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Effect of Feeding Frequency on Non-Carcass Components and Wholesale Cuts of Iranian Fat-Tailed Lambs

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Abstract: This experiment was conducted to evaluate the effect of feeding frequency on non-carcass components and wholesale cuts in fat-tailed ram lambs of the Varaminni breed (n = 30, BW = 30.6±3.47 kg). Animals were assigned to three experimental groups according to their initial live body weights in a completely randomized design. The lambs in three groups fed with a TMR ration based on live body weight. First group (control) fed one daily, second group (treatment) fed twice times daily and third treatment fed four times per day. Live body weights recorded at 21 days intervals. Moreover, four lambs from each group were slaughtered and carcass characteristics were measured. Final BW, total BW gain and ADG did not differ ($p>0.05$). Tail fat content were significantly ($p<0.05$) higher in control than those in experimental group. The other carcass characteristics were not significantly different in control with experimental groups. It was concluded that increase of feeding frequency in varaminni ram lambs (fat tailed lambs) resulted in decreased fat reservoirs thus may be beneficial for improving meet production and decrease in fat content of tail.

Key words: Feeding frequency, non-carcass components, varaminni lambs

INTRODUCTION

Feeding ruminants at frequent intervals establishes a reasonably steady-state condition for both digestion and metabolism (Mark and Amos, 1991). Increasing the frequency of meal consumption by ruminants may complement the effect of fiber, associated with its physical form, on ruminal fermentation by maintaining a more constant ruminal Water-Holding Capacity (WHC). Feeding less frequently may shift site of nutrient digestion from the rumen to the hindgut, altering the supply of fermentable substrate to the ruminal microbes and ultimately affecting the protein: energy ratio supplied to the small intestine. These relationships might especially be true when high concentrate diets are fed (Bragg *et al*., 1986).

The goal of bunk management practices such as programmed feeding, multiple feed deliveries per day and consistent timing of feed delivery is to reduce variability in intake (Schwartzkopf-Genswein *et al*., 2003). Increase of feeding frequency may improve bioenergetics efficiency and nitrogen retention in the body (Sutton *et al*., 1985; Shabi *et al*., 1999). Feeding of animals in less frequency increases fat deposition and mobilization. Consequently, the efficiency of energy retention will be decreased (Sutton *et al*., 1986). Robinson and McNiven (1994) showed that feeding cows for seven times per day instead of two times increased DMI, OM, NDF and crude protein intake. Moreover, feeding cows for five times daily instead of two times increased DMI and rumen pH and decreased propionate: acetate ratio in rumen (Robinson and McQueen, 1994). French and Kennely (1990) showed that increased feeding frequency improved rumen pH and acetate: propionate ratio, but plasma insulin concentration tended to decrease. Consuming of easily digestible carbohydrates will decrease rumen pH and consequently will decrease cellulolytic activity. It can increase amilolytic activity and consequently increases acetate: propionate ratio in rumen (Bauman *et al*., 1971; Kaufmann, 1976). Increased propionate concentration can stimulate insulin secretion in ruminants (Jenny *et al*., 1972). Increased insulin secretion will stimulate glucose and fatty acid absorption and consequently will increase lipogenesis and reduce lipolysis in adipose tissue. In lactating cows, insulin usually decreases fatty acid availability for milk fat synthesis (Foster and McGarry, 2000; Sutton *et al*., 1988). Therefore, increase of feeding frequency probably reduces fat synthesis and deposition in different body tissues. In sheep reported are very low and effect of feeding frequency on milk fat and tissue component specially fat content are unknown. Church *et al*. (1980) reported Increased eating rates have been associated with

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improved performance in sheep, Thus, the aim of this study was to investigate the effect of feeding frequency on body weight and carcass characteristics in Varaminy growing ram lambs contain fat tail that today fat production in form o tail is very important problem of animal nutritionist in Iran.

