

Full Length Research Paper

Palatability and animal preferences of plants in Tehsil Takht-e-Nasrati, District Karak, Pakistan

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In the present investigation, 161 plant species were judged for palatability purpose in Tehsil Takht-e-Nasrati, District Karak, Khyber Pakhtun Khawa, Pakistan. The study shows that 161 plant species including 22 (13.4%) trees, 23 (14%) shrubs and 116 (72.6%) herbs were grazed among five animals in different seasons. Of the 161 recorded species, 29 species (18.01%) were non palatable, 32 species (19.88%) were highly palatable, 43 species (26.71%) were mostly palatable, 34 species (21.12%) were less palatable and 23 species (14.29%) were rarely palatable. The overall animals preferred 83 plant species (62.88%) in a fresh form, single species (0.76%) in dry form and 48 species (36.4%) in both forms. The goat preferred the most plant (118 species, 33.52%), camel (79 species, 22.4%), cow (61 species, 17.33%), sheep (51 species, 14.5%) and donkey (43 species, 12.22%). The most preferred species by animals were *Zizyphus mauritiana*, *Acacia modesta*, *Cyperus* species, *Dichanthium annulatum*, *Euphorbia prostrata* and *Kickxia ramosissima*. In winter, there is less availability of palatable species in plain areas from an agriculture point of view, while it is reverse in hilly areas. It was observed that palatability and animal preference increased in summer. As such, a recommendation was made to evaluate the nutritional and mineral status of high palatable plants.

Key words: Palatability, fresh condition, dry condition, animal choice, seasonal effect.

INTRODUCTION

Palatability is a type of plant characteristic that determines the stimulation of plants or its parts or feed as stimulated by the sensory impulses of grazing animals (Heath et al., 1985). In animal diets, the fruits and flowers were required seasonally (Pfister and Malechek, 1986). Sheep feed generally consist of more than 50% grasses during all the seasons, while shrub components tends to increase during dry seasons in Africa (Migongo-Bake and Hansen, 1987). Palatability is affected through different animal factors such as differential preference for forage species, period, phase of pregnancy, general health and hunger of animal. Palatability is also affected through different plant factors such as seasonal availability of plant, degree of maturity, growth stage, phenology, morphological and chemical nature (Hussain and Durrani,

2009). Comparative wealth of related plant species, animal accessibility to plants/sites and environment also affect palatability (Grunwaldt et al., 1994; Nyamangara and Ndlovu, 1995). Many studies concluded that in excess, grazing decreases palatable species in the range (Malubekova, 1996; Badshah and Hussain, 2011). Considering the need of information and significance of semi-arid area of Tehsil Takht-e-Nasrati, the current effort was carried out to judge the seasonal availability of feed plants, degree of palatability by parts and forage preference by grazing animals. The outcome will help the ecologists to propose ways and resources to progress this region and other similar parts in Pakistan.

MATERIALS AND METHODS

Tehsil Takht-e-Nasrati is bounded by Tehsil Banda Daud Shah on the North West, Tehsil Karak on the North East, District Mianwali

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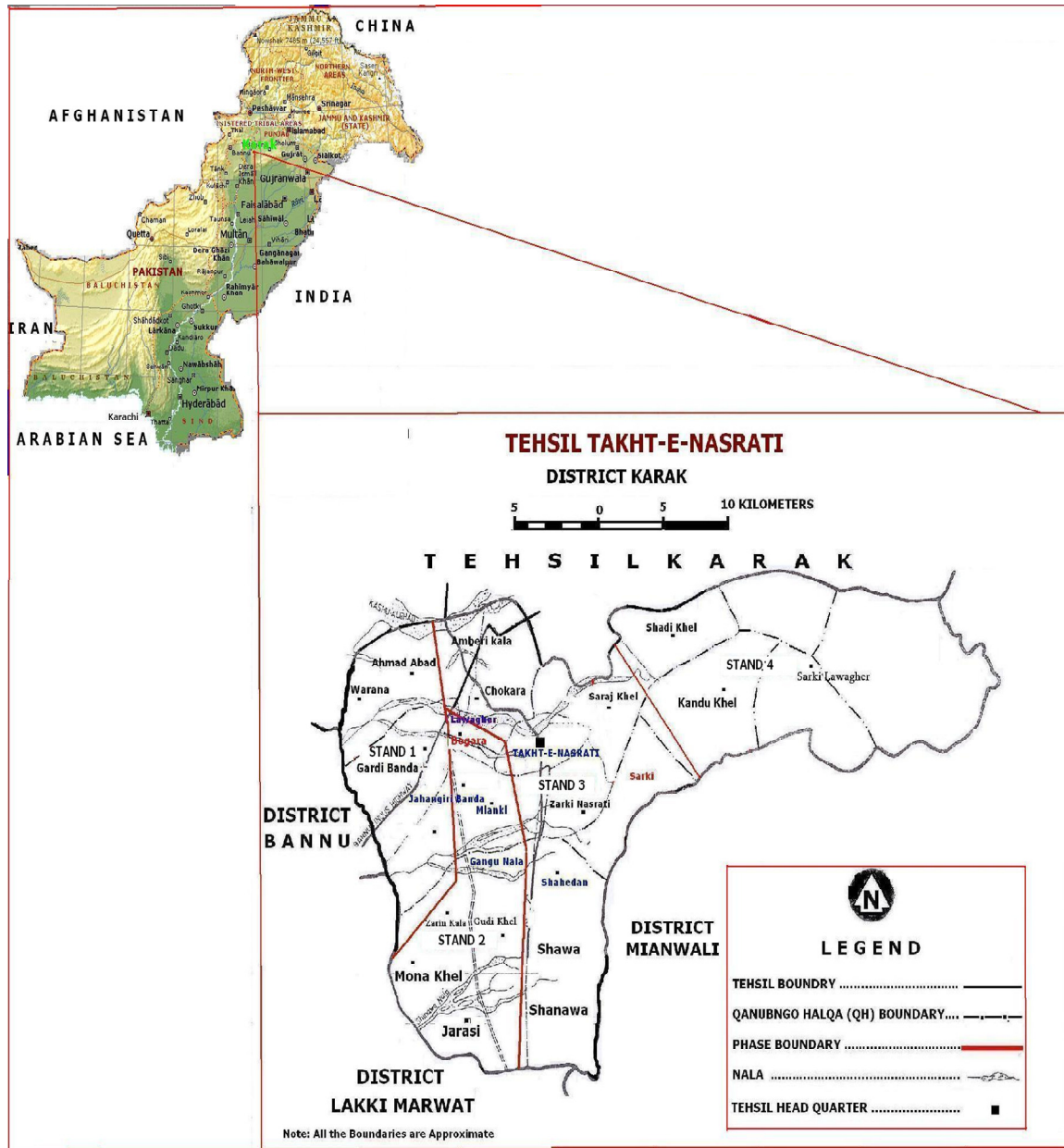


