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# THE EFFECT ON FEEDLOT PERFORMANCE AND DIGESTIBILITY OF WHOLE CROP BARLEY AND OATS FED AS SILAGE AND HAY IN LAMBS

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*This study was conducted to determine qualities of silages and effects on food intake, body weight gain, feed:gain ratio and nutrient digestibility in lambs of whole crop barley and oats (as silage or hay) harvested at the milk stage.*

*Twenty four 8 month old Akkaraman male lambs, averaging 26,02 kg were assigned randomly to four groups. Lambs received one of two forage sources (barley or oats) conserved in one of two ways (silage or hay) during the experiment. The 1st diet included barley silage; 2nd diet included barley hay; the 3rd diet included oat silage while the 4th diet included oat hay. Dry matter (DM) levels were 31,76; 84,86; 30,95; 86,62 % for each group respectively. The pH, $NH_3$-N and lactic acid levels of the silages were determined as 4.9; 5.20: 0.52; 0.55 % and 2.54; 2.00 in DM respectively. Dry matter intakes (DMI) of the lambs were 471; 981; 434 and 1007 g in each group, respectively ($P<0.01$). Body weight gains (BWG) were found to be 93.2; 84.7; 81.9, 85,7 g/day In each group respectively. Feed : gain ratios were determined as 5.05; 11.58; 5.33; 11.74 g DMI/g BWG for each group respectively. Dry matter, crude protein and crude cellulose digestibility were determined as 64.96; 54.53; 63.62; 52.09 %; 63.44; 46.78; 61.98; 44.52 %; 59.15; 47.42; 61.45; 49.05 % for each group, respectively ($P<0.05$).*

*Key words: barley, digestibility, feedlot performance, hay, oat, silage.*

## INTRODUCTION

The increased popularity of whole crop cereals is related to emphasis on reducing the cost of production and maximizing output of animals and land in a forage program (Depeters *et al.*1989). Barley, wheat and oats ensiled at the same maturities, have similar dry matter digestibilities that tend to decrease with increasing maturity (Cannel and Jobson, 1968; Helsel and Thomas, 1987). A higher proportion of the nutrients of plants may be retained by ensiling than can be accomplished by haymaking, even if the weather is satisfactory, chiefly because shattering and bleaching losses are held to a minimum. Thus, ensiling grass preserves 85% or more of the feed value of the crop, whereas haymaking

under the best conditions will preserve only 80 %, and under poor conditions only 50 to 60% Ensminger et al., (1990). For hay to be of superior quality, it must score high for four properties: (1) nutrient content (2) palatability (3) digestibility and (4) efficiency of utilization. Research has generally shown a good relationship between the chemical composition of hay and its feeding value Ensminger et. (1990 ).

(Riewe and Lippke,1970) noted that the effect of feed intake on digestibility varied with the type of forage or feed. Digestibility of dry matter tended to be greater for silage than for hay. Greater digestibility of silage than of hay may explain why different dry matter intakes for silage and hay resulted in similar weight gains for animals fed on both forages (Petit and Flipot, 1992).

Our study was conducted to determine the qualities of two silages and their effect as dietary components on body weight gain and feed conversion of lambs in comparison with hay made from the same two forages.

## MATERIALS AND METHODS

*Feed Materials:* Barley and oats for silage and hay were cut from the same fields at the same time (at the milk stage) to compare the same plant material preserved by two methods. Fresh samples of the barley and oats were taken for DM and other chemical analyses. DM levels of fresh materials were determined immediately. The barley and oats were ensiled in a heap silo with preservative (1% salt and 0.5% sugar). Similar materials partially cured in the field were baled and carried to the barn. Silos were opened after 45 d. Silage samples were taken immediately for DM and other chemical analyses and frozen. The samples of hay (barley and oat) were taken for chemical analyses and stored.

*Animals and Experimental Design:* Twenty four Akkaraman lambs averaging 26.02 kg body weight were divided into four equal groups. Each group was offered one of four treatments consisting of one of two types of forage (oats or barley), preserved as silage or hay fed alone. Dry matter intake was recorded daily for each lamb kept in individual cages. Lambs were removed from the cages every 14 d to be weighed. Feces were collected once daily, weighed, and sampled for determination of DM. The feces was dried at 55 $^{o}$C composited for 7-d periods for each animal and stored for later analysis. The experiment lasted for 60 d.

*Chemical Analysis:* For chemical analysis, samples of feed and feces were oven-dried at 55$^{o}$C. Forages and feces samples were subjected to DM, ash, organic matter (OM), crude protein (CP), ether extract, nitrogen free extract analyses, according to AOAC (1980) procedures. The method of Crampton and Maynard, 1970) was used to measure crude fiber. Silage $NH_3$-N was determined according to the method of Annino (1964). Silage lactic acid (Petit and Flipot, 1992) and VFA were determined by gas chromatography Leventini *et al.* (1990).

