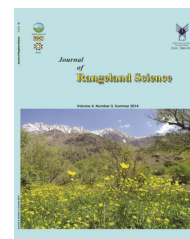


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**Full Length Article:**

## Preference Value Evaluation of Rangeland Plant Species for Kaboudeh Sheep

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**Abstract.** Study on the livestock diet is one of the main priorities in the management of rangeland in Iran. So, this study was conducted to compare preference values of plant species in three age classes of Kaboudeh sheep (one, three and five year old ones) in rangelands of Bavanat, Fars province, Iran. For each age class, four sheep were selected and their grazing times from different plant species were recorded using a timing method (chronometer) for two hours during the day. The effects of livestock age, plant species and their interactions on preference values of plant species were assessed using a factorial experiment (GLM test). Also, one way ANOVA was applied to compare preference values between plant species for each age class of animals. The results showed that the age of the animals and plant species had significant effects on preference values of plant species. Species of *Poa pratensis* and *Avena fatua* for young animals and *Acer cinerascens* for older animals had higher preference values. In addition, species of *Poa pratensis* and *Prangos ferulaceae* had appropriate preference values for all three age classes of animals. As vegetation cover in the study area is mostly consisted of the bushes and shrubs in autumn and on the other hand, sheep has little ability to graze this kind of plant species subsequently during the grazing period, they dominantly focus on herbal species. In general, animal diet demands cannot be provided from rangelands and it is required to use the methods of manual feeding with dry forage and supplements. One of the possible alternatives is to harvest and store the annual yield of *P. ferulaceae* in spring in order to feed the animals in autumn and winter.

**Key words:** Preference value, Age class, Kaboudeh sheep, Bavanat rangelands

## Introduction

Nutritional needs and grazing of livestock in rangelands are often encountered with problems such as low forage quality and quantity. Knowledge about the factors that affects the selection and preference of forage by livestock is necessary for proper management of rangelands, especially in arid and semi-arid regions. In addition, suitable rangeland management requires an adequate knowledge about temporal and spatial variations of forage quality, quantity and preference value of plant species for livestock as well. Preference value is defined as higher tendency of animals to graze a special plant species in comparison with other species in free grazing conditions in which animal is able to select plant species freely.

Preference value is affected by animal characteristics such as age, sex and kind of livestock (Arzani, 2009). Study on forage quality has been done continuously in Iran (e.g. Ghanbari and Sahraei, 2012) while the results about diet selection and preference values have been seldom reported (Askarizadeh and Heshmati, 2010). Recognition of livestock diet can be used to set proper programs of feeding for different kinds of animals in different seasons in order to reach a better management of rangelands. Some researchers such as Ashrafzadeh *et al.* (2012) studied plant species preference values for camels in southern region of Fars province. They reported that annual species (e.g. *Stipa capensis*) in spring and perennial species (e.g. *Ziziphus spina-christi*) in other seasons can be efficiently used for supplying nutritional demands of camels. Hosseini Kahnuj *et al.* (2011) studied preference value of plant species for Raeni goats in rangelands of Kahnuj in South of Kerman province.

They reported that in conditions of abundance of forage supply during the late winter to the late spring, grass species (e.g. *Stipa capensis*) and in the

late summer, shrubby plants have important roles in supplying diet for this animal. Baghestani Meybodi and Arzani, (2004) evaluated preference values of some important plant species in steppe rangelands of Yazd and reported that in existence of grass species, animals focus on grazing these species but if these grass species decrease, animals divert their preference to shrubs. Dianati Tilaki & Mir Jalili (2007) investigated the times that different animals (sheep and goat) spent on grazing some plant species in Yazd rangelands. They stated that some species (e.g. *Artemisia aucheri*) were the most palatable plants for sheep. Haenlein & Ramirez (2007) reported that sheep preferred to graze grasses, shrubby plants and forbs, respectively. On the other hand, individuals of a kind of animal also differ in their grazing behavior. Vallentine (2001) and some other researchers (e.g., Ahmadi *et al.*, 2009 and Arzani, 2009) considered the animal's age as one of the most important factor that affects the diet preference of livestock. However, there are many different factors that affect diet of livestock in rangelands. As a result, it is necessary to conduct the studies in different conditions such as different regions in the country, different seasons and different kinds of livestock to identify factors that affect grazing behavior of livestock. Finally, as there should obtain knowledge about animals and pastures in each region instead of approving one program for all rangelands, special programs can be prescribed for each rangeland. So, this study aimed to assess preference values of plant species for three age classes (one year, three years and five year old ones) of Kaboudeh sheep race in summer rangeland of Bavanat, Fars province, Iran.