Figure 1. Map of Tehsil Takht-e-Nasrati showing research spots.

and Lakki Marwat on the South East, and Tribal area Adjoining District Bannu on the South West. The total area of Tehsil is about 613.66 km². Majority of the area consists of rigged dry hills and rough field areas, that is, 323.97 km². Agricultural land is about 289.7 km² (Figure 1). The major income source of the area is agriculture, which is rain depended. Takht-e-Nasrati is situated at 340 m above the sea level. The climate of the area is not markedly different from the other parts of District Karak. The area is located in semi-arid climatic region, having hot summer and very cold winter. The rainfall is scanty and uncertain. Winter rains are generally of long duration and of low intensity. Summer monsoon rains are torrential in heavy shore intensity. In the year 2001 to 2010, 121.6 mm of rainfall per 10 year was recorded on district level. June and July are the hottest months, whereas December and January are the coldest months. In the year 2001 to 2010, the mean maximum

temperature was 39.5°C in the month of the June, whereas the mean minimum temperature was as low as 4.26°C in the month of January, recorded on district level (Table 1). The climate and weathers are also influenced by wind. In hottest months, especially June, swivel winds are developed on the plain area after noon due to local heating and convection is uprising. Sometimes, strong, dry and hot winds with huge dust enter the area from different sides.

Survey

Differential palatability of plants was recorded by daily monitoring the individual animals grazing preferences by different plant species, plant parts and plant condition for two successive years (2009 and 2010) from spring to summer and from summer to winter

Table 1. Average climatic data of Tehsil Takht-e-Nasrati, Karak for the year 2001 to 2010.

Month	Temperature (°C)		Humidity (%)		Rainfall (mm)	Soil temperature (°C) Average	Wind speed (km/h)
	Max.	Min.	Max.	Min.			
January	19.18	4.26	75.80	35.24	27.43	7.03	2.9
February	21.69	7.29	77.39	42.23	37.72	9.14	3.2
March	28.20	12.06	75.38	35.23	37.17	13.89	3.5
April	34.74	17.94	66.12	29.42	36.54	19.02	5.2
May	38.32	22.33	59.66	30.73	31.6	21.87	5.4
June	39.50	25.9	59.96	32.89	74.24	25.78	5.5
July	38.44	25.76	73.33	38.76	121.6	26.77	5.2
August	36.66	25.29	75.68	42.61	108.3	26.37	4.1
September	35.47	21.95	77.21	39.29	61.58	23.49	3.7
October	32.33	16.79	71.55	35.51	15.13	20.09	3.5
November	26.71	10.01	71.56	36.66	5.80	14.10	3.2
December	21.93	5.67	75.20	35.90	15.38	8.96	3.1
Mean	31.1	16.27	71.57	36.21	47.71	18.04	4.04

Source: Agricultural Research Farm Ahmadwala Karak.

repeatedly on different area in Tehsil Takht-e-Nasrati, District Karak, Pakistan.

Grazing animals

A total of six animals, that is, goat, camel, cow, sheep and donkey were studied for their preference as the different animals have different choice of plant selection for grazing. All the animals were personalized to the presence of humans; it was achievable to notice their grazing favorite from a few meters. Radio transmitters were fitted on some of the creatures for easy detection and observation at any time. These assessments were used to setup a food choice or palatability index for observed edible plants (Hussain and Mustafa, 1995).

Palatability classes of plants

Plants were classified into following palatability classes:

1. Non palatable (NP): Not grazed by animals at any stage; possibly poisonous or harmful.
2. Highly palatable (HP): Species, which were preferred the most by domestic animals.
3. Mostly palatable (MP): Species with usual preference by the livestock.
4. Less palatable (LP): Species with less first choice.
5. Rarely palatable (RP): Species not often grazed under compulsion when no other feed exist (Hussain and Durrani, 2009).

Information collection

In order to assess the palatability of the plant species as non palatable, most palatable, high palatable, low palatable, rare palatable, etc., data were achieved through random sampling by interviewing 500 respondents from different inhabitants of the area. A special questionnaire was distributed to plant collectors, housewives, elders, plant traders and shepherd, who are the authentic users and have plenty of palatability information in

relation to the plants and their animal preference. Analysis of data was finished with the help of group deliberations among different age classes of the research area that comprise genders, village people and shepherd of the society. The information about the palatability of the plants was obtained from local experienced people through questioners and personal interviews.

Plants anthology and safeguarding

The data was classified, tabulated, analyzed and accomplished for final statement. The plants were collected, dried and preserved for identification. Plants were identified with the help of available literature (Ali and Qaiser, 1995) and voucher specimens have been put down in herbarium, Department of Botany, University of Peshawar, Pakistan.

RESULTS AND DISCUSSION

This study shows that 161 plant species including 22 (13.4%) trees, 23 (14%) shrubs and 116 (72.6%) herbs were grazed among five animals, that is, goat, camel, cow, sheep, and donkey in the area in different seasons. Of the 161 recorded species, 29 species (18.01%) were non palatable, 32 species (19.88%) were highly palatable, 43 species (26.71%) were mostly palatable, 34 species (21.12%) were less palatable and 23 species (14.29%) were rarely palatable (Table 2 and Figure 2). Of the 22 recorded tree species, all species were palatable in which eight species (36.36%) were highly palatable, six species (27.27%) were mostly palatable, five species (22.73%) were less palatable and three species (13.64%) were rarely palatable. Of the 23 recorded shrub species, 11 species (47.83%) were non palatable, two species (8.69%) were highly palatable, single species (4.35%) were mostly palatable, six species (26.09%) were less

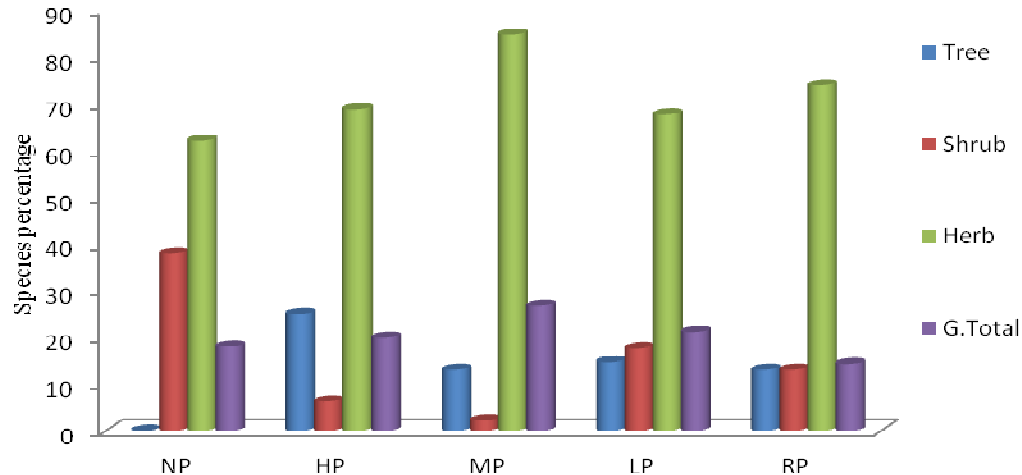


Figure 2. Differential palatability of plant species in Tehsil Takht-e-Nasrati, Karak.

