage. The overall average ranged from 6.3 % to 24.7 % among the plants at three phenological stages. The overall percentage of moistures composition was maximum in *A. scentifolia* (30 %) in vegetative stage as well as in reproductive stage (23.5%) and 20.6 % recorded in post reproductive stage. The lowest moisture percentage was recorded in *C. ciliaris* and *Ajuga bracteosa* (7% each species) in vegetative stage, 5.5% in *B. glomerata* in reproductive stage and 5.3 % (*A. viridis*) in post reproductive stage. However, the lowest average was shown by *B. glomerata* (6.3%) and highest average by *A. scentifolia* (24.67%). It was recorded that post reproductive stage show lowest percentage of moisture in all tested plants (Table 1). ANOVA showed that moisture composition among the plant species had no interdependency. The variations between the phenological stages of different species are paramount. The standard deviation is lowest in the post reproductive stage, exposed that state not best as forage. The locals store *Bromus hordeaceus, S. viridis, B. pectinatus, C. ciliaris* and *B. reptans* mostly at their juvenile stage. The results revealed that moisture contents not only varied among the species but withal between the different phenological states of the plants (Tab. 3). Hussain et al. (2010) stated that moisture content varies in different species. Das et al. (2009) and Hanif et al., (2006) concluded that green leafy

vegetables had higher moisture content. Saidu and Jideobi (2009) also recorded highest % of moisture in water leaf. Hussain et al. (2009) found high moisture content in A. sativum (67.66 %) and *V. officinalis* (6.82 %). The moisture contents in the present case are much less than that of the cited results. Adnan et al., (2010) described the ranged of moisture in *B. falcatum*, *F. tenacissima*, L. *angustifolia, V. officinalis* and *O. limbata* and this agrees with our results.

Nitrogen (%)

Nitrogen content among the tested species varied from 1.2 % to 2.4 % in vegetative stage, 0.7 % to 2 % in reproductive stage and 0.9 % to 2.1 % in post reproductive stage. The maximum contents were recorded in *P. glabrum* (2.41%) in vegetative stage, *B. pectinatus* (2.0%) in reproductive stage and 2.05% in *P. glabrum* in post reproductive stage. The lowest nitrogen content was present in *A. bracteosa* (1.21%) in vegetative stage, 0.73% (*A. viridis*) in reproductive stage and 0.85 % in post reproductive stage. Generally, *P. glabrum* had the highest contents at vegetative stage and post reproductive stage and *A. viridis* had the lowest content in reproductive and post reproductive stage. The lowest average was recorded for *Ajuga bracteosa* (1.12%) followed by *F. squarrosa* (1.363%). Highest average contents were investigated in *B. pectinatus* (2.67%) while lowest was found in reproductive stage. The vegetative stages had generally higher N content. The results revealed that nitrogen contents were marginally higher in grasses than other plant species (Table. 1). ANOVA showed that the variance among the plants was highly paramount between different stages of the phenology were highly significant (Tab. 3).

Crude Protein (CP)