## Materials and methods

### Study area

The study area is located in the rangelands of northeastern Bavanat, Fars, Iran. The distance of the study area from

Shiraz city was 240 km and its area was ca 700 ha. Mean annual rainfall of the area is 270 mm that falls mostly during autumn and winter seasons. Geographical location of the study area is 53° 45' 43" eastern longitude and 30° 12' 14" northern latitude. Regional climate is cold and dry winters and summers' duration is short with mild temperature. Minimum and maximum air temperatures are -20 °C and 34 °C, respectively. Maximum altitude is 3362 m above sea level at peak of mount Khaton (Ashrafzadeh *et al.*, 2014). Vegetation cover includes herbaceous species, bushes, shrubs and trees. In spring, annual plants such as *Prangos ferulaceae* have a considerable persistence in vegetation cover of the study area.

### **Vegetation cover measurements**

Vegetation sampling was done in the mid of autumn, at the period of falling down of leaves of shrubs and trees (and after seeding stage of perennial herbs). Although, bushes and shrubs were dominated in the above-ground vegetation, herbaceous species in form of dry stands existed in composition of vegetation as well. 3×3m plots were applied in the study for vegetation assessment (Kerbs, 2001; Mesdaghi, 2002; Cox, 2002). In the study area, three key areas were selected. In order to evaluate vegetation cover, 20 plots were established randomly in each key area. Then, percentage of cover of all plant species was estimated and plant species were also identified inside the plots.

### **Measurement of preference values of plant species**

Preference values of all plant species were recorded by a timing method (chronometer) for three age classes of animals in the key areas. Three age classes of Kaboudeh sheep (ewes of one, three and five year old ones) were selected. Then, for each age class, four

focal animals were selected. In each day, one focal animal grazing duration of plant species was measured for two hours. Time recording was done every morning from 8 to 10 AM. Then, relative grazing time of each species was determined in a percentage value. As different species had different preference values, plant species were also classified into the palatability classes. In the first step, the time that was spent on grazing a special species was recorded by a timing method (Chronometer), then preference value was computed (relative grazing time) and analyzed with the software. Finally, according to the preference values of plant species in the experimental field, the class of palatability was defined for each plant species.

### **Statistical analysis**

The data had a normal distribution. Factorial experiment (GLM: General Linear Model) was used to examine the impacts of animal age, plant species and their interactions on the preference values. The preference value as the dependent factor and age and species as the fixed independent factors were entered into the model. Since the interactions between age and plant species were not significant, one-way ANOVA and post-hoc tests were used to compare the preference values of plant species for each age class of animals (one, three and five year old ones). All statistical analyses were applied by Excel and SPSS ver. 17 software.

### **Results**

#### **Vegetation types in the experimental field**

Based on the field surveys and dominant plant species, three vegetation types (communities) were recognized in the study area. It should be noted that some of the recorded species were in the form of dry standing vegetation and litter (Table 1).