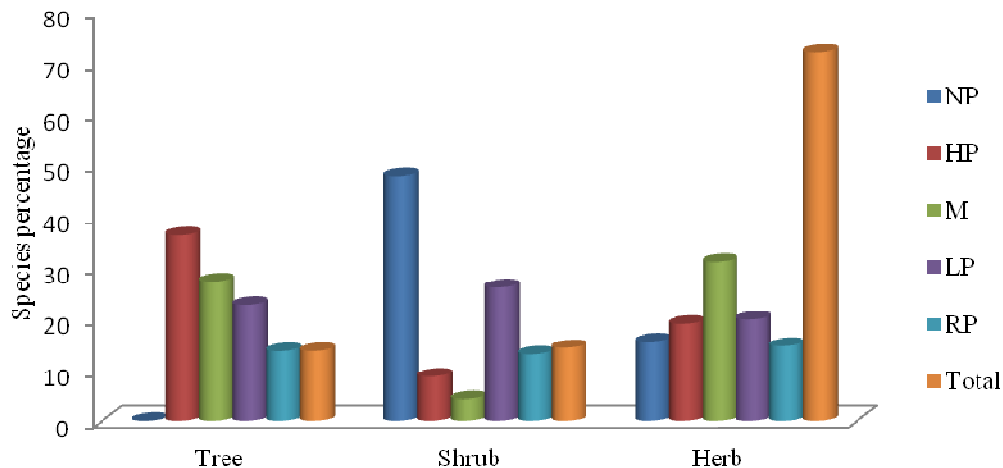


Figure 3. Differential palatability percentage in each stratum of plant species in Tehsil Takht-e-Nasrati, Karak.

palatable and three species (13.04%) were rarely palatable. Among herbs species, 18 species (15.52%) were non palatable while other were palatable in which 22 species (18.97%) were highly palatable, 36 species (31.03%) were mostly palatable, 23 species (19.83%) were less palatable and 17 species (14.66%) were rarely palatable. Comparison among percentage of palatable species, the percentage of non palatable shrubs was 47.83% and those of herbs were 15.52%. All the recorded trees were palatable. Among high palatable species of tree, the percentage was high, that is, 36.4% than herbs which was 19%. The shrubs had low value of 8.7%. In medium palatable species, the herbs dominated, that is, 31.03% as compared to tree species (27.27%) and shrub (4.35%). Among shrubs, the low palatable was higher (26.09%) than tree (22.73%) and herbs (19.83%). The percentage of rare palatable plants was high in herbs

and grasses (14.66%) as compared to tree (13.64%) and shrubs (13.04%) (Table 2 and Figure 3).

Differential palatability of plant parts

The animal preference differed for various parts of the plants. It is seen that 88 (66.67%) plants were grazed as a whole, 40 (30.3%) leaves were used, two (1.52%) inflorescences and fruits each were utilized. 10 (41.67%) plants as a whole and leaves each and two (8.33%) inflorescences and fruits each of tree were preferred by animals. Among shrubs, four (36.36%) whole plant and eight (72.73%) leaves were preferred by livestock. In herbs, 74 (77.08%) whole plants and 22 (22.92%) leaves were preferred by grazing animals (Table 2 and Figure 4). Hussain and Durrani (2009) observed that 99 species

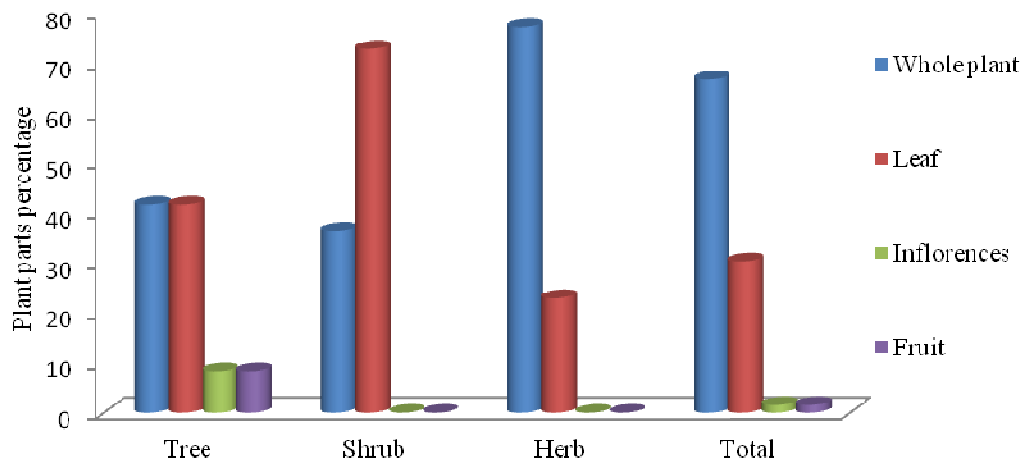


Figure 4. Plant parts preferred by animals in Tehsil Takht-e-Nasrati, Karak.

of whole plants, 30 species of leaves and 29 species of floral parts were used.

Herbivory increases plant diversity qualitatively in two diverse ways, that is, global frequency abundance (amount of herbivory related species) and spatial variability (herbivory levels can form temporary neighboring refuges for herbivory for each species). Both of these mechanisms function only if there is no negative association between plant palatability and its aggressive capacity. If there is no connection, then plant diversity is increasing the task of herbivores level of monophagy (Pacala and Crawley, 1992). Adequate feed quantity is essential to provide necessary nutrient herbivores. Appropriate grazing is important to sustain sufficient forage environment. Younger tissues were more drought tough than older tissues. Younger tissues also grew longer with succeeding wilting as water moved from old to young tissues. Anderson (1994) stated that wilted tissues had increased sugar contents and are highly palatable due to conversion of starch to sugar. Plant vigor is maintained only when half of the plant is grazed. Clark et al. (1998) recommended that an entire year of break restores the losses of plant dynamism.

Plant condition preferred by animals

The animals prefer plants in both fresh or in dry conditions. The overall animals preferred 83 plant species (62.88%) in a fresh form, single species (0.76%) in dry form and 48 species (36.4%) in both forms. In trees, 15 species (68.18%) were preferred in fresh, single species (4.54%) in dry and six species (27.3%) in both conditions. In shrubs, 10 species (83.33%) were preferred in fresh form and two species (16.7%) were preferred in both conditions. In herbs, 58 species (59.18%) plants were preferred in fresh, while 40 species (40.8%) were preferred in both conditions (Table 2 and Figure 5). The study indicates that animals usually

preferred live fresh tissues. Grazing is significant in that it decreases the fraction of deceased parts and increases the chances of accessibility and availability of live tissues of species.

