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EFFECT OF SEASONAL CHANGES AND TYPE OF ROUGHAGE ON:
I- GROWTH PERFORMANCE, METABOLIC ACTIVITY AND CARCASS CHARACTERISTICS OF CROSSBREED LAMBS

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ABSTRACT

Eighteen growing crossbreed lambs (23.2±0.91 kg average live body weight; 5 month old) were used to investigate growth performance, feed efficiency, metabolic aspects and carcass characteristics of lambs as affected by type of roughage under different seasons. Lambs were randomly distributed to three experimental groups (six for each). First group was fed starter concentrate feed mixture (CFM) and berseem hay (R1;as a control). Whereas, other groups were fed CFM plus berseem silage supplemented with either 5% ground yellow corn (BSC; R2) or lactic acid bacteria and yeast mixture (BSB; R3) during ensiling process. The local environmental temperature was recorded monthly. Daily weight gain, relative growth rate, daily dry matter intake and feed conversion were recorded. Also, production and economic efficiency of lambs were calculated. The adjusted net energy of maintenance (NEm) and growth (NEg) were calculated according to thermal air temperature. Results showed that total gain and average daily gain of lambs fed R2 were higher than other groups with no significant differences, while feed conversion in R3 was better than other groups (7.771 *vs*. 9.425 and 8.497 for R3, R1 and R2, respectively) owing to the lowest total dry matter intake with R3.The NEm was slightly higher in R2 than other groups. Whereas, R3 was the lowest ($P<0.01$) value of NEg. Retained energy and production efficiency were higher ($P<0.01$) in R3 than other groups and followed by R2. Carcass characteristics of lambs did not differ significantly among groups. However, R2 showed better values of hot dressing%, L.D weight, DM and CP%. It can be concluded that, both ground yellow corn and biological supplements to ensiling process of berseem improved feed conversion and production efficiency of lambs. The best growth performance, profit and economic efficiency under the local thermal temperature was recorded in groups fed berseem silages, specially in R2, compared with control which fed berseem hay as a basal diet.

Keywords: Lambs, growth, carcass, net energy, seasonal changes, roughage

INTRODUCTION

Traditionally, silage has been made from cereals and grasses although legumes silage has been produced (Belibasakis *et al.,* 1997). Cereal silages are rich in energy but poor in crude protein (±7%), whilst the converse is true for legume silages. Titterton *et al*. (1997) found that the CP of mixed maize and legume silage was greater than maize silage alone. Titterton *et al.* (2000) successfully ensiled mixed forage tree legumes (FTLS) with maize and the CP of the mixed silages was reported to be comparable with that of commercial feeds, being 17.2% for maize – leucaena. Although FTLS are protein-rich forages, they often contain significant levels of anti-nutritional substances such as tannins and toxic chemicals that interfere with digestion and utilization of protein, minerals and carbohydrates in ruminants (Rittner and Reed, 1992). However, some anti-nutritional factors can be inactivated or removed by ensilage.

The efficiency of feed utilization has been quite difficult and expensive to measure and quantify compared to the rather simple measurements of growth rate. It was thus practical and the norm to measure gross intake and gain as measures of feed efficiency. However, Ferrell and Jenkins (1984) showed that the relationship between feed (energy) intake and gain is not linear.

The thermo-neutral zone is interval of thermal environment, usually characterized by temperature within which an animal's total heat production is approximately constant for a given energy intake (Nienaber and Hahn, 2004). There is an apparent worldwide lack of realization that changes in the physical and genetic constitution of animals may have affected their thermoregulatory capability in hot climate for example, blood plasma fluctuation in volume and constituents (Sokolov and Arbel, 1992), as well as how they cope with heat stress (Shklyar and Arbel, 2004). When temperature is between 5 to 15^{o}C the animals are most productive, and when the temperature is between 15 to 25^{o}C a small degree of loss in production occurs, however when temperature exceed the upper critical temperature (25^{o}C) a great degree of loss in production occurs.

The environmental temperature in Egypt reaches its highest degrees during summer months (July and August) when mean maximum temperature is 41^{o}C for upper Egypt and 38^{o} C for the Northern part of Egypt); consequently, there is a gap between summer temperatures and the upper critical temperature for animals, which causes great losses in production (Arbel and Sokolov,1994). Empirical adjustment for bread, sex, age, season, temperature, acclimatization, cold and heat stress, activity and previous nutrition compensatory gain were included to address several factors known to affect maintenance requirements (Ferrell and Oltjen, 2008).

Evaluation of detailed energy budgets for individual animals and groups of animals can indicate imbalances between metabolic heat production and heat losses to the environment under various realistic combinations of weather variables. Associated weather data must be at an appropriate resolution. For each class of animal, but particularly for young or newborn, the maximum possible (peak) rate of metabolic heat production is of considerable interest, together with the length of time it can be sustained. The likely duration of weather outside the thermo- neutral zone of an animal needs to be known while the accumulation of such periods over a season (when interpreted in terms of implied weight loss, etc.) will provide some measure of economic performance (Das, 2004).The recommendations contained in most animal production books are for animals exposed to conditions relatively free of thermal stress or a temperature range of about 15 to 25^{o}C. Extremes in temperature influence the behavior and metabolic process. All these changes go together to change returns to labor and management. Adjustments can be made to the diets, so that performance and profits can be predicted (Ames *et al.,* 1981). Roughages tend to be more highly digested during warm conditions than when the same diet is fed to animal at cold temperatures (Ames *et al.,* 1981).

The present study was conducted to investigate growth performance, feed efficiency metabolic aspects and carcass characteristics of growing lambs as affected by type of roughage under different seasonal changes, as well as to predict the potential net energy for production of berseem hay or silages diets fed to growing lambs.