**Table 1.** Plant species that existed in each vegetation type

	Species	Family	Life Form	Vegetation Cover (%)
Type I	<i>Ferula foetida</i>	Apiaceae	Herb	33
	<i>Artemisia aucheri</i>	Asteraceae	Shrub	17
	<i>Prangos ferulaceae</i>	Apiaceae	Herb	13
	<i>Acer cinerascens</i>	Aceraceae	Tree	8
	<i>Amygdalus lycioides</i> var. <i>horrida</i>	Rosaceae	Shrub	3
	Type II	<i>Artemisia aucheri</i>	Asteraceae	Shrub
<i>Prangos ferulaceae</i>		Apiaceae	Herb	10
<i>Avena fatua</i>		Poaceae	Herb	15
<i>Poa pratensis</i>		Poaceae	Herb	10
<i>Berberis vulgaris</i>		Berberidaceae	Shrub	3
<i>Phlomis fruticosa</i>		Lamiaceae	Herb	2
Type III	<i>Acer cinerascens</i>	Aceraceae	Tree	25
	<i>Amygdalus lycioides</i> var. <i>horrida</i>	Rosaceae	Shrub	18
	<i>Ferula foetida</i>	Apiaceae	Herb	10
	<i>Prangos ferulaceae</i>	Apiaceae	Herb	8
	<i>Artemisia aucheri</i>	Asteraceae	Shrub	3
	<i>Gundelia tournefortii</i>	Asteraceae	Herb	1
	<i>Achillea millefolium</i>	Asteraceae	Herb	1

### Analysis of variance and mean comparisons

Results of GLM showed that preference values of plant species were significantly affected by animals' age classes and plant species. But animal age and plant species interaction effects were not significant on preference value of plants by Kaboudeh sheep (Table 2).

Results of one way ANOVA and Duncan test showed that plant species had a significant difference of preference values for Kaboudeh sheep. *Poa pratensis* and *Avena fatua* had the highest preference value for one year old animals

and species such as *Astragalus parrawinus* and *Acer cinerascens* were not grazed by this age class. Three-year-old animals spent most of their time on grazing *Prangos ferulaceae* and *Poa pratensis* but they did not graze *Amygdalus lycioides* var. *horrida*.

The highest preference value of the *Acer cinerascens* and *Poa pratensis* was related to five year old animals, and species such as *Berberis vulgaris* were not consumed by the animals of this age (Table 3). Finally, the results showed that the palatability of *Prangos ferulaceae* was in class I for all the ages (Table 4).

**Table 2.** The result of the analysis of variance and the level of F significant of animal age, plant species and their interactions on the preference value

Sources of Variations	df	F	Sig.
Animal age	2	1.36	0.043
Plant species	15	4.22	0.000
Plant species× Animal age	30	1.32	0.512

**Table 3.** Comparison of preference values of plant species for each age class by one-way ANOVA

Plant Species Name	Family	Life Form	Animal Age Class		
			One Year Old	Three Years Old	Five Years Old
<i>Artemisia aucheri</i>	Asteraceae	Shrub	3.60 C (a)	4.70 C (a)	8.30 C (a)
<i>Acer cinerascens</i>	Aceraceae	Tree	0.00 D (c)	0.00 D (c)	4.51 A (a)
<i>Avena fatua</i>	Poaceae	Herb	14.10 B (a)	14.00 B (a)	3.70 C (b)
<i>Amygdalus lycioides</i> var. <i>horrida</i>	Rosaceae	Shrub	0.00 D (c)	0.00 D (c)	0.00 D (c)
<i>Astragalus adscendens</i>	Fabaceae	Shrub	0.00 D (c)	0.00 D (c)	0.00 D (c)
<i>Achillea millefolium</i>	Asteraceae	Herb	9.00 C (a)	0.00 D (c)	0.00 D (c)
<i>Astragalus parrawinus</i>	Fabaceae	Shrub	0.00 D (c)	0.00 D (c)	0.00 D (c)
<i>Berberis vulgaris</i>	Berberidaceae	Shrub	0.00 D (c)	0.00 D (c)	0.00 D (c)
<i>Ferula foetida</i>	Apiaceae	Herb	0.00 D (c)	0.00 D (c)	0.00 D (c)
<i>Gundelia tournefortii</i>	Asteraceae	Herb	0.00 D (c)	0.00 D (c)	3.80 C (a)
<i>Malva neglecta</i>	Malvaceae	Herb	0.00 D (c)	0.00 D (c)	0.00 D (c)
<i>Melilotus officinalis</i>	Fabaceae	Herb	0.00 D (c)	1.40 C (a)	0.00 D (c)
<i>Phlomis fruticosa</i>	Lamiaceae	Herb	0.00 D (c)	0.00 D (c)	0.00 D (c)
<i>Poa pratensis</i>	Poaceae	Herb	44.10 A (a)	33.1 A (a)	49.60 A (a)
<i>Prangos ferulaceae</i>	Apiaceae	Herb	6.50 C (b)	16.5 B (a)	17.40 B (a)
<i>Scorzonera tortuosissima</i>	Asteraceae	Herb	0.00 D (c)	0.00 D (c)	5.50 C (a)

