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The Effect of Dietary Alhagi (*Camel grass*) Ensiled with Different Levels of Low Quality Date-Palm on Apparent Nutrient Digestion Coefficients in Kermani Sheep

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Abstract: A digestibility trial was conducted to evaluate feed consumption and digestibility coefficients of DM, OM, CP and Ca in Kermani lambs fed Alhagi silages supplemented with low quality date palm. Animals were randomly distributed into three groups of three lambs. The first group was fed silage containing 5% date-palm, the second group fed silage containing 10% date-palm and the third one received silage containing 15% date-palm. In the digestibility trial, three animals from each group were housed separately in metabolism cages in order to collect faeces. The apparent digestibility of OM was not affected as the date level in silage increased. The digestibility of DM ($p = 0.065$), NDF ($p<0.001$), ADF ($p<0.05$) and CP ($p<0.001$) decreased as the date palm level was increased from 5-15%. Dry Matter Intake (DMI) was increased from 433.9-467.4 g day^{-1} in lambs fed diet containing 15% date-palm silage. Results of this experiment suggested that silage containing 15% date-palm could be a good quality roughage for small ruminants.

Key words: Date palm, digestibility, Alhagi, sheep, organic matter, crude protein

INTRODUCTION

In most areas of Iran where drought is widespread, feed availability is one of the most important limitations on animal production. Alhagi plant is one of the species that rising in the most areas from the lowest desert to mountains. This perennial plant belongs to large legume (Legaminosae), growing in all soil. Its root penetrates underground deeply and in this sense has high resistance to dehydration and resistant to cold and can be grown in altitude of 4000 m.

Alhagi plant and low quality date-palms are the most common feedstuffs for ruminants during drought periods in countries having hot climates. Alhagi, a weed growing in most agricultural farming land and also in deserts with low rainfall is a good source of feed for ruminants. Alhagi plant during seeding containing 78, 29, 288 and 99 g kg^{-1} CP, ether extract, crude fibre and ash, respectively. However, during blossoming CP content of Alhagi increasing to 125.2 g kg^{-1} (Bashtini *et al*., 2008).

The stems and upper parts of Alhagi, including leaves are sun dried and used as feed for small ruminants such as sheep and goats (Bashtini *et al*., 2008). In the south and southeast of Iran, where date-palms are produced on a very large scale, there are >26 million date palm trees, most of which are in Bam, Jiroft and Kahnouj cities located in southeast of Kerman province. The date production in Iran on average is about 20 kg tree^{-1} although, many varieties may produce >125 kg tree^{-1}. As in other industries, production of dates in Iran produces a very large amount of by-products in the form of discarded dates and low quality date palm which are not suitable for packing (Ziaei and Sharifi Hosseini, 2009). Low Quality Date Palms (LQDP) are dried or used fresh as a feed for ruminants (Al-Dabeeb, 2005).

Date-palm contains compounds which may cause some diseases in ruminants particularly in cow therefore, only low amounts are fed to ruminants. Ensiling low quality date-palms with Alhagi may reduce levels of these compounds.

As according to the knowledge, no research in this area has been carried out, the objective of the study was to assess the feeding value of Alhagi and low quality date palm silage mixtures, by measuring the nutrient digestibility of silages in Kermani sheep.

MATERIALS AND METHODS

This experiment was carried out at Jiroft Faculty of Agriculture, Shahid Bahonar University of Kerman, Iran, using Alhagi plants harvested from the university farms and low quality date-palm obtained from Kahnoj, a city in the southeast of Kerman province in February 2009.

As Alhagi belongs to large legume (Legaminosae) which has high buffering capacity resisting to pH variation, therefore we did not include a control treatment without date-palm. The levels of Low Quality Date-

Palm (LQDP) (5, 10 and 15%) were added to Alhagi plant (chopped to 5 cm length) on a fresh weight basis. After thorough mixing of each combination, the mixture was ensiled in three underground silos containing 400 kg each. The silos were opened after 90 fermentation days. pH values were measured according to the method of Denek and Can (2006). The Fleig points of the silages were calculated by the following equation reported by Denek and Can (2006):

$$\text{Fleig points} = 220 + (2 \times \text{DM\%} - 15) - 40 \times \text{pH}$$

where, Fleig points represent for values between 85 and 100, very good quality; 60 and 80, good quality; 55 and 60, moderate quality; 25 and 40, satisfying quality; <20, worthless.

Samples of silage and raw materials (Alhagi, LQDP) were dried at 65°C and analyzed for DM, OM, ash and CP by the procedures of AOAC (1995). Nine Kermani rams (28.06±0.55 kg), at the age of 1 year were used as experimental animals (three per treatment) in an apparent digestibility determination.

The rams were randomly allocated to different treatments and subjected to a 21 day trial period, consisting of a 10 day adaptation period and 10 days feed intake and collection period (Denek and Can, 2006). During the collection period, the rams were fed at *ad libitum* intake in two equal portions at 8:00 and 17:00 h. Water was available at all times.

