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Feeding corn silage improves nursing performance of Awassi ewes when used as a source of forage compared to wheat hay

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ABSTRACT

The objective of this study was to evaluate the effect of using corn silage (SILAGE) or wheat hay (HAY) as a source of forage on nursing performance of Awassi ewes. Forty ewes (body weight; BW = 43.5 ± 1.58 kg) and their single lambs (BW = 6.3 ± 0.28 kg) were randomly assigned to two diets; SILAGE *vs.* HAY (four pens/diet; five ewes/pen). Concentrate feeding was restricted to 1.1 kg dry matter (DM)/ewe/d, whereas forage was offered *ad libitum*. The study lasted for 56 d (7 d of adaptation and 49 d of data collection). Ewes and lambs were weighed after the adaptation period and at the end of the study. Milk yield and blood samples were collected on days 9, 16, 23, 30, 37, 44 and 51. Intakes of forage and total DM were greater (P<0.05) in SILAGE-fed ewes compared to those fed HAY. Additionally, intakes of crude protein, ether extract and net energy were also greater (P≤0.002) in the SILAGE group. However, neutral and acid detergent fiber intakes were greater (P=0.022) in the HAY than in the SILAGE group. Average daily gain was greater (P=0.032) in the SILAGE than the HAY group. Circulating glucose concentration was greater (P=0.023) in the SILAGE treatment compared to the HAY group, while serum urea nitrogen was similar (P=0.914) in both groups. Milk, total milk solids, protein and fat yields were greater (P<0.05) in the SILAGE than in the HAY group. Dietary replacement of wheat hay with corn silage to early lactating Awassi ewes improved feed intake, yields of milk and milk components, ewe body weight, and lamb average daily gain.

1. Introduction

Awassi sheep, the predominant breed in the Middle East, are raised to supply both milk and meat. Jordan is a semi-arid country in that region with an average rainfall of merely 200 mm/year (El-Shatnawi and Ereifej, 2001). The greatest rainfall occurs in December and January; followed by emergence of spring grasses, such that maximum pasture mass is obtained

Abbreviations: ADF, acid detergent fiber; ADG, average daily gaina; NDF, neutral detergent fiber; BW, body weight; CP, crude protein; DM, dry matter; EE, ether extract; NFC, non-fiber carbohydrates; TS, total solids.

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in late winter and early spring (February and March). However, erratic rainfall and overgrazing, reduces the availability of high quality forage.

The main forages utilized by livestock in the Middle East are wheat and barley hay, which are available at reasonable costs but have a low nutritive value (energy and crude protein concentration) and digestibility. To overcome negative nutritive attributes of hay for milk production, local producers use corn silage during the winter months. Corn silage contains moderate levels of crude protein (88 g/kg dry matter (DM) and net energy (6.07 MJ/kg DM) which makes it a good forage source for lactating ewes compared to wheat hay (NRC, 2001). Our hypothesis states that using corn silage rather than wheat hay as a source of forage would improve milk production and composition as well as ewe body weights and growth of their lambs. Therefore, the objective of this study was to evaluate nursing performance of ewes and pre-weaning growth of their lambs when corn silage was used as the main forage source.

2. Materials and methods

2.1. Experimental design and diets

The study was conducted at the Agriculture Center for Research and Production at Jordan University of Science and Technology (JUST), which is classified as a semi-arid region with an average annual rainfall of 240 mL, at latitude 32° 30′ N and 35° 57′ E and elevation of 510 m above sea level. August is the warmest month with an average temperature of 32.6 °C while February is the coldest month with an average temperature of 3.5 °C.

All animal-related procedures used in the current study were pre-approved by the Institutional Animal Care and Use Committee at JUST. Forty nursing Awassi ewes (body weight; BW = 43.5 ± 1.58 kg) and their single lambs (BW = 6.3 ± 0.28 kg) were randomly assigned to one of two forage treatments: wheat hay (HAY; $n = 20$) or corn silage (SILAGE; $n = 20$). Ewes were penned in groups of fives in eight adjacent open-sided pens (4 m × 4 m; four pens per diet).

Concentrates (barley-based) were fed per pen with an allowance of 1.1 kg/ewe/d on DM basis. Ingredient and chemical composition of the concentrate mixture, wheat hay and corn silage are presented in Table 1. Concentrates were mixed every 2–3 weeks, and sampled for laboratory analysis to ensure consistency of chemical composition. In addition, samples of wheat hay and corn silage were frozen at −20 °C every 2 weeks for chemical analysis. Forage and water were offered *ad libitum* throughout the study duration. Concentrates and forages were offered once daily at 09:00 h. Forage refusal was collected, weighed and sampled daily before feeding. Lambs had access to the diets of the ewes and, thus, the lambs' intake was not exclusively from nursing. The study lasted for 56 d, comprised of a 7-d adaptation period and a 49-d period for data collection. Ewe and lamb BW was recorded after the adaptation period and at the end of the study.

2.2. Laboratory procedures

At the end of the experiment, samples of wheat hay, corn silage and refusals were composited for each pen. The samples were then dried at 55 °C in a forced-air oven to constant weight (dry matter 1) and ground to pass a 1 mm sieve (Brabender, Duisburg, Germany). These samples were analyzed for DM (100 °C in air-forced oven for 24 h; dry matter 2), N (Kjeldahl procedure; # 976.06), and ether extract (EE; Soxtec procedure, Soxtec System HT 1043 Extraction Unit, Tecator, Hoganäs, Sweden; # 920.29) using AOAC (1990) procedures. The actual DM content was then calculated by multiplying dry matter 1 by dry matter 2. Neutral detergent fiber (aNDF) and acid detergent fiber (ADF) analysis was performed according to procedures described by Van Soest et al. (1991) using the Ankom^{2000} fiber analyzer apparatus (Ankom Technology Corporation, Macedon,

Table 1
Ingredients of the concentrate and chemical composition of the concentrate mixture, wheat hay (HAY) and corn silage (SILAGE) fed to nursing Awassi ewes.

Item	Concentrate	HAY	SILAGE
Ingredient			
Barley grain	650		
Wheat bran	80		
Corn grain	160		
Soybean meal (440 g/kg CP; solvent)	80		
Salt	12		
Limestone	15		
Vitamin/mineral premix[a]	3		
Chemical composition			
DM (g/kg)	911	901	389
CP (g/kg DM)	162	36	91
aNDF (g/kg DM)	199	761	477
ADF (g/kg DM)	58	515	314
EE (g/kg)	40	20	37
NE_l (MJ/kg)[b]	7.74	4.23	6.07

[a] The composition per kg of the vitamin/mineral premix was: vitamin A, 2,000,000 IU; vitamin D3, 40,000 IU; vitamin E, 400 mg, Mn, 12.80 g; Zn, 9.00 g; I, 1.56 g; Fe, 6.42 g; Cu, 1.60 g; Co, 50 mg; Se, 32 mg.
[b] Net energy for lactation was calculated based on NE values presented for each feed ingredient in the standard tables from NRC (2001).