Crude protein refers to all nitrogenous compounds found in plants. It is an important constituent of the food. It is related to the vitamins, calcium, phosphorus and digestibility **(**Granskopp, Bohnert, 2003; Hussain, Durrani, 2009**)**. The crude protein contents varied from 5.5 to 17.2 % in vegetative stages, 4.3 -16.1% in reproductive stages and 3.3 - 12.4% in post reproductive stages. The lowest content was recorded in *Cenchrus ciliaris* (3.3 %) and highest was presented in *Setaria viridis* (17.2 %). The CP contents increased in reproductive and decreased in post reproductive stage. It is evident (Tab. 1) that crude protein content decrease with age. The lowest average was recorded in post reproductive stage (7.6%) followed by reproductive stage (10.4%). Similarly, lowest average among the phenological stages was noted for *Bromus hordeaceus* (5.5%) and highest (14.6 ppm) for *Setaria viridis* (Tab. 1). Statistical analysis designated that standard deviation had the lowest value for post reproductive stage (2.7), which showed that values are closely cognate as compared to reproductive stages (3.5). ANOVA withal represented the variance among species and between different phenological stages highly consequential for crude protein (Tab. 3). *Nelumbo nucifera* contained 1.36% total nitrogen (Hussain and Durrani, 2008; Shad *et al*., 2011). Their range of % agreed with our results. From the result it is obvious that vegetative stage had the highest concentration of CP than other stages. This is in accordance with some workers (Granskopp and Bohnert, 2003; Hussain and Durrani, 2008) who also stated that CP values average values higher at vegetative stages than other stages. It is stated that cattle, sheep and goats grazed during spring and to the end of summer due to the abundance of proteins that maintain growth and development of animals. Hanif et al. (2006) estimated protein (0.9 % to 2.1 %) in the selected vegetables. The plants growing at higher altitudes experience quite different climate and had higher content of CP than plants of plains. Cheema et al. (2011) reported high concentration of CP in leaves of *Morus alba* and is a best source of protein in ruminant feeding. They also described that different level of CP is due to differences of protein accumulation. Our results suggested that the investigated plants had sufficient level of protein which is the best source of supplement both in summer and winter. Yao et al. (2000) said that *Morus alba* is a best source of protein for ruminants. Adenipekun and Oyetunji (2010) observed little differences between *Vigna unguiculata* (23%) and *Arachis hypogea* (24%). Hussain et al. (2010) also found that *Sonchus asper* and *M. azadrichta* had the highest concentration of proteins. Our result agrees with above mentioned works. Plants like *P. glabrum, F. squarrosa, H. perforatum, Rumex dentatus, Solanum nigrum, Ajuga bracteosa* and *A. viridis* had also the highest content of CP than other species. Ginger contains 6.4% protein (Hussain et al. 2009). James et al. (2010) said that protein content varies from parts to parts in plants. According to Shah et al. (2009) who stated that protein rich plants had 23% -33%, our all investigated plants had moderate level of proteins. The results are also in line with different workers (Hussain et al. 2010; Adnan et al. 2010; Zia-ul-Haq

et al. 2014; Hameed and Hussain, 2015; Hameed et al. 2008).

Crude Fibers (CF)

Generally, it various ranges from 10.3% - 22.7 % at phenological stages. The results revealed that fibers content increase and naturally it transpired so. The minimum fiber content was recorded for *A. bracteosa* (10.3 %) and maximum % of fiber content in *B. glomerata* (20.5%) at vegetative stages. It varied from minimum 12.4 % (*A. bracteosa)* to maximum 21.5 % (*B. glomerata*) in reproductive stages. In post reproductive stages it fluctuated from 14.9% (*C. ciliaris*) to 22.7% (*B. glomerata*) in post reproductive stage. The lowest average was recorded in vegetative stages (14.6 %) and highest average in post reproductive stage (18.2 5). Similarly, lowest average % content shared by *A. bracteosa* (12.7 %) and highest (21.6 %) average % contributed by *B. glomerata* (Tab. 1,). The statistical analysis (ANOVA) showed that variance among the species and between different phenological stages is highly consequential. The post reproductive stages showed minimum standard deviation from their mean values, betekoned dependency of the values (Tab. 3). Belewu and Babalola (2009) stated that CF can be used for useful purposes if treated with microorganisms. Hussain et al. (2010) estimated fibers varied from 9.5 % to 12.12% in selected medicinal plants. This range is similar to our range of values. Hameed *et al*., (2008) determined CF in ranged of 5.32% (*P. plebjum*) to 19.37 % (*R. hastatus*). In our study, *Rumex hastatus* had about the same values. *P. glabrum* (15.7%) also had similar % values. Tab. 1 present crude fiber content of selected plants, *R. dentatus, S. nigrum, A. bracteosa* and *A. viridis* are the main food eaten by man and animal. These plants are also medicinally important and useful in colon and urinary cancer. Hussain et al. (2010) stated that higher level of fibers increases digestibility but high content in diet can cause intestinal irritation. It can be deduced from the results that plants like *R. dentatus* and *S. nigrum* are very effective in digestion and some abdominal ailment.