Silages and faeces were collected and stored according to Denek and Can methods. All diet and faecal samples were stored in plastic bags and kept in freezers until the end of the experiment for chemical analysis. At the end of experiment, Dry Matter (DM), Organic Matter (OM), Crude Protein (CP), ADF and NDF, Ca and P contents of feed and faeces samples were determined according to Van Soest *et al.* (1991) at the Animal Science Research Institute of Mashhad in Khorasan Razavi Province.

Data analysis: Data were subjected to an analysis of variance using the General Linear Model procedure in the statistical package Minitab (2004). Between-treatment comparisons were made using the Tukey-test. The statistical model used for the analysis of dependent variables was:

$$Y_{ijklm} = \mu + T_i + B_r + e_{ijklm}$$

Where:

Y_{ijklm} = The individual observation
μ = The experimental mean
T_i = The treatment effect
B_r = The block effect
e_{ijklm} = The random error

RESULTS AND DISCUSSION

The nutrient composition of Alhagi plant and LQDP are shown in Table 1. Chemical composition, pH and fleig points of silage of Alhagi with different levels of LQDP are shown in Table 2. Supplementing Alhagi with increasing levels of LQDP significantly ($p<0.001$) decreased DM content of silage and silage containing 15% LQDP had lower DM than those of silages containing 5 and 10% LQDP, respectively.

The crude ash of silages containing different levels of LQDP (5, 10 and 15%) was 121, 119.2 and 123.8 g kg^{-1}, respectively and silage consisting 15% LQDP had higher ash compared to the other silages. OM content of silages significantly decreased from 879-876 g^{-1} kg in silages containing 5 and 15% LQDP, respectively.

NDF content of silages significantly ($p<0.001$) decreased from 615-66 and 575 g kg^{-1} and the ADF content of silages was significantly ($p<0.001$) reduced from 500-460 and 457 g kg^{-1} by increasing the level of LQDP from 5-10 and 15%, respectively. Effect of LQDP and Alhagi on CP of silage was significant ($p<0.001$) and silage containing 15%, LQDP had higher CP content (687 compared to 673 and 612 g kg^{-1} CP) than those of the other silage.

The level of Ca and P in silage containing 15% LQDP (13.2 and 1.1 g kg^{-1}) was significantly ($p<0.05$ and 0.001, respectively) higher than Ca and P of silages consisting 5 and 10% LQDP (12.3, 0.8 and 12.4 and 0.7 g kg^{-1}, respectively). In the current experiment pH value was decreased ($p = 0.219$) from 4.5-4.3 in silages containing

Table 1 Chemical composition of Alhagi and date-palm

Component (g kg^{-1})	Alhagi	Date-palm
DM	404.9	755
OM	902.0	981
CP	120.0	20

Table 2: Chemical composition, pH, Fleig points of silage of Alhagi supplemented with different Levels of Low Quality Date-Palm (LQDP)

Variables	5%	10%	15%	S.E.M	p-value
	----------LQDP----------				
DM (g kg^{-1})	430.0^a	400.0^b	370.0^c	33.00	0.001
Crude-ash (g kg^{-1})	121.0	119.2	123.8	6.41	0.880
OM (g kg^{-1})	879.0	880.8	876.0	6.40	0.879
NDF (g kg^{-1})	615.0^a	566.0^b	575.0^c	5.00	0.001
ADF (g kg^{-1})	500.0^a	460.0^b	457.0^b	1.00	0.001
CP (g kg^{-1})	673.0^a	612.0^b	687.0^c	5.00	0.001
Ca (g kg^{-1})	12.3^a	12.4^a	13.2^b	1.50	0.023
P (g kg^{-1})	0.8^a	0.7^b	1.1^c	0.10	0.001
pH	4.5	4.3	4.3	0.06	0.219
Fleig-points	114.0	115.3	107.9	2.49	0.195

5 and 10 or 15% LQDP, respectively. The fleig points of the silages decreased (p = 0.195) from 115.0-114.0 and 107.9 in silages containing 10, 5 and 15% LQDP, respectively. Apparent nutrient digestibility of silages and dry matter intake of sheep are shown in Table 3. Increasing LQDP had no significant effect (p>0.05) on DM digestibility of silages. OM digestibility in sheep fed silage containing 5, 10 and 15% was 895, 864 and 817 g kg^{-1}, respectively. Increasing the level of LQDP significantly (p<0.001 and 0.05) decreased apparent digestibility of NDF (from 551-499 and 437 g kg^{-1}) and ADF (from 508-438 and 381 g kg^{-1} in silage containing 5, 10 and 15% LQDP, respectively.