The existence of fresh plant materials increases ungulate grazing animal efficiency.

Hussain and Durrani (2009) stated that seasonal availability of fodder species depend on phenological stages and climate. This is similar to our observation that if the climate is suitable, extra fresh fodder plants will be obtainable to livestock. In drought and winter seasons, dried species and trees become the only supply of fodder to the livestock. In 2009 and 2010, low precipitation occurred in the study area which noticeably turned down the livestock population, like goat, sheep, cow, etc. It produced deficiency of dairy products and meat in the area. Hussain and Mustafa (1995) stated that in Nsairabad valley, the livestock used mostly fresh forage species. Marqueus et al. (2004) stated that in absence of annuals, the shrubs provide fresh fodder. It is obvious that most of the forage species are present in March to April and fodder availability is high in this time.

Animal preference for plant

The preference of goat, camel, cow, sheep and donkey for the palatability was observed. The goat preferred the most plant (118 species, 33.52%), camel (79 species, 22.4%), cow (61 species, 17.33%), sheep (51 species, 14.5%) and donkey (43 species, 12.22%). Goat preferred the herbs (89 species, 75.4%), shrubs (nine species, 7.63%) and tree (20 species, 16.9%). Camel preferred herbs (52 species, 65.82%), tree (19 species, 24.05%), while shrubs (8 species, 10.12%). The cow also preferred herbs (44 species, 72.13%), tree (13 species, 21.31%) and shrubs (four species, 6.56%). Sheep preferred herbs (40 species, 78.43%), tree (six species, 11.76%) and shrubs (five species, 9.8%). Donkey also preferred herbs

Table 2. Differential palatability plant species, plant parts and various parts preference by livestock.

S/N	Species	Habit	Palatability class					Plant part				Plant condition			Grazing animal				
			NP	HP	MP	LP	RP	Whole	Leaf	Inf	Fruit	Fresh	Dry	Both	Cow	Goat	Sheep	Camel	Donkey
1	<i>Acacia modesta</i> Wall.	T	-	+	-	-	-	+	-	-	-	-	-	+	-	+	-	+	-
2	<i>Acacia nilotica</i> (L.) Delice.	T	-	+	-	-	-	+	-	-	-	-	-	+	-	+	-	+	-
3	<i>Albizia lebbbeck</i> (L.) Benth.	T	-	-	-	-	+	-	-	+	+	-	+	-	+	-	-	+	-
4	<i>Capparis decidua</i> (Forssk.) Edge worth.	T	-	-	+	-	-	-	-	+	+	+	-	-	-	+	+	-	+
5	<i>Dalbergia sissoo</i> Roxb.	T	-	-	+	-	-	-	+	-	-	+	-	-	+	+	-	+	-
6	<i>Eucalyptus globules</i> L.	T	-	-	-	+	-	+	-	-	-	+	-	-	-	+	-	-	-
7	<i>Eucalyptus lanceolatus</i> L.	T	-	-	-	-	+	+	-	-	-	+	-	-	+	+	-	-	-
8	<i>Gymnosporia royleana</i> Wall. ex M. A. Lawson.	T	-	-	-	+	-	+	-	-	-	+	-	-	-	+	-	+	-
9	<i>Melia azedarach</i> L.	T	-	-	+	-	-	-	+	-	-	+	-	-	+	+	-	+	-
10	<i>Monothea buxifolia</i> (falk.) A.DC.	T	-	+	-	-	-	-	+	-	-	+	-	-	-	+	-	+	-
11	<i>Morus alba</i> L.	T	-	-	-	+	-	-	+	-	-	+	-	-	+	+	+	+	-
12	<i>Morus nigra</i> L.	T	-	-	-	+	-	-	+	-	-	+	-	-	+	+	+	+	-
13	<i>Parkinsonia aculeata</i> L.	T	-	-	-	-	+	-	+	-	-	+	-	-	-	+	-	+	-
14	<i>Phoenix dactylifera</i> L.	T	-	-	-	+	-	-	+	-	-	+	-	-	-	+	-	-	-
15	<i>Prosopis farcta</i> (Banks & Sol.) J.F. Macbr.	T	-	+	-	-	-	+	-	-	-	-	-	+	+	+	+	+	+
16	<i>Prosopis juliflora</i> (Sw.) DC.	T	-	+	-	-	-	+	-	-	-	+	-	-	-	+	-	+	-
17	<i>Punica granatum</i> L.	T	-	-	+	-	-	+	-	-	-	-	-	+	+	+	+	+	+
18	<i>Salvadora oleoides</i> Decne.	T	-	+	-	-	-	-	+	-	-	+	-	-	+	+	-	+	-
19	<i>Tamarix aphylla</i> (L.) Karst.	T	-	-	+	-	-	-	+	-	-	+	-	-	+	-	-	+	-
20	<i>Tamarix decidva</i> Roxb.	T	-	-	+	-	-	-	+	-	-	+	-	-	+	-	-	+	-
21	<i>Zizyphus maurtiana</i> Lam.	T	-	+	-	-	-	+	-	-	-	-	-	+	+	+	+	+	+
22	<i>Zizyphus oxyphylla</i> Edgew.	T	-	+	-	-	-	+	-	-	-	-	-	+	+	+	+	+	+
Total		-	0	8	6	5	3	10	10	2	2	5	+	6	3	20	6	9	4
23	<i>Alhagi maurorum</i> Medic.	S	-	-	-	-	+	-	-	-	-	+	-	-	-	-	-	+	-
24	<i>Astragalus psilocentros</i> Fisch.	S	-	-	-	+	-	+	-	-	-	+	-	-	-	+	-	+	-
25	<i>Calligonum polygonoides</i> L.	S	-	+	-	-	-	+	-	-	-	+	-	-	-	+	+	+	-
26	<i>Calotropis procera</i> (Wild) R.Br.	S	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	<i>Capparis spinosa</i> L.	S	-	-	+	-	-	-	+	-	-	+	-	-	-	+	-	+	-
28	<i>Cassia angustifolia</i> Vahl.	S	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	<i>Datura metel</i> L.	S	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	<i>Dodonaea viscosa</i> L.	S	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	<i>Ocimum basilicum</i> L.	S	-	-	-	+	-	-	+	-	-	+	-	-	-	+	-	-	-
32	<i>Opuntia ficus indica</i> (L.) Mill.	S	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
33	<i>Ostegia limbata</i> (Benth) Boiss.	S	-	-	-	+	-	-	+	-	-	+	-	-	-	+	-	+	-
34	<i>Periploca aphylla</i> Decne.	S	-	-	-	-	+	-	+	-	-	+	-	-	+	+	+	+	-
35	<i>Rhazya stricta</i> Decne.	S	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36	<i>Ricinus communis</i> L.	S	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
37	<i>Rosa indica</i> L.	S	-	-	-	+	-	-	+	-	-	-	-	+	-	+	-	-	-

Table 2. Contd.