Ether Extract (EE)

Tab. I depicts that the differences were highly significant between the tested species and non-significant among the phenological stages. It varied from 4.3 % (*F. squarrosa*) to 8.2 % (*P. glabrum*) in vegetative, 4.2% (*S. viridis*) to 9.4% (*P. glabrum*) in reproductive and 4.1% (*F. squarrosa*) to 10.3% (*P. glabrum*) in post reproductive stage. The vegetative and reproductive had kindred average % (5.9%) while post reproductive stage had higher % (6.4%) than other two stages. Minimum average was recorded for *F. squarrosa* (4.2%) and maximum (9.3%) was recorded for *P. glabrum* (Tab. 1,).

Ash

The ash content in vegetative stage varied from 9 % - 89 %, 6 % - 61 % in reproductive stage and 5 % to 31 % in post reproductive stage. The data revealed that a trend of decrementing order is found with aging of plant. The minimum ash % was recorded in post reproductive stage (5%) and maximum was recorded in vegetative stage (89%). The average % of ash ranged from 12.3 % (*A. scentifolia*) to 49.7 % (*H. perforatum*) (Tab. 1,). The ANOVA depicted that variance among the plant species and between different phenological behaviors are non-paramount. Deviation from mean is high in vegetative stage than other stages (Tab. 3). Hussain et al. (2010) determined ash % in *Melia azadarichta, Sonchus eruca, W. cogulans* and *F. indica* which ranged 10.6% to 16%. Hameed et al. (2008) recorded 15% ash content in root of *P. maculosa.* Hussain and Durrani (2009) reported 19 % ash content in garlicare tablets. Ash content of the herbs is smaller than the forbs. The results revealed that ash content of forages decrease progressively with age of plants. Similar to our findings, Kilcher (1981) also suggest similar trends. However, some workers reported that ash content increases with age of plants (Hussain and Durrani, 2008; Azim et al.1989; Wahid, 1990).

Neutral detergent fiber (NDF)

NDF contents were low in vegetative stages of the tested species and were high in post reproductive stages. It varied from 30.4% (*P. glabrum*) to 78.6 % (*F. squarrosa*). NDF range from 30.4 % (*P. glabrum*) to 68.5% (*F. squarrosa*) in vegetative, 40.3% (*R. dentatus*) to 76.6 % (*H. perforatum*) in reproductive and 40.5 % (*S. nigrum*) to 78.6 % (*F. squarrosa*) in post reproductive stage. Vegetative stage (44.5 %) had minimum average NDF concentration while post reproductive stage (63.3 %). Similarly, *S. nigrum* (39.8 %) had the lowest average and *F. squarrosa* (78.6%) had the highest average at all stages. The results revealed that grasses had conventionally high concentration of NDF than other estimated plants (Tab. 2,). The variations were highly significant among tested plants and phenological stages (Tab. 3). NDF is related to the phenological behavior of plants and strongly affected by maturity (Granskopp and

Bohnert, 2003; Hussain and Durrani, 2008; Hussain and Durrani, 2009; Wahid, 1990; Sultan et al. 2007; Dabo et al.1980; Andrighetto et al. 1993). This agrees with the present work. Cheema et al. (2011) determined highest NDF in *Ziziphus jujuba* and lowest in *Acacia nilotica.* Schmidek et al.(2000) investigated NDF content varied from 30.2 to 39.3 %. This range does not agree with above sited review (Tab. 1,2 & 3;).

Acid detergent fibers (ADF)

ADF contents varied from 10.5% (*C. ciliaris*) to 51.2% (*B. glomerata*) in post reproductive stage. The lowest average of ADF contents was recorded in vegetative stage while highest average was determined for reproductive stages (Tab. 2,). The variations among species and different phenological stages were non-significant. It showed an ascending trend in concentration with age of plants (Tab. 3). Hussain and Durrani (2008) stated that ADF had almost similar trend like NDF. Our findings were supported by various investigators (Cheema et al. 2011; Ashraf et al. 1995, Sultan et al. 2007; Wahid, 1990) who also reported high level of ADF in fodder species at different stages.