MATERIALS AND METHODS

Animals and location of experiment: Thirty weaned uncastrated ram lambs of the fat tailed varaminy breed with 5-6 months of age and mean initial BW of 30.6±3.47 kg were used in the experiment carried out over a 14 week period between October and January 2004 at the sheep feedlot facility of the Animal Science Department of Tehran University in Karaj, approximately 45 km west of Tehran city. The mean maximum temperatures of the area ranged from 20°C in October to 15°C in January with 250 mm annual rainfall. Lambs were weighed, ear tagged and treated for external (Azontole, Bayer, Germany) and internal (Albandazole, VMP Co., Iran) parasites and injected with enterotoxemia vaccine (Razi Institute, Iran). Lambs were individually housed in concreted floor pens (1.25×0.8 m) in an environmentally controlled building and were allowed *ad libitum* access to feed and water throughout the trial. Lambs were assigned to three dietary treatments in a completely randomized design. The mean BW gain and ADG of 30 lambs by the end of trial were 14.1±3.2 kg and 156.6±24.4 g, respectively. The basal diet (Table 1) was formulated for maximum growth and met or exceeded the requirements recommended by NRC (1985). The 30 treatments consisted of the basal diet supplemented with one (control), two, or four time per day. Feed samples were obtained from each batch of feed mixed for the determination of DM, CP, Ether Extract (EE), ADF, NDF, Ca and P (AOAC, 1990). At the end of 15 week trial, all of the lambs in each treatment group were weighed after 16 h of feed deprivation and four lambs from each group were slaughtered by Iranian traditional procedure (Nik-Khah, 1984) in the department of Animal Science abattoir. After complete bleeding, the bodies were skinned and external organs such as head, feet and skin were weighed. The carcasses were eviscerated and the internal organs or tissues including heart, liver, kidneys (without fat), lungs, gastrointestinal tract (GIT) and kidney-pelvic-gut fat was separated and weighed. Wholesale cuts including neck, proximal thoracic limb, proximal pelvic limb, steak-lumbar, brisket-abdominal region and fat tail were separated and weighed (Nik-Khah, 1984). The Average Daily Gain (ADG) was calculated by differences of the initial BW and the slaughter live weight (final BW).

Table 1: Components and chemical composition of basal diet

Ingredients	Percentage
Alfalfa hay	20.0
Wheat straw	10.0
Barley	55.0
Wheat bran	6.0
Cottonseed meal	4.0
Soybean meal	3.0
Mineral-Vitamin premix	0.3
$CaCO_3$	1.4
Common Salt	0.3
Chemical compositionDM	91.0
CP (%)	12.3
Ether extract (%)	2.1
NDF (%)	35.0
ADF (%)	16.5
Ca (%)	0.9
P (%)	0.6

All of composition on DM basis except DM

Experimental design: The individual lamb was considered the experimental unit. Least-squares means were reported with pooled standard error. Differences were considered significant at $p<0.05$. The data were analyzed with the GLM procedures of SAS (1998). Initial BW was used as a covariate in the analysis of the final BW and ADG.

RESULTS

The final BW, total BW gain and ADG were not affected by treatment (Table 2). The head, skin, feet, heart, liver, kidney, empty GIT, lung, heart fat and internal fat weights were not affected by feeding frequency ($p>0.05$) (Table 3). When the two treatments were compared with the control group, there were no significant differences in the head, feet, liver, kidney, lung, empty GIT weights ($p>0.05$), whereas, treatment with two time per day have higher value in many part of non-carcass component, also Internal fat weight of lambs fed diets include 2 or 4 time per day were numerically higher from control and this value in treatment with 4 time per day was highest. Among carcass wholesale cuts, the weights of proximal thoracic limb, proximal pelvic limb, neck, steak-lumbar and

Table 2: Effect of feeding frequency on final BW, total BW gain and Average Daily Gain (ADG) in fat-tailed lambs

Items	Control group	Two time per day	Four time per day	Significance
Final BW (kg)	44.080±3.400	44.160±3.090	43.500±3.120	NS
Total BW gain (kg)	14.130±2.900	14.280±2.740	13.990±2.840	NS
ADG (kg)	0.156±0.008	0.158±0.008	0.155±0.007	NS

NS: Non-Significant

Table 3: Effect of feeding frequency on non-carcass components in fat-tailed lambs