38	<i>Saccharum bengalense</i> Retz.	S	-	-	-	+	-	-	+	-	-	+	-	-	+	-	-	-	-	
39	<i>Saccharum spontaneum</i> L.	S	-	-	-	+	-	-	+	-	-	+	-	-	+	-	-	-	-	
40	<i>Vites vinifera</i> L.	S	-	-	-	-	+	-	+	-	-	+	-	-	-	+	-	+	-	
41	<i>Vitex trifolia</i> L.	S	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
42	<i>Vitex negundo</i> L.	S	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
43	<i>Withania coagulans</i> (Stocks) Dunal.	S	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
44	<i>Withania somnifera</i> (L) Dunal.	S	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
45	<i>Zizyphus nummularia</i> (Burm.f) W.&A.	S	-	+	-	-	-	+	-	-	-	-	+	+	+	+	+	+	+	
Total			-	11	2	1	6	3	4	8	0	0	0	0	2	4	9	3	8	1
46	<i>Abelmoschus esculentus</i> (L.) Moench.	H	-	-	-	+	-	-	-	-	-	+	-	-	+	+	-	-	-	
47	<i>Achyranthus aspera</i> L.	H	-	-	-	+	-	+	-	-	-	-	-	+	-	+	+	+	-	
48	<i>Aerva persica</i> (Burm.f.) Merrill.	H	-	-	+	-	-	+	-	-	-	+	-	-	-	+	-	+	-	
49	<i>Ajuga bracteosa</i> Wall.ex Benth.	H	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
50	<i>Allium cepa</i> L.	H	-	-	-	+	-	-	-	-	-	+	-	-	-	+	-	-	-	
51	<i>Allium sativum</i> L.	H	-	-	-	+	-	-	-	-	-	+	-	-	-	+	-	-	-	
52	<i>Aloe barbadensis</i> Mill.	H	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
53	<i>Alternanthera pungens</i> Kunth.	H	-	-	-	-	+	+	-	-	-	+	-	-	-	+	+	+	+	
54	<i>Amaranthus viridis</i> L.	H	-	-	+	-	-	+	-	-	-	+	-	-	+	+	+	+	+	
55	<i>Anagalis arvensis</i> L.	H	-	-	-	-	+	+	-	-	-	+	-	-	+	-	-	-	-	
56	<i>Arachis hypogaea</i> L.	H	-	+	-	-	-	+	-	-	-	-	-	+	+	+	+	+	+	
57	<i>Asparagus gracilis</i> Royle.	H	-	-	-	+	-	+	-	-	-	+	-	+	-	-	-	-	-	
58	<i>Asphodelous tenuifolius</i> Cavan.	H	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
59	<i>Avena sativa</i> L.	H	-	+	-	-	-	+	-	-	-	-	-	+	+	+	+	+	+	
60	<i>Boerhavia diffusa</i> L.	H	-	-	-	+	-	+	-	-	-	-	-	+	+	+	+	+	+	
61	<i>Brassica rapa</i> L.	H	-	+	-	-	-	+	-	-	-	-	-	+	+	+	+	+	+	
62	<i>Calendula arvensis</i> L.	H	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
63	<i>Capsicum annum</i> L.	H	-	-	-	+	-	+	-	-	-	-	-	+	-	+	-	-	-	
64	<i>Carthamus oxycantha</i> Bieb	H	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	
65	<i>Celosia argentea</i> L.	H	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
66	<i>Cenchrus biflorus</i> Hook. f.	H	-	-	+	-	-	-	+	-	-	+	-	-	+	+	+	+	+	
67	<i>Cenchrus ciliaris</i> L.	H	-	+	-	-	-	-	+	-	-	+	-	-	+	+	+	+	+	
68	<i>Centaurea iberica</i> Trev.Ex. Spreng	H	-	-	+	-	-	+	-	-	-	+	-	-	+	+	+	+	+	
69	<i>Chenopodium album</i> L.	H	-	-	+	-	-	+	-	-	-	-	-	+	+	+	+	+	+	
70	<i>Chenopodium murale</i> L.	H	-	-	+	-	-	+	-	-	-	-	-	+	+	+	+	+	+	
71	<i>Chrozophora obliqua</i> (Vahl) A. Juss.	H	-	-	-	+	-	+	-	-	-	+	-	-	-	-	-	+	-	
72	<i>Cicer arietinum</i> L.	H	-	+	-	-	-	+	-	-	-	-	-	+	+	+	+	+	+	
73	<i>Cistanche tubulosa</i> (Schenk) Wight.	H	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
74	<i>Citrullus colocynthis</i> L. Schrad.	H	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
75	<i>Cleome viscosa</i> L.	H	-	-	-	-	+	+	-	-	-	+	-	-	-	+	-	-	-	
76	<i>Cocculus pendulus</i> (Forst) Diels.	H	-	-	+	-	-	+	-	-	-	+	-	+	-	+	-	-	-	

Table 2. Contd.