Hemicellulose

The results revealed that grasses had higher hemicellulose contents than forbs. It varied from 10.2% (*B. reptans*) to 23.5% (*F. squarrosa*) in vegetative, 10.2 % (*B. pectinatus*) to 25.2% (*F. squarrosa*) in reproductive and 10.4% (*S. nigrum*) to 31.5% (*F. squarrosa*) in post reproductive stages. As a whole hemicellulose content ranges from 10.2% to 31.5% among the tested plants. The lowest average was recorded at reproductive stages (17.2 %) and highest average recorded in post reproductive stages (20.5%). The individual minimum average (12.7%) accounted for *A. viridis* and highest (26.7%) for *F. squarrosa* (Tab. 2,). The differences were highly paramount among different plants and consequential between phenological stages (Tab. 3).

Acid detergent lignin (ADL)

The present study revealed that ADL like other parameters incremented with maturity in the tested species. It varied from 3.6 % (*R. hastatus*) to 13.7 % (*A. bracteosa*) in vegetative stage, 3.5 % (*Rumex dentatus*) to 15.9 % (*S. viridis*) in reproductive stage and 2.2 % (*S. nigrum*) to 21.2 % (*S. viridis*) in post reproductive stages. The lowest average accounted for vegetative stages and highest average recorded for post reproductive stages. The individual minimum average value was shown by *Cenchrus ciliaris* and highest by *Setaria viridis.* The data revealed that grasses accumulate more ADL with maturity (Tab. 2,). The statistical analysis showed that the differences among different species and phenological stages were non-significant (Tab. 3). Similarly, the present findings agreed with various workers (Azim et al. 1989; Sultan et al. 2007; Robles and Boza, 1993) who observed increasing ADL contents with increase of age of plants. Hussain and Durrani (2008) and Kramberger and Klemencic (2003) described that lignin content was higher in stem than leaves and also its concentration enhances as the plants grow. Our results support this statement.

Nitrogen Free Extract (NFE)

The statistical analysis revealed that differences among different tested species were paramount and showed little deviation from the mean values, while phenological stages represented that variation was highly consequential. *Bromus hordeaceus* (50.8 %) had the highest in vegetative stage, *A. bracteosa* (63.6 %) in reproductive stage and *Setaria viridis* (58.6 %) had the highest value at post reproductive stage. The lowest average was recorded in vegetative stage and highest average of NFE estimated in post reproductive stage. Generally, *H. perforatum* (37.4 %) had the lowest average value in all plants and *Setaria viridis* (53.5 %) had maximum average (Tab. 3). The NFE values ranged similar in the results as reported by Hussain and Durrani (2008).

Carbohydrates

The data revealed that there was an ascending pattern of carbohydrates in all tested species. It is evident from Tab. I that grasses had higher contents of carbohydrates. It varied from 38.5 % (*P. glabrum)* to 84.6 % (*Rumex hastatus*) in vegetative stages, 40.2 % (*Setaria viridis*) to 80.1 % (*B. glomerata*) in reproductive stages and 50.3 % (*A. viridis*) to 82.2 % (*B. glomerata*) in post reproductive stages.

Tab. 1. Proximate composition of selected forage plants of Chakesar Valley, District Shangla, Pakistan.