Capital letters show comparisons of column (between species for individual animal's age class)

Lowercase letters in parenthesis show comparisons of row (between age classes of animals)

(As the numbers in the table were too small so each number was multiplied by 100)

**Table 4.** Class of palatability of plant species for three age classes of sheep

Plant Species	Family	Life Form	Palatability Classes for Age Classes of Animals		
			One Year Old	Three Years Old	Five Years Old
<i>Artemisia aucheri</i>	Asteraceae	Shrub	III	III	III
<i>Acer cinerascens</i>	Aceraceae	Tree	N	N	I
<i>Avena fatua</i>	Poaceae	Herb	II	II	III
<i>Amygdalus lycioides</i> var. <i>horrida</i>	Rosaceae	Shrub	N	N	N
<i>Astragalus adscendens</i>	Fabaceae	Shrub	N	N	N
<i>Achillea millefolium</i>	Asteraceae	Herb	III	N	N
<i>Astragalus parrawinus</i>	Fabaceae	Shrub	N	N	N
<i>Berberis vulgaris</i>	Berberidaceae	Shrub	N	N	N
<i>Ferula foetida</i>	Apiaceae	Herb	N	N	N
<i>Gundelia tournefortii</i>	Asteraceae	Herb	N	N	III
<i>Malva neglecta</i>	Malvaceae	Herb	N	N	N
<i>Melilotus officinalis</i>	Fabaceae	Herb	N	III	N
<i>Phlomis fruticosa</i>	Lamiaceae	Herb	N	N	N
<i>Poa pratensis</i>	Poaceae	Herb	I	I	I
<i>Prangos ferulaceae</i>	Apiaceae	Herb	III	II	II
<i>Scorzonera tortuosissima</i>	Asteraceae	Herb	N	N	III

N= Not grazed by sheep

## Discussion

According to the results of this study, different plant species have different preference values for Kaboudeh sheep. Although most of the nutritional requirements of the livestock in the studied area were supplied from the rangelands, our results indicated that vegetation composition in autumn is poor. Dominant plants in the area are in the shrubby and bushy forms in autumn while sheep has little ability to graze such

plants. Some other researchers identified that grazing season is an effective factor on preference value of plant species (Sanadgol, 2005; Alikhah Asl et al., 2009; Schwartz and Ellis, 1981; Migongo-Bake and Hansen, 1987). Raoufi Rad et al. (2013) reported that bushy species had less palatability for sheep and a greater part of its diet (about 67%) is consisted of herbaceous species. However, our results showed that the age classes differ in their grazing behaviors in

consuming plant species. One-year old animals consumed only five of the 16 different plant species in the area. *Poa pratensis* and *Avena fatua* had higher preference values for one-year sheep and shrubby species except *Artemisia aucheri* was not consumed by these animals. In addition, *Artemisia aucheri* had not considerable preference values and is classified in class III of palatability. Therefore, it can be concluded that in extreme environmental conditions that herbaceous species are rare in the plant composition, one-year old sheep do not have any tendency to consume bushy and shrubby species and subsequently, they are not able to provide their nutritional requirements by grazing the branches. Hosseini Kahnuij *et al.* (2011) showed that one-year old animals spent most of their time on grazing of herbaceous species. On the other hand, consumption of bushy and shrubby species by this age class was minimal. Indeed, bushy and shrubby species have harsh and unfavorable structures. But older animals (three years and older) had focused to consume species such as *Prangos ferulaceae* and *Poa pratensis* while these age classes did not graze such species as *Amygdalus lycioides* var. *horrida*.