77	<i>Convolvulus arvensis</i> L.	H	-	+	-	-	-	+	-	-	-	-	-	+	+	+	+	+	+
78	<i>Convolvulus pluricaulis</i> Choisy.	H	-	-	+	-	-	+	-	-	-	-	+	-	-	+	+	+	+
79	<i>Corchorus trilocularis</i> L.	H	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
80	<i>Coriandrum sativum</i> L.	H	-	-	-	-	+	+	-	-	-	+	-	-	-	+	-	-	-
81	<i>Coronopus didymus</i> (L.) Smith.	H	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
82	<i>Crotalaria medicaginea</i> Lam.	H	-	+	-	-	-	+	-	-	-	-	-	+	+	+	+	+	+
83	<i>Cucurbita maxima</i> Duchesne.	H	-	-	-	-	+	+	-	-	-	+	-	-	-	+	-	-	-
84	<i>Cucurbita pepo</i> L.	H	-	-	-	-	+	+	-	-	-	+	-	-	-	+	-	-	-
85	<i>Cuscuta reflexa</i> Roxb.	H	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
86	<i>Cymbopogon jwarancusa</i> (Jones) Schult.	H	-	-	-	+	-	-	+	-	-	+	-	-	+	+	-	-	-
87	<i>Cynodon dactylon</i> (L.) Pers.	H	-	+	-	-	-	+	-	-	-	-	-	+	+	+	+	+	+
88	<i>Cyperus rotundus</i> L.	H	-	+	-	-	-	+	-	-	-	-	-	+	+	+	+	+	+
89	<i>Cyperus scarlosus</i> R.Br.	H	-	+	-	-	-	+	-	-	-	-	-	+	+	+	+	+	+
90	<i>Daucus carota</i> L.	H	-	-	-	-	+	+	-	-	-	+	-	-	-	+	-	-	-
91	<i>Descurainia Sophia</i> (L.) Webb.	H	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
92	<i>Desmostachya bipinnata</i> (L.) Stapf.	H	-	-	-	+	-	-	+	-	-	-	+	-	-	+	-	-	-
93	<i>Dichanthium annulatum</i> (Forssk) Staph.	H	-	-	-	+	-	+	-	-	-	-	-	-	-	+	-	-	-
94	<i>Digera muricata</i> (L.) Mart.	H	-	-	-	-	+	+	-	-	-	-	-	+	+	+	+	+	+
95	<i>Echinochloa colonum</i> (L.) Link.	H	-	-	+	-	-	-	+	-	-	-	-	+	+	+	+	+	+
96	<i>Echinops echinatus</i> D.C.	H	-	-	-	+	-	-	+	-	-	+	-	-	-	+	-	+	-
97	<i>Eragrostis poaoides</i> Beauv.	H	-	-	+	-	-	+	-	-	-	-	-	+	+	+	+	+	+
98	<i>Erodium malacoides</i> (L.) Her. Ex Ait.	H	-	-	+	-	-	-	+	-	-	+	-	-	-	+	-	+	-
99	<i>Eruca sativa</i> Millel.	H	-	-	+	-	-	+	-	-	-	+	-	-	+	+	-	+	+
100	<i>Euphorbia helioscopia</i> L.	H	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101	<i>Euphorbia prostrata</i> Ait.	H	-	+	-	-	-	+	-	-	-	-	-	+	+	+	+	+	+
102	<i>Evolvulus alsinoides</i> L.	H	-	-	-	+	-	+	-	-	-	+	-	-	-	+	+	-	-
103	<i>Fagonia cretica</i> L.	H	-	+	-	-	-	+	-	-	-	+	-	-	-	-	-	+	-
104	<i>Fumaria indica</i> (Hausk.) Pugsley.	H	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
105	<i>Helianthus annus</i> L.	H	-	-	+	-	-	+	-	-	-	+	-	-	-	+	+	-	-
106	<i>Heliotropium europaeum</i> L.	H	-	-	-	+	-	+	-	-	-	+	-	-	-	-	-	+	-
107	<i>Heliotropium strigosum</i> Willd.	H	-	-	-	+	-	+	-	-	-	+	-	-	-	-	-	+	-
108	<i>Hordeum vulgare</i> L.	H	-	+	-	-	-	+	-	-	-	-	-	+	+	+	+	+	+
109	<i>Hypericum pendulum</i> L.	H	-	-	+	-	-	+	-	-	-	-	-	+	+	-	-	-	-
110	<i>Iflora fontanesii</i> Cass.	H	-	-	+	-	-	+	-	-	-	+	-	-	-	+	-	-	-
111	<i>Indigofera linifolia</i> (L.f.) Retz.	H	-	-	-	-	+	+	-	-	-	+	-	-	-	+	-	-	-
112	<i>Ipomoea hederacea</i> (L.) Jacq.	H	-	-	+	-	-	+	-	-	-	+	-	-	+	+	+	-	-
113	<i>Kickxia ramosissima</i> (Wall) Janchen.	H	-	+	-	-	-	+	-	-	-	-	-	+	+	+	+	+	+
114	<i>Lactuca sativa</i> L.	H	-	-	+	-	-	+	-	-	-	+	-	-	-	+	-	-	-
115	<i>Lactuca serriola</i> L.	H	-	-	+	-	-	+	-	-	-	+	-	-	-	+	-	-	-
116	<i>Launaea nudicaulis</i> (L.) Hook. f.	H	-	-	+	-	-	+	-	-	-	+	-	-	+	+	+	+	+
117	<i>Lens culinaris</i> Medic.	H	-	+	-	-	-	+	-	-	-	-	-	+	+	+	+	+	+

Table 2. Contd.

118	<i>Lippia nodiflora</i> (L.) L.C. Rich.ex. Michaux.	H	-	-	+	-	-	+	-	-	-	+	-	-	-	+	-	-	-
119	<i>Lithospermum arvense</i> L.	H	-	-	-	+	-	+	-	-	-	+	-	-	-	+	-	-	-
120	<i>Luffa acutangula</i> Roxb.	H	-	-	-	-	+	+	-	-	-	+	-	-	-	+	-	-	-
121	<i>Luffa aegyptiaca</i> (L.) M. J. Rocrn.	H	-	-	-	-	+	+	-	-	-	+	-	-	-	+	-	-	-
122	<i>Lycopersicon esculentum</i> Mill.	H	-	-	-	-	+	+	-	-	-	+	-	-	-	+	-	-	-
123	<i>Malcolmia africana</i> (L.) R.Br.	H	-	-	-	-	+	+	-	-	-	+	-	-	-	+	-	-	-
124	<i>Malva parviflora</i> L.	H	-	-	-	+	-	+	-	-	-	-	-	+	+	+	+	+	+
125	<i>Malva neglecta</i> Wallr.	H	-	-	-	+	-	+	-	-	-	-	-	+	+	+	+	+	+
126	<i>Malvastrum coromandelianum</i> (L.) Gareke.	H	-	-	+	-	-	-	+	-	-	+	-	-	-	+	-	-	-
127	<i>Medicago laciniata</i> (L.) Mill.	H	-	-	+	-	-	-	+	-	-	+	-	-	-	+	+	+	+
128	<i>Melilotus indicus</i> (L.) All.	H	-	-	+	-	-	+	-	-	-	+	-	-	-	+	-	-	-
129	<i>Mentha arvensis</i> L.	H	-	-	+	-	-	-	+	-	-	+	-	-	-	+	-	-	-
130	<i>Micromeria biflora</i> (Buchi. Ham exD. Don Benth).	H	-	-	+	-	-	-	+	-	-	+	-	-	-	+	-	-	-
131	<i>Momordica charantia</i> L.	H	-	-	+	-	-	-	+	-	-	+	-	-	-	+	-	-	-
132	<i>Orobancha ramose</i> L.	H	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
133	<i>Oxalis corniculata</i> L.	H	-	-	-	-	+	-	+	-	-	+	-	-	-	+	-	-	-
134	<i>Peganum harmala</i> L.	H	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
135	<i>Pennisetum typhoideum</i> (Burm.) Stapf.	H	-	+	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+
136	<i>Phragmites karka</i> (Retz.) Trin. Ex. Steud.	H	-	-	-	-	+	-	+	-	-	+	-	-	-	+	-	-	-
137	<i>Plantago ciliata</i> Desf.	H	-	-	+	-	-	+	-	-	-	-	-	+	+	+	+	+	+
138	<i>Plantago ovata</i> Forssk.	H	-	-	+	-	-	+	-	-	-	+	-	-	-	+	+	+	+
139	<i>Pupalia lappacea</i> (L.) Juss.	H	-	-	+	-	-	-	+	-	-	-	-	+	-	+	-	+	-
140	<i>Ranunculus muricatus</i> L.	H	-	-	-	+	-	-	+	-	-	-	-	+	-	+	-	-	-
141	<i>Raphanus sativus</i> L.	H	-	-	-	+	-	-	+	-	-	-	-	+	-	+	-	-	-
142	<i>Rumex dentatus</i> L.	H	-	-	-	+	-	+	-	-	-	-	-	+	+	+	+	+	+
143	<i>Salvia moorcroftiana</i> Wallich ex Benth.	H	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
144	<i>Saussurea heteromalla</i> (D.Don.) Hand.	H	-	-	-	-	+	-	+	-	-	+	-	-	-	+	-	+	-
145	<i>Sesamum indicum</i> L.	H	-	+	-	-	-	-	+	-	-	-	-	+	-	+	-	-	-
146	<i>Silene conoidea</i> L.	H	-	-	-	+	-	-	+	-	-	-	-	+	+	+	-	-	-
147	<i>Sissymbrium irrio</i> L.	H	-	-	+	-	-	+	-	-	-	+	-	-	-	+	-	+	-
148	<i>Solanum incanum</i> L.	H	-	-	-	+	-	+	-	-	-	-	-	+	-	+	-	+	-
149	<i>Solanum nigrum</i> L.	H	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
150	<i>Solanum surattense</i> Burm. f.	H	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
151	<i>Sonchus asper</i> (L.) Hill.	H	-	-	+	-	-	+	-	-	-	+	-	-	-	+	-	-	-
152	<i>Sorghum vulgare</i> (L.) Pers.	H	-	+	-	-	-	+	-	-	-	+	-	-	-	+	-	+	-
153	<i>Spinacia oleraceae</i> L.	H	-	-	+	-	-	+	-	-	-	+	-	-	-	+	-	-	-
154	<i>Taraxacum officinale</i> Weber.	H	-	-	+	-	-	-	+	-	-	+	-	-	-	+	-	-	-
155	<i>Trianthema portulacastrum</i> L.	H	-	-	+	-	-	-	+	-	-	+	-	-	-	+	-	-	-
156	<i>Tribulus terrestris</i> L.	H	-	-	+	-	-	+	-	-	-	-	-	+	+	+	+	+	+
157	<i>Trifolium alexandrianum</i> L.	H	-	+	-	-	-	+	-	-	-	-	-	+	+	+	+	+	+
158	<i>Triticum aestivum</i> L.	H	-	+	-	-	-	+	-	-	-	-	-	+	+	+	+	+	+