		Moisture (%)				N (%)				Crude Protein (%)				Crude Fibers (%)				Ether Extract (%)				Ash (%)			
No	Species	Veg	Rep	P..Rep	Avg	Veg	Rep	P..Rep	Avg	Veg	Rep	P..Rep	Avg	V	Rep	P.Rep	Avg	Veg	Rep	P.Rep	Avg	Veg	Rep	P..Rep	Avg
1	*Brachiaria reptans*	17	14.3	14.5	15.3	1.93	1.62	1.72	1.76	10.5	7.2	9.6	9.1	13.1	15.2	15.7	14.7	7.2	7.5	8.5	7.73	20	29	19	22.7
2	*Polygonum glabrum*	18	13.5	10.1	13.9	2.41	1.53	2.05	2	14.7	13.3	10.5	12.9	15.3	14.2	17.6	15.7	8.2	9.4	10.3	9.3	74	8	31	37.7
3	*Fimbristylis squarrosa*	20	21.5	20.6	20.7	1.59	1.07	1.43	1.36	12.9	14.3	8.7	12.0	13.4	12.5	18.5	14.8	4.3	4.2	4.1	4.2	88	28	18	44.7
4	*Artemisia scentifolia*	30	23.5	20.5	24.7	1.78	1.35	1.3	1.48	10.7	9.5	7.4	9.2	12.4	13.6	17.5	14.5	5.4	5.1	5.3	5.27	9	8	20	12.3
5	*Rumex hastatus*	16	15.6	11.5	14.4	1.93	1.63	1.67	1.74	5.5	8.4	5.5	6.5	13.7	12.5	18.6	14.9	6.3	6.2	7.1	6.53	45	13	20	26
6	*Bromus hordeaceus*	8	5.5	5.5	6.33	1.49	1.4	1.35	1.41	8.1	4.3	4.1	5.5	20.5	21.5	22.7	21.6	7.2	6.7	7.3	7.07	45	7	10	20.7
7	*Setaria viridis*	14	15.3	15.2	14.8	1.81	1.62	1.71	1.71	17.2	16.1	10.5	14.6	18.4	19.5	21.7	19.9	4.4	4.2	4.6	4.4	89	17	10	38.7
8	*Bromus pectinatus*	17	15.6	15.3	16	2.32	2.01	1.87	2.07	12.5	8.1	4.2	8.3	17.7	18.5	19.6	18.6	5.2	5	5.3	5.17	81	6	20	35.7
9	*Hypericum perforatum*	15	16.5	15.3	15.6	1.63	1.51	1.54	1.56	14.6	10.5	7.5	10.9	14.3	15.6	18.5	16.1	6.3	6.1	6.6	6.33	70	61	18	49.7
10	*Rumex dentatus*	9	9.2	10.3	9.5	2.11	1.91	1.94	1.99	12.5	10.7	6.9	10.0	11.5	16.4	17.5	15.1	4.5	4.2	4.6	4.43	43	7	5	18.3
11	*Cenchrus ciliaris*	7	6.5	6.4	6.63	2.15	1.87	1.97	2	8.5	5.1	3.3	5.6	12.4	14.8	14.9	14	5.4	5.1	5.7	5.4	55	20	20	31.7
12	*Solanum nigrum*	10	8.6	7.5	8.7	1.53	1.5	1.47	1.5	13.1	10.8	7.4	10.5	17.5	17.7	18.8	18	6.2	6.1	6.8	6.37	88	19	19	42
13	*Ajuga bracteosa*	7	6.6	5.6	6.4	1.21	1.1	1.05	1.12	15.1	14.1	12.4	13.9	10.3	12.4	15.4	12.7	7.3	7.5	7.6	7.47	56	21	20	32.3
14	*Amaranthus viridis*	8	8.3	5.3	7.2	1.32	0.73	0.85	0.97	16.3	12.6	8.4	12.4	14.2	16.5	18.2	16.3	5.2	4.7	5.3	5.07	20	14	13	15.7
Maximum		30.0	23.5	20.6	24.7	2.4	2.0	2.1	2.1	17.2	16.1	12.4	14.6	20.5	21.5	22.7	21.6	8.2	9.4	10.3	9.3	89.0	61.0	31.0	49.7
Minimum		7.0	5.5	5.3	6.3	1.2	0.7	0.9	1.0	5.5	4.3	3.3	5.5	10.3	12.4	14.9	12.7	4.3	4.2	4.1	4.2	9.0	6.0	5.0	12.3
Average		14.0	12.9	11.7	12.9	1.8	1.5	1.6	1.6	12.3	10.4	7.6	10.1	14.6	15.8	18.2	16.2	5.9	5.9	6.4	6.1	55.9	18.4	17.4	30.6
S.D		6.5	5.6	5.3	5.6	0.4	0.3	0.4	0.3	3.3	3.5	2.7	2.9	2.9	2.8	2.2	2.5	1.2	1.5	1.7	1.5	27.0	14.4	6.2	11.5

Tab. 2. Proximate composition of the selected forage plant species of Chakesar Valley, District Shangla, Pakistan.