Despite other ages, five-year old animals grazed *Acer cinerascens* strongly and this tree was in the group of palatable species for five-year old animals. This age group consumed *Gundelia tournefortii* occasionally although their tissue was barbed. The results reported by Ashrafzadeh *et al.* (2012) showed that older animals are more successful to select tree species and woody plants can provide a part of their nutritional requirements. Hosseini Kahnuij *et al.* (2011) stated that older animals had wider thresholds to select a composition of herbaceous, bushy and shrubby species for grazing. These results showed that sheep did not graze branches in considerable amount but in hard conditions, the animals that had good

physical conditions were able to provide a part of their nutritional requirements from species such as *Gundelia tournefortii* and *Acer cinerascens*. Forage availability can affect both consumption and nutritional values of grazed forage (Rogosic *et al.*, 2006; Yayneshet *et al.*, 2008) and older animals are taller and prefer to graze tall species (Sanon *et al.*, 2007).

## Conclusion

In overall, the results of this study showed that in every composition of plants, the sheep prefer to graze herbaceous species and their ability for grazing woody species was very little. Therefore, sheep in hard conditions (i.e. autumn) were not able to supply the requirements from rangeland and it is necessary to feed them with complementary forage. One of the options can be the harvesting of some plants (e.g. *Prangos ferulaceae*) and storing of them in spring to feed animals in autumn and winter.

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## ارزیابی ارزش رجحانی گونه‌های گیاهی برای گوسفند نژاد کبوده

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**چکیده.** مطالعه‌ی رژیم غذایی دام‌ها یکی از مهمترین اولویت‌های مدیریت مراتع کشور می‌باشد. تحقیق حاضر با هدف مقایسه‌ی ارزش رجحانی گونه‌های گیاهی برای سه گروه سنی (یک‌ساله، سه‌ساله و پنج ساله) گوسفند نژاد کبوده در مراتع شمال استان فارس (بخش مزایجان از توابع شهرستان بوانات) انجام شد. برای هر کلاسه سنی، چهار رأس دام انتخاب و به مدت دو ساعت در هر روز، زمان چرای هر رأس دام از گونه‌های گیاهی بوسیله‌ی روش زمان‌سنجی (کرونومتر) اندازه‌گیری شد. برای بررسی اثر سن دام، گونه گیاهی و اثر متقابل آنها بر روی ارزش رجحانی گونه‌ها از طرح فاکتوریل (آزمون GLM) استفاده شد. مقایسه ارزش رجحانی گونه‌های گیاهی برای هر کلاسه سنی دام با استفاده از آزمون تجزیه واریانس یکطرفه انجام شد. نتایج نشان داد کلاسه سنی دام و گونه گیاهی تأثیر معنی‌داری بر ارزش رجحانی گونه‌های گیاهی داشتند، بطوری‌که گونه‌های *Poa pratensis* و *Avena fatua* برای دام‌های جوانتر و گونه‌ی *Acer cinerascens* برای دام‌های مسن‌تر بیشترین ارزش رجحانی را داشتند. علاوه بر این گونه‌های *Poa pratensis* و *Prangos ferulaceae* برای هر سه گروه سنی ارزش رجحانی مناسبی داشتند. بطور کلی با توجه به اینکه اغلب پوشش گیاهی مراتع این منطقه در فصل پاییز مربوط به گونه‌های بوته‌ای و درختچه‌ای می‌باشد و از طرفی گوسفند توانایی چندانی در استفاده از چنین گونه‌هایی نداشته و غالب رفتار چرای آن به گونه‌های علفی معطوف می‌باشد، بنابراین نیازهای غذایی دام در این شرایط نمی‌تواند از مراتع تأمین گردد و نیازمند اقدامات دیگری از جمله تغذیه دستی و کمکی می‌باشد. یکی از این گزینه‌ها می‌تواند برداشت و ذخیره بخشی از گونه‌ی *P. ferulaceae* در فصل بهار برای تغذیه دام در فصل‌های پاییز و زمستان باشد.

**کلمات کلیدی:** ارزش رجحانی، کلاسه سنی، گوسفند کبوده، مراتع بوانات