*Statistical Analysis:* All data were subjected to analysis of variance of (SPSS, 1993). Treatment means were compared using using Duncans multiple range test.

## RESULTS

*Chemical Composition of Forages:* Fresh barley contained higher DM, OM, CP and nitrogen free extract than fresh oats. Barley silage contained higher crude

protein and nitrogen free extract and lower crude cellulose than oat silage. Barley hay contained higher crude protein than oat hay. Thus the chemical composition of the forages differed between hay and silage.

Table 1. Chemical composition of the feed ingridients

| | Barley | | Barley Hay | Oat | | Oat Hay |
|---|---|---|---|---|---|---|
| | Fresh | Silage | | Fresh | Silage | |
| DM | 33.76 | 31.76 | 84.86 | 32.22 | 30.95 | 86.62 |
| Ash* | 8.82 | 10.20 | 8.94 | 9.10 | 9.70 | 8.20 |
| OM * | 91.18 | 89.80 | 91.06 | 90.90 | 90.30 | 91.80 |
| CP * | 8.35 | 8.50 | 8.22 | 7.66 | 7.80 | 7.59 |
| CF * | 23.50 | 23.60 | 30.86 | 28.50 | 29.20 | 32.20 |
| Ether Extract* | 2.20 | 2.44 | 2.14 | 2.20 | 2.30 | 2.10 |
| N-Free Extract * | 57.13 | 55.26 | 49.84 | 52.54 | 51.00 | 49.91 |

*( DM basis).

DM: Dry Matter , OM: Organic Matter, CP: Crude Protein, CF: Crude Cellulose,

*Silage Characteristics:* Barley silage pH was lower than oat silage pH (Table 2). The levels $NH_3$-N in the silages were similar. Lactic and acetic acid contents were higher in barley silage than in oat silage but butyric acid content was similar between the silages.

*Dry Matter Intake and Body Weight Gain:* DMI did not differ between the silages (oat and barley) or between the hays (oat and barley) (Table 3). DMI was lower for lambs fed silage than for those fed hay ($P<0.01$). The mean change in BW of the lambs was similar for hay and silage ($P<0.05$). The feed:gain ratio was greater when hay was fed than when silage was fed ( $P<0.01$).

Table 2: Organic acid and ammonia content (% in DM) and pH of the silages

| | Barley Silage | Oat Silage |
|---|---|---|
| pH | 4,90 | 5,20 |
| $NH_3$-N | 0,52 | 0,55 |
| Lactic acid | 2,54 | 2,00 |
| Acetic acid | 1,98 | 1,72 |
| Butyric acid | 0,03 | 0,03 |

Table 3. Dry matter intake, body weight gain, feed : gain ratio of the l ambs

| | Barley Silage | Barley Hay | Oat Silage | Oat Hay | SEM |
|---|---|---|---|---|---|
| Forage intake g (DM) / d | 471,67 [b] | 981,69 [a] | 434,05 [b] | 1007,00 [a] | 58,26* |
| Initial Body Weight (kg) | 26,33 | 26,00 | 25,83 | 25,94 | 0,57 |
| Final Body Weight (kg) | 31,83 | 31,00 | 30,67 | 31,00 | 0,61 |
| ADG (g/d) | 93,22 | 84,74 | 81,92 | 85,76 | 5,03 |
| Feed: gain (g DMI/ g ADG) | 5,05 [b] | 11,58[a] | 5,33 [b] | 11,74[a] | 1,47* |

Means in the same line with different superscripts differ significantly.

*: P<0.01

*Digestibility:* Whole tract digestibilities of nutrients did not differ between lambs fed barley silage or oat silage (P<0.05) (Table 4). Barley and oat hay digestibilities were also similar (P<0.05). Nutrient digestibility of the silages was higher than for the hay (P<0.05) (Table 4).

Table 4. Whole tract digestibility, %

| | Barley Silage | Barley Hay | Oat Silage | Oat Hay | SEM |
|---|---|---|---|---|---|
| Dry Matter | 64,96 [a] | 54,53 [b] | 63,62[a] | 52,09 [b] | 0,20* |
| Ash | 50,10 | 47,51 | 51,23 | 44,59 | 0,19 |
| Organic matter | 65,49 [a] | 55,16 [b] | 65,03 [a] | 52,83 [b] | 0,21* |
| Crude Protein | 63,44 [a] | 46,78 [b] | 61,98 [a] | 44,52 [b] | 0,27* |
| Crude Cellulose | 59,15 [a] | 47,42 [b] | 61,45 [a] | 49,03 [b] | 0,22* |
| Eter Extract | 75,61 [a] | 68,83 [b] | 78,21 [a] | 64,31 [b] | 0,22* |
| N-Free Extract | 68,17 [a] | 61,16 [b] | 66,75 [a] | 55,96 [b] | 0,23* |

Means in the same line with different superscripts differ significantly.