		NDF (%)				ADF (%)				Hemicellulose (%)				ADL (%)				NFE (%)				Carbohydrates (%)			
No	Species	Veg	Rep	P.Rep	Avg	Veg	Rep	P.Rep	Avg	Veg	Rep	P.Rep	Avg	Veg	Rep	P.Rep	Avg	Veg	Rep	P.Rep	Avg	Veg	Rep	P.Rep	Avg
1	*Brachiaria reptans*	35.1	65.2	70.3	56.9	17.3	24.4	45.3	29	10.2	14.4	17.8	14.1	5.2	8.8	8.4	7.47	38.3	37.5	45.6	40.5	54.3	64.3	59.7	59.4
2	*Polygonum glabrum*	30.4	62.5	68.5	53.8	24.2	37.5	40.2	34	17.3	20.3	27.5	21.7	10.1	7.5	10.4	9.33	45.5	45.6	55.3	48.8	38.5	55.4	60.3	51.4
3	*Fimbristylys squarrosa*	68.5	75.7	78.6	74.3	30.5	28.4	32	30.3	23.5	25.2	31.5	26.7	4.3	14.6	12.2	10.4	30.6	37.4	48.6	38.9	47.1	63.6	75.5	62.1
4	*Artemisia scentifolia*	37.5	65.6	70.8	58	31.3	25.4	47.6	34.8	15.7	13.5	12.4	13.9	8.5	13.7	11.3	11.2	45.3	46	55.7	49	62.5	75.5	80.1	72.7
5	*Rumex hastatus*	41.5	60.5	68.6	56.9	28.1	40.7	41.3	36.7	16.6	18.7	18.3	17.9	3.6	12.5	15.2	10.4	44.5	47.4	57.7	49.9	84.6	73.3	75.5	77.8
6	*Bromus hordeaceus*	51.3	70.4	70.4	64	31.2	42.5	51.2	41.6	17.5	17.4	27.2	20.7	9.5	10.7	18.7	13	50.8	48.3	55.6	51.6	72.7	80.1	82.2	78.3
7	*Setaria viridis*	52.3	70.8	71.7	64.9	35.5	40.7	37.5	37.9	22.7	24.5	23.3	23.5	7.7	15.9	21.2	14.9	47.5	54.5	58.6	53.5	55.3	40.2	58.3	51.3
8	*Bromus pectinatus*	55.6	75.7	76.5	69.3	28.3	37.5	48.5	38.1	21.4	10.2	13.2	14.9	4.8	10.6	12.6	9.33	35.3	44.3	58.3	46	60.4	73.5	76.7	70.2
9	*Hypericum perforatum*	40.5	76.6	70.6	62.6	30.6	36.8	17.1	28.2	17.5	16.6	18.3	17.5	5.6	15.6	16.7	12.6	40.2	36.4	35.6	37.4	45.5	51.4	73.4	56.8
10	*Rumex dentatus*	33.5	40.3	45.6	39.8	26.7	34.2	14.3	25.1	20.7	14.7	18.3	17.9	11.7	3.5	10.8	8.67	42.1	45.6	39.3	42.3	81.3	76.3	77.5	78.4
11	*Cenchrus ciliaris*	61.3	70.5	65.3	65.7	29.5	35.1	10.5	25	22.2	21.3	25.2	22.9	12.5	4.3	3.3	6.7	36.3	55.6	38.5	43.5	72.4	46.2	56.2	58.3
12	*Solanum nigrum*	37.3	41.5	40.5	39.8	21.4	40.3	13.2	25	16.5	14.2	10.4	13.7	10.6	7.5	2.2	6.77	48.2	60.3	50.6	53	73.3	75	74.1	74.1
13	*Ajuga bracteosa*	37.5	40.3	45.4	41.1	28.3	25.2	12.7	22.1	15.6	20.1	27.7	21.1	13.7	6.6	5.6	8.63	44.6	63.6	52.5	53.6	65.4	70.5	65.2	67
14	*Amaranthus viridis*	41.3	42.3	43.5	42.4	27.7	42.2	41.3	37.1	12.3	10.3	15.5	12.7	13.6	10.5	7.6	10.6	42.5	55.3	46.7	48.2	42.5	51.3	50.3	48
Maximum		68.5	76.6	78.6	74.3	35.5	42.5	51.2	41.6	23.5	25.2	31.5	26.7	13.7	15.9	21.2	14.9	50.8	63.6	58.6	53.6	84.6	80.1	82.2	78.4
Minimum		30.4	40.3	40.5	39.8	17.3	24.4	10.5	22.1	10.2	10.2	10.4	12.7	3.6	3.5	2.2	6.7	30.6	36.4	35.6	37.4	38.5	40.2	50.3	48
Average		44.5	61.3	63.3	56.4	27.9	35.1	32.3	31.8	17.8	17.2	20.5	18.5	8.67	10.2	11.2	10	42.3	48.4	49.9	46.9	61.1	64	68.9	64.7
Standard Deviation		11.4	14.1	13.3	11.6	4.53	6.57	15.3	6.17	3.9	4.71	6.59	4.35	3.53	4	5.56	2.39	5.59	8.47	7.78	5.52	14.6	12.9	10.2	10.8