Items	Control group	Two time per day	Four time per day	Significance
Internal fat (kg)[a]	0.770±0.040	0.795±0.040	0.790±0.020	NS*
Head (kg)	2.540±0.500	2.600±0.670	2.440±0.770	NS
Limb (kg)	0.950±0.030	1.070±0.080	0.930±0.070	NS
Skin (kg)	8.890±0.630	9.250±0.890	8.250±0.790	NS
Empty gut (kg)[b]	2.320±0.270	2.539±0.170	1.990±0.270	NS
Liver (kg)	0.620±0.080	0.580±0.050	0.570±0.010	NS
Spleen (kg)	0.044±0.001	0.048±0.008	0.046±0.006	NS
Lungs (kg)	0.640±0.050	0.560±0.050	0.570±0.020	NS
Heart (kg)	0.140±0.010	0.140±0.010	0.150±0.020	NS
Kidney	0.010±0.002	0.010±0.001	0.010±0.001	NS
Testis (kg)	0.270±0.030	0.280±0.050	0.210±0.050	NS

[a]: Internal Fat = Kidney-pelvic-gut fat, [b]: Empty gastrointestinal tract, *NS: $p>0.05$

Table 4: Effect of feeding frequency on wholesale cuts in fat-tailed lambs

Parameters	Control group	Two time per day	Four time per day	Significance
Neck (kg)	2.50±0.60	2.51±0.56	2.50±0.41	NS*
Proximal thoracic limb (kg)	3.91±0.48	3.92±0.93	3.90±0.31	NS
Proximal pelvic limb (kg)	6.01±0.73	6.05±0.92	5.99±0.41	NS
Steaks-lumbar (kg)	3.27±0.52	3.28±0.56	3.29±0.47	NS
Brisket-abdominal region (kg)	3.40±0.41	3.39±0.38	3.37±0.25	NS
Tail fat	4.38±0.76a	3.76±0.53[b]	3.65±0.86[b]	$p<0.05$

[a,b]: The means in rows with different superscripts are significantly different, *NS: $p>0.10$

brisket-abdominal region were not affected by feeding frequency ($p>0.05$), where the weights of fat tail decreased by addition of feeding frequency ($p<0.05$) (Table 4).

DISCUSSION

In the present study, increase of feeding frequency did not affect final BW, total BW gain and ADG. It is commonly assumed that fluctuations in intake can cause acidosis and reduce mean DMI and this reduce were affected ADG (Britton and Stock, 1987). However, in the present study body weight changes were not significantly different in both experimental groups, where the ratios of some carcass components is were relatively higher in treatment group than those in control group. Increase in feeding frequency decreased fat deposition in tail of varaminni ram lambs. Moreover, internal fat content were not differ with increased feeding frequency that this occur was inversed with other research (Sutton *et al*., 1985; Shabi *et al*., 1999). Shabi *et al*. (1999) has been suggested that increase of feeding frequency would decrease fat synthesis and deposition in body. In Iranian tail fat lamb that tail is main store of fat, increased feeding frequency were decreased fat content of this part but feeding frequency has not affected on internal fat. Sutton *et al*. (1986 and 1988) and French and Kennely (1990) in three separated studies, observed that feeding of dairy cows 6 times per day instead of 2 times decreased plasma insulin concentration but increased GH and glucose concentrations. They suggested that it was due to decreased rumen propionate concentration. Considering the important role of insulin in lipogenesis and reducing lipolysis and stimulatory effect of GH on lipolipogenesis and protein accretion (Foster and McGarry, 2000) it is concluded that increasing of feeding frequency can decrease fat synthesis and deposition. It seems in tailed sheep this effect influence the fat content in tail and do not influence the internal fat deposition. Moreover this decrease in fat tail influence other tissue such as wholesale cuts that in this study numerically was increased.

Implication: Fat production specially in sheep carcass in form of tail in Iranian sheep is very high, thus different method such as genetically, physiological and nutritional method applied for decrease fat contain of carcass. One of nutritional method for increase protein and decrease fat is bunk management Increase of feeding frequency in this lambs led to decreased tail fat. Hence. We emphasis that with increased feeding frequency, carcass fat (in tail) content of sheep is mediated.

REFERENCES

AOAC, 1990. Official Methods of Analysis. 15th Edn., Association of Official Analytical Chemists. Washington, DC., pp: 69-90.