*: P<0,05

## DISCUSSION

The content of nutrient matter in the silages was lower than that in the fresh forages which agrees with the results of Çerçi *et al.* ( 1997). The contents of CP, ether extract and nitrogen free extract of the silage were greater than those of the equivalent hay, which agrees with the data of Petit and Flipot (1992). Due to losses during haymaking, the nutrient content of hay was lower than for silage (Ergül, 1993). DMI of barley hay was similar to oat hay which may reflect similar nutrient content and palatability. Differences among cultivars and maturity had significant effects on nutrient composition and in vitro dry matter digestibility of forages. However, at a similar stage of maturity, cereals may vary in nutrient availability (Depeters, 1989). In this study, the nutrient contents of oats and barley were similar when harvested at the same maturity.

The pH of barley silage was lower but lactic acid and acetic acid levels were higher than those of oat silage. This probably results from the more easily fermentable soluble carbohydrate in barley silage than in oat silage (Johnson 1966).

Silage DMI was less than for of hay, which agrees with the results of Campling (1966). Intake of silage may be quite variable and depends on silage fermentation characteristics (Demarqually, 1973). In general, DMI of unwilted silage is less than that of the equivalent hay (Petit and Flipot, 1992). DMI of barley silage was similar to that for oat silage which disagrees with the results of Okine *et al.* (1994), who observed a negative association between dietary NDF concentration and DMI. Depeters *et al.* (1989) reported that DMI tended to decline with increasing proportion of silage and less of hay.

The feed:gain ratios of the silage fed groups were higher than those of the hay fed groups (P.01) which may be due to higher leaf/stem ratios and higher digestibilities of silages than hays (Petit and Flipot, 1992, Nelson and Satter 1990). Body weight gain was similar for the silage and hay fed groups which agrees with the results of Petit *et al.* (1992).

The digestibility of barley hay was similar to that of oat hay. The DM digestibilities of several hays found by Cherney *et al.* (1990) were significantly better. Digestibility of nutrient matter tended to be greater for silage than for hay (Table 4); this agrees with the results of different studies (Petit and Flipot 1992; Aronen 1990). Digestibility of barley silage was similar to that for oat silage. Khorasani *et al.* (1993) found 67, 64,6; 65,6, 63,3; 48,8, 50,4 % digestibility of barley and oat silage DM, CP, CF, respectively with no statiscally significant difference statistically between the groups. This agrees with our findings but differs from other studies (Khorasani *et al.* 1996, Gupta *et al.* 1981). Kraim *et al.* (1990) reported greater N digestibility for silage than for hay ($P<0.05$). The percentage of DM in the feces was greater with silage (15.7 %) than with hay (13 %) diets, which could have resulted from an increased content of water in the rumens of hay-fed than for silage-fed animals (Lawlor and Shea, 1967). Jahkmola (1983) reported that DM digestibility was 83 % for alfalfa silage and 75 % for alfalfa hay.

Our results indicated no significant differences for nutrient content DMI, digestibilities, body weight gains or feed : gain ratios between barley and oat silages or between barley and oat hays. However, we found that the feed conversion of the silage fed groups was better than for the hay fed groups.

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## SVARLJIVOST JEČMA I OVSA U OBLIKU SENA ILI SILAŽE I UTICAJ OVIH HRANIVA NA PROIZVODNE PARAMETRE JAGNJADI

TATLI P I CERCI IH

### SADRŽAJ

Ova ispitivanja su sprovedena sa ciljem da se odredi kvalitet silaže i njen uticaj na utrošak hrane, prirast i konverziju hrane kao i svarljivost pojedinih sastojaka kod jagnjadi hranjenih ječmom ili ovsom u obliku silaže ili sena dobijenog kosidbom u mlečnom stadijumu biljke.

Ispitivanja su izvršena na 24 muške jagnjadi rase Akkeraman, u uzrastu od 6 meseci i prosečne telesne mase od 26.02 kg. U toku eksperimenta, jagnjad su hranjena kabastom stočnom hranom koja je bila pripremeljena kao seno ili silaža i na tom osnovu podeljena u četiri ogledne grupe: jagnjad prve grupe su hranjena ječmenon silažom, druge grupe senom ječma, treće, ovsenom silažom i četvrte, senom ovsa. U radu su iznete razlike u procentu suve materije, pH, sadržaja $NH_3$-N i mlečne kiseline u različitim hranivima kao i u ukupnom unosu suve materije za svaku grupu životinja. Najveći prirast postignut je kod jagnjadi prve grupe gde je i konverzija hrane bila najbolja. Osim toga i svarljivost suve materije, grube celuloze i proteina je bila najveća u senu ječma.