Table 2. Contd.

159	<i>Vicia sativa</i> L.	H	-	+	-	-	-	+	-	-	-	-	-	+	+	+	+	+	+
160	<i>Xanthium strumarium</i> L.	H	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
161	<i>Zea mays</i> L.	H	-	+	-	-	-	+	-	-	-	-	-	+	+	+	+	+	+
Total		-	8	22	36	23	7	74	22	0	0	58	0	40	44	89	42	52	38
Grand total		-	29	32	43	34	23	88	40	2	2	83	1	48	61	118	51	79	43

(38 species, 88.37), tree (four species, 9.3%) and shrubs (single species, 2.32%) (Table 2 and Figure 6).

In this study, it was observed personally that in summer, palatability was reached at high stage due to the unavailability of herbs, so the animals for a moment grazes unpalatable plants which indicate that the palatability depends on the existence of plant species (Figure 7). It was perceived that in winter, the *Zizyphus mauritiana* became a high palatable species in the plain area, while in spring they become low palatable or rare palatable which substantiated that the palatability depends on seasonal discrepancy. It was noted that the *Dalbergia sissoo* was grazed by cow and camel only (Figure 8). Hickman et al. (2004) described that livestock diversity was the main changeable controlling diversity of the plant species and its plant life composition changes are also studied in grazing areas that are moderately acceptable. Papachristou et al. (2003) stated that goats like all livestock, express nutritional freedom since they choose plant species of high nutrient in meadow. The free grazing rangeland plants include *Cymbopogon jwarancusa* and *Dichanthium annulatum*. *C. jwarancusa* was commonly available at lower hilly area in Chokara and Ambiri Kala. The *D. annulatum* was available throughout the study area. In this study, it was observed that the people of the area mostly use *Z. mauritiana* and *Acacia modesta* during winter and spring, respectively as fodder for goat. Hussain

and Durrani (2009) observed the seasonal availability of forage, palatability and preferences of goats and sheep varied in their botanical composition throughout the growing season. Sheep generally preferred grasses and goat shrubs in the investigated area. Our result agrees with other workers (Farooq, 2003; Gillen and Sims, 2004; Melinda et al., 2002; Solomon et al., 2007).

From this investigation, it was noticed that the plant palatability varied significantly throughout the year at different altitude by different animals and became tremendous in summer. The palatability depends on the plant availability. In areas where vegetation was much, animals made choice of plants for their requirement, but it was also observed that in summer the animals ate non-palatable species. The goats walking up a sharp slope may necessitate up to 10 times more vigor as walking on the plain to reach tender preferred shrubby twigs (Figure 9); our judgment had the same opinion with Grunwaldt et al. (1994) who stated that at low elevation, salt marsh species are less palatable than high elevation.

Some species including *Euphorbia helioscopia* were non palatable probably due to occurrence of phenolics, alkaloids, saponins and further toxic materials (Kayani et al., 2007). *Euphorbia prostrata*, *Cynodon dactylon* and *Cenchrus ciliaris* were highly palatable in the area. According to Sultan et al. (2008) and Inam-ur-Rahim et al. (2008), *Cenchrus ciliaris* is the most common

grass along field boundaries and margins of the heaps. Palkova and Leps (2008) stated that the incensement of plant attractiveness for herbivores is due to the presence of nitrogen content in plant species. It becomes difficult to critically differentiate between lethal and nonpoisonous plants as animals obtain detestation to food as a consequence of offensive approach of physical awkwardness happening by existence of poison, or glut of nutrients, or by insufficient nutrient foodstuff.

This is noticeable when grazing animals no longer acquire attention still for favorite food or when offered substitutes (Provenza, 1995). Most plants were toxic while eating in huge quantity at a particular stage which might give nutritive forage when consumed in small quantity or mixed up with other forage. Various herds were found freely in the area because the professions of most people are agriculture and livestock.