The apparent digestibility coefficient of CP significantly (p<0.001) decreased from 853-714 and 727 g kg^{-1} in sheep received silages containing 5, 10 and 15% LQDP, respectively. Increasing the level of LQDP had no significant effect on Ca digestibility. Ca digestibility in sheep fed silages supplemented with 5, 10 and 15% LQDP was 492, 411 and 433 g kg^{-1}, respectively. Daily DM intake in sheep was not significantly (p>0.05) affected by the level of LQDP.

In the current experiment the DM content of Alhagi was 404.9 g kg^{-1} which is <477 g kg^{-1} which was reported by Bashtini *et al.* (2008) but the OM and CP content of the plants used in this experiment was similar to those reported by these researchers. Variation in DM of Alhagi may be attributed to different methods of drying or harvesting time and climate. The chemical composition of LQDP was similar to the values reported by other researchers (Chaira *et al*., 2007).

Supplementation of Alhagi with different levels of LQDP resulted in a decrease in silage DM content, as would be predicted from the composition of these materials. Increasing the level of LQDP resulted in an increase in ash and consequently decreased OM content of silage which may be explained by the fact that in the current experiment, LQDP was used with kernels which are rich in minerals and thus have lower OM. The NDF and ADF content of silages decreased with increasing level of LQDP which can be attributed to the low level of these feed components in LQDP.

Table 3: Digestibility coefficient of chemical composition of silage and Dry Matter Intake (DMI) of sheep

Digestibility (g kg^{-1})	5%	10%	15%	S.E.M	p-value
	----------LQDP----------				
DM	571.0	552.0	490.0	25.30	0.065
OM	895.0	864.0	817.0	52.60	0.578
NDF	551.0^{a}	499.0^{ab}	437.0^{b}	27.70	0.001
ADF	508.0^{a}	438.0^{ab}	381.0^{b}	30.70	0.016
CP	853.0^{a}	714.0^{b}	727.0^{b}	33.00	0.001
Ca	492.0	411.0	433.0	29.10	0.129
DMI	433.9	433.2	467.4	15.67	0.217

[1]LQDP = Low Quality Date- Palm

Conversely, supplementation of Alhagi with increasing level of LQDP increased the CP content of silages which can be attributed to the higher amount of CP in the kernel of LQDP. Hashemi (1986) reported that ensiled Alhagi plant itself at pH 4.6 containing 471.6 and 72.5 g kg^{-1} DM and CP, respectively. The results showed that Ca and P content of silages increased by augmenting of LQDP as a result of these mineral rich kernels. The pH values and fleig points of our silages decreased with increasing the level of LQDP, although all values for pH were in the range of good quality silage.

The fleig points of the silages were also in the range of good quality silage, although these values were slightly higher than those of the other researchers (Denek and Can, 2006). In the current experiment DM digestibility decreased from 571-490 g kg^{-1} in silage containing 15% LQDP. The finding was concur with those of Al-Dabeeb, (2005) who reported that DM digestibility of the diet was decreased from 713 (control diet) to 633.6 g kg^{-1} in an experimental diet with 20% LQDP. The results are similar to those of Denek and Can (2006) who carried out an experiment using tomato pulp ensiled with wheat straw and found similar DM digestibility in Awassi sheep. Weiss *et al.* (1997) reported that DM digestibility in dairy cattle fed mixture of corn and TP silage was 667 g kg^{-1}. Variation in DM digestibility can be attributed to the animal species, feed stuff and measurement method of DM digestibility.

The results showed that OM digestibility decreased by increasing the level of LQDP; in this case the digestibility values were higher than those of (Al-Dabeeb, 2005) who reported 695 and 646 g kg^{-1} in sheep receiving diets containing 10 and 20% date. In the current experiment, increasing the level of LQDP resulted in a decrease in NDF and ADF digestibility which can be attributed to the low fibre content in LQDP.

Although, there are no data in the literature to discuss the case more, Al-Dabeeb (2005) reported that crude fibre digestibility in sheep fed with diets supplemented with 10 and 20% discarded dates was 547 and 528 g kg^{-1}, respectively. Al-Yousef *et al.* (1993) reported a decrease in CF digestibility of the discarded dates. Al-Dabeeb (2005) reported a drop in digestibility coefficient of CF of discarded date. Supplementation of Alhagi with LQDP decreased CP digestibility of silages.

The results concur with those of Al-Dabeeb (2005) who reported a decrease (from 686-655 g kg^{-1}) in CP digestibility in sheep fed diets containing 10 and 20% discarded dates. Al-Yousef *et al.* (1993) reported a decrease in CP digestibility of the discarded dates. In the

current experiment, Ca digestibility was decreased when the level of LQDP was increased. However, there are no data in the literature to discuss the case in detail.

CONCLUSION

Based on the results from this experiment, it was concluded that LQDP can be efficiently used as a suitable ingredient for preparing silages with a very good quality and according to the results of the experiment, silage containing 15% LQDP and Alhagi could be a good source of roughage for small ruminants.

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