Key Note: NDF = Neutral Detergent Fibers, ADF = Acid detergent fibers, ADL = Acid detergent lignin, NFE % = Nitrogen free extract.

Tab.3. ANOVA for proximate analysis of species and their phenological stages of some selected forage plants of Chakesar valley, Distrct Shangla, Pakistan.

Source of Variation	df	Moisture (%)	N (%)	Crude Protein (%)	Crude Fiber (%)	Ether extract (%)	Ash (%)	NDF (%)	ADF (%)	ADL (%)	NFE (%)	Hemicellulose (%)	Carbohydrates (%)
Between the Plant Species	13	95.7**	0.3**	25.5**	18.1**	8.1**	398.3 ns	400.22**	114.154 ns	17.163 ns	91.36*	56.75**	347.78**
Between the Phenological Stages	2	18.7**	0.3**	78.2**	47.4**	1.6ns	6755.3 ns	1484.7**	183.044 ns	21.917 ns	229.5**	41.35*	217.47 Ns
Error	26	3.0	0.017	2.5	1.4	0.666	289.8	51.875	92.233	21.117	36.049	12.029	68.106

Similarly, the lowest average was recorded in vegetative stages (61.1 %) and highest average was recorded for (68.9 %) post reproductive stage. The lowest average was investigated for *A. viridis* (48.03 %) and highest average was recorded for *Rumex dentatus* (78.4 %) at three phenological stages (Tab. 1,). The differences among tested species were highly significant (p = 0.05) but were non-significant between phenological stages (Tab. 3). High level of carbohydrates in forages is important for animals because carbohydrates are ready made source of energy (Hussain and Durrani, 2008; Holechek et al., 1998). Carbohydrates ranged between 18.3 to 64.3% in different plants are reported by various workers. The present finding also agree with previously available literature (Hussain et al. 2010; Hanif et al. 2006; Adnan et al. 2010; Adenipekun and Oyetunji, 2010; James et al. 2010). In this respect, however, Hameed et al. (2008) reported otherwise. Hussain and Durrani (2008) described that structural carbohydrate composition varies with seasons and growth stages. Holechek et al. (1998) stated that livestock preferred grasses because they can use efficiently cellulose and hemicellulose due to the presence of microorganisms in their gut.

CONCLUSION

Comparison of the results of proximate composition of fourteen plants show that overall percentage of moisture composition was maximum in *A. scentifolia* while lowest % was recorded in *C. ciliaris* and *A. bracteosa.* Nitrogen content was maximum in *P. glabrum* and lowest in *A. bracteosa.* The lowest content of crude protein was observed in *C. ciliaris* and highest in *Setaria viridis*. It increases in reproductive stages and decreses in post reproductive stages. It decline with age structure. Crude fibers content in these plants increase with age of plants. The minimum content was recorded for *A. bracteosa* and maxximum for *B.glomerata*. The ether extract was min. in *F. squarrosa* and maximum in *P. glabrum.*
Similarly, ash content also increase with age structure. However, neutral detergent fiber and acid detergent fibers were decreased in vegetative stage. Hemicellulose was higher in forbs. Nitrogen free extract varies with species types and carbohydrates was found in high content in all grasses. It is suited for storage in winter.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS

Mohib Shah performed the experiment. Mohib Shah and Farrukh Hussain Designed and analyzed the experiment. Ishfaq Hameed and Khushnood Ur Rehman wrote the manuscript. All authors read and approve the manuscript.

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