In tree species, *Z. mauritiana* leaves and shoots become highly preferred by goat under compulsion during early spring and late winter, while in summer, the *Acacia modesta* is highly preferred in hilly area. However, in plains, during summer, the animals graze every plant which had come in their front, due to low availability of plant species in the area (Figure 10). Omer et al. (2006) observed that production of food is higher in spring in dry temperate forests in Northern area of Pakistan. Hussain and Durrani (2009) working on Harboi range land, Pakistan, described that goat

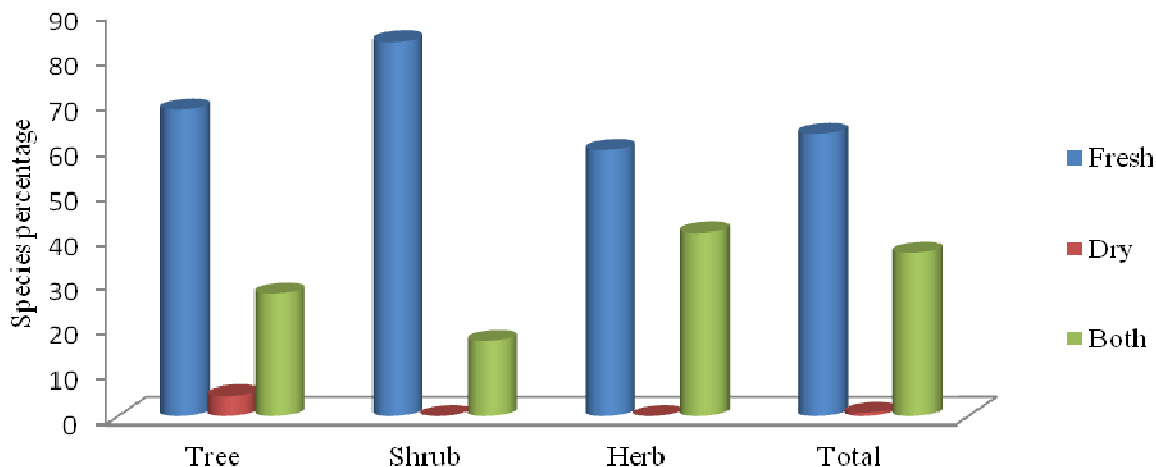


Figure 5. The preference by lives stock for fodder in fresh and dry condition of Tehsil Takht-e-Nasrati, Karak.

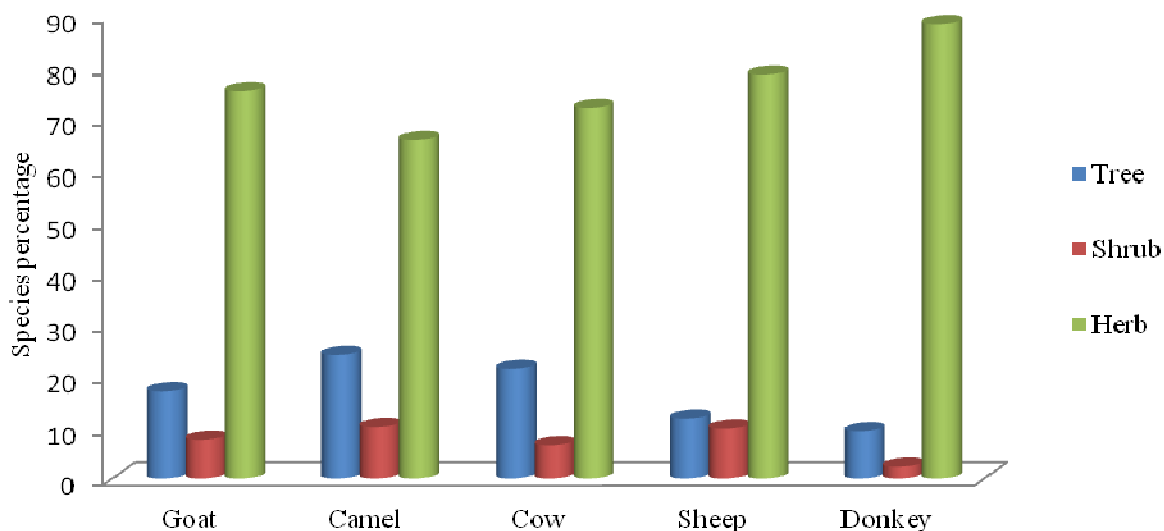


Figure 6. Animal preference for plant species in Tehsil Takht-e-Nasrati, Karak.

consumed more species of herbs, shrubs, grasses and tree than other animals. Our results are similar with these previous statements. The camel preferred *Tamarix aphylla*, *Heliotropium europaeum* in summer and *Fagonia cretica* in spring. The cow preferred *Dalbergia sissoo* in summer, while in spring and winter it preferred *Saccharum bengalense* due to unavailability of plants (Figure 11). It was obvious that the cow and donkey did not prefer spiny or prickly, while camels preferred such plants. Due to the access and availability of species, grasses were preferred in spring and trees were preferred in winter, while in summer the herbs and shrubs were preferred by animals in the area. It was observed that goat preferred trees and shrubby species as compared to other animals, while during comparison among

plant strata, the shrubs were preferred by cow (Figure 12). Our outcome is similar with that of Nyamanagara and Ndlovu (1995). Rasool et al. (2005) stated that grazing system of Baluchistan involved 74% nomads, 21% transhumanist and 5% inactive type.

Acacia nilotica was preferred mostly at flowering stage in the plains. Palatable and non palatable species and animal preference were also studied by Hussain and Mustafa (1995) and Gyamtosho et al. (1996). Kayani et al. (2007) reported that phenolics, alkaloids and saponins chemicals in plants were regarded as anti-nutritional feature which decreased the palatability. These animals might have adapted to digest these plants because of nutritional habit of eating a particular feed during early life. It was suggested that saliva might possibly conjugate



Figure 7. Sheep graze upon non palatable plants under compulsion.



Figure 8. *D. sissoo* is being grazed by cow due to their preference.



Figure 9. The goats reached inaccessible area due to non availability of forage.



Figure 10. Goat try to reach high shoots due to non availability of forage in the area.



Figure 11. *S. bengalense* grazed as a preference by cow during spring and winter due to unavailability of other forage plants.



Figure 12. Goat preferred *A. modesta* in summer.

with the volatile oils and tannins to render them non-toxic (Nyamangara and Ndlovu, 1995). *C. jwarancusa* was low palatable. The presence of phenolics and alkaloids gave negative factors in the palatability for animals in *C. jwarancusa* (Kayani et al., 2007). In plains, the grazing seasons starts from April and ceases in October. The present study shows that the palatability depends on plant species, animal type and season. It was suggested that plant palatability should be conformed on the basis of animal food requirement in support of improving physical condition and output of domestic animals in the region.

Conclusion

From this study, it was observed that palatability does not only depend on plant species, but also depend on different factors such as animal type, seasonal type, area habitat and weather. It is suggested that plant palatability should conform to the basis of elemental and nutritional value of plant species and also the animal food requirement in support of improving physical condition and output of domestic animals in the region.

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