Bauman, D.E., C.L. Davis and H.F. Bucholtz, 1971. Propionate production in the rumen of cows fed either a control or high grain, low fiber diet. J. Dairy Sci., 54: 1282.

Bragg, D.S.A., M.R. Murphy and C.L. Davis, 1986. Effect of source of carbohydrate and frequency of feeding on rumen parameters in dairy steers. J. Dairy Sci., 69: 392.

Britton, R.A. and R.A. Stock, 1987. Acidosis, rate of starch digestion and intake. Okla. Agric. Exp. Sta. Res. Rep., 121: 125-137.

Church, D.C., R.P. Randall and E. Ortega, 1980. Relationships between eating rate of sheep and live weight gain, weight and fill of the gastrointestinal tract. J. Anim. Sci., 51: 1373-1380.

French, N. and J.J. Kennelly, 1990. Effects of feeding frequency on ruminal parameters, plasma insulin, milk yield and milk composition in Holstein cows. J. Dairy Sci., 73: 1857-1863.

Foster, D.W. and J.D. McGarry, 2000. Glucose, Lipid and Protein Metabolism. In: Text Book of Endocrine Physiology. Griffin, J.E. and S.R. Ojeda (Eds.), Oxford University Press, pp: 393-419.

Jenny, B.F., C.E. Polan and F.W. Thye, 1972. Effects of high grain-restricted roughage rations on serum insulin in the lactating bovine. J. Dairy Sci., 55: 399 (Abstr).

Kaufmann, W., 1976. Influence of the composition of the ration and the feeding frequency on pH regulation in the rumen and on feed intake in ruminants. Liv. Prod. Sci., 3: 103.

Mark, A.F. and H.E. Amos, 1991. Effects of dietary fiber and feeding frequency on ruminal fermentation, digesta water-holding capacity and fractional tutnover of contents. J. Anim. Sci., 69: 1312-1321.

Nik-Khah, A., 1984. The growth and carcass quality of Afshari. Turkey and Mehraban lambs on different diets. Proc. Aust. Soc. Anim. Prod., 15: 498-499.

NRC, 1985. Nutrient Requirements of Sheep. 6th Revised Edn., National Academy Press, Washington, DC., pp: 45-53.

Robinson, P.H. and M.A. McNiven, 1994. Influence of flame rousting and feeding frequency of barley on performance of dairy cows. J. Dairy Sci., 77: 3631-3643.

Robinson, P.H. and R.E. McQueen, 1994. Influence of supplemental protein source and feeding frequency on rumen fermentation and performance in dairy cows. J. Dairy Sci., 77: 1340-1353.

SAS., 1998. Users Guide: Statistics, Version 6.08. SAS Inst., Inc., Cary NC.

Schwartzkopf-Genswein, K.S., K.A. Beauchemin, D.J. Gibb, D.H. Crews, D.D. Jr. Hickman, M. Streeter and T.A. McAllister, 2003. Effect of bunk management on feeding behavior, ruminal acidosis and performance of feedlot cattle: A review. J. Anim. Sci., 81: E149-E158.

Shabi, Z., I. Bruckental, S. Zamwell, H. Tagari and A. Arieli, 1999. Effects of the synchronization of the degradation of dietary crude protein and organic matter and feeding frequency on ruminal fermentation, nutrient digestibility and milk yield and composition in dairy cows. J. Dairy Sci., 82:1252-1260.

Sutton, J.D., W.H. Broster, D.J. Napper and J.W. Siviter, 1985. Feeding frequency for lactating cows: Effects on digestion, milk production and energy utilization. Br. J. Nutr., 53: 117-130.

Sutton, J.D., I.C. Hart, W.H. Broster, R.J. Elliott and E. Schuller, 1986. Feeding frequency for lactating cows: Effects on rumen fermentation and blood metabolites and hormones. Br. J. Nutr., 56: 181-192.

Sutton, J.D., I.C. Hart, S.V. Morant, F. Schuller and A.D. Simmonds, 1988. Feeding frequency for lactating cows: Diurnal patterns of hormones and metabolites on peripheral blood in relation to milk-fat concentration. Br. J. Nutr., 60: 265-274.