MATERIALS AND METHODS

The present study was carried out at Mahallet Mousa Research Station, Kafr El-Sheikh Governorate belonging to Animal Production Research Institute, Ministry of Agriculture. The object of this study was to investigate the effect of seasonal changes and type of roughage on growth performance, metabolic activity and carcass characteristics of growing crossbred lambs.

Ensiling process:

About 20 ton of fresh berseem (3^{rd} cut) was collected from the field and divided into 2 equal portions for making silage with different treatments. Berseem (*Trifolium alexandrinum L.*) was mechanically chopped using Turkish harvester chopper machine to 2-3 cm of length. The chopped berseem was wilted for 24 h to reduce the moisture content to be about 70% before ensiling. At that time, the air temperature degree was 29^oC and the relative humidity was 70%. Wilted berseem was well pressed in layers using wheel tractor to ensure air removal and it was supplemented with 5%ground yellow corn (BSC) or 2% bacteria-yeast mixture (BSB) solution (EM1; contains 2.2×10^8 CFU /ml of lactic acid bacteria and 1.0×10^3 CFU/ml of yeast) in two siloes, respectively. After filling of each silo, it was covered by plastic sheet followed by thin layer of rice straw and layer of soil to maintain anaerobic condition of silo. The ensiled berseem was kept for 2 months before feeding animals.

Experimental animals:

Eighteen growing crossbreed lambs (Rahmany x Romanouf; 5 months old) of 23.2±0.91 kg average live body weight were used in the present study and continued to reach about 7 months. The animals were randomly distributed to three experimental groups according to their live body weight (6 lambs for each).

Experimental rations:

Three experimental rations were formulated as follows:

R1: 52.25% concentrate feed mixture (CFM) + 47.8% berseem hay (BH; as a basal diet of the farm; control).

R2: 42.1% CFM + 57.9% BSC.

R3: 51.7% CFM + 48.3% BSB.

The chemical composition and feeding values of CFM, berseem silages, hay and tested rations are investigated by Abd El-hady *et al.* (2012). The crude protein% of tested rations was ranged from 15.58 to 15.83% according to NRC, (1985). Lambs were individually fed the experimental rations to cover the requirements of growing lambs and were adjusted monthly according to their body weight changes. The experimental period extended for 7 months. The ingredients of CFM were 36% yellow corn, 22% soybean meal (44%), 15% linseed cake, 22% wheat bran, 3% molasses, 1.5% calcium carbonate and 0.5% sodium chloride.

Housing and feeding management:

Lambs were housed in semi-open stall barn and fed the experimental rations as group feeding. Starter CFM and berseem silage or hay were offered twice daily (8.0 AM and 4.0 PM). The offered feeds were fixed and calculated as the percentage of concentrate to roughage ratio to satisfy their maintenance and production requirements. Drinking water was available during the day. Mineral blocks were available free of choice for all animals under the experiment.

All lambs were injected subcutaneously with anti-parasites and cut their wool at the beginning of the experiment. Individual fasting live body weight (LBW) and group feed intake of lambs were recorded biweekly. Daily weight gain (DWG) was calculated, as well as relative growth rate (RGR) of each lamb was determined as a percentage of DWG divided by the initial LBW. The economic efficiency of experimental rations was also calculated.

Adjusted net energy and production efficiency:

Although each forage species (i.e. legumes, grasses, corn silage, etc.) has its own separate equations for predicting energy values, all equations are based on a negative correlation with ADF. Most testing laboratories use computer programs containing these equations to estimate the appropriate value (Belyea *et al.,* 1993):

NEm (Mcal/kg diets) = (1.037 – 0.0124 x ADF) x 2.25

NEg (Mcal/kg diets) = [2.54 – (2.42 / (NEm x 2.2))] / 2.2

So, the calculated NEm and NEg for the tested rations were as follows:

Treatments	NEm	NEg
Control	1.735	0.866
BSC	1.614	0.845
BSB	1.676	0.856

The adjustment for thermal effects on digestibility can be made to diet component values for feed or diets by the following general formula (Ames *et al.,* 1981):

$NEm = 0.077 \times LBW^{0.75}$

$A = B + B[CF (T – 20)]$

Where: A = value adjusted for environment

B = Diet component value (NEm, Mcal/kg) ;

CF = correction factor (0.001 for NEm) ;

T = Effective ambient temperature.

Adjusted Production Efficiency % = Retained energy / adj. NEg x 100

Adjusted NEg = MEI - NEIm

Retained energy, Mcal/d = $LBW^{0.2955} \times 0.544 \times DWG^{1.262}$ (Overton, 1999).

The environmental temperature was recorded monthly from the beginning to the end of the experiment by Rice Research and Training Center, Sakha Weather Station, Kafr El-Sheikh Governorate as follows:

	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
Air Temperature ^{o}C	32.0	33.0	33.5	28.0	21.0	22.0	20.0

Carcass characteristics:

At the end of the experiment, body measurements of three lambs from every group were recorded and lambs were slaughtered. The warm carcass weight was recorded to calculate individual worm dressing percentage. Also, warm carcass length was measured. Carcass and non-carcass characteristics were measured. The weight of longissimus muscle and its measurements were recorded. Dry matter, crude protein and pH of homogenized longissimus meat were determined.

Statistical analysis:

Data of the study were analyzed using the general linear model (GLM) of SAS (2003). Data of body weight, daily weight gain, relative growth rate, as well as adjusted net energy and production efficiency were subjected using two way analysis of variance model included treatment, time and interaction between them. Whereas, carcass characteristics were analyzed using one way classification model included treatment effect. The overall means were compared using Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Growth performance of lambs:

The averages of live body weight (LBW), daily gain (ADG) and relative growth rate (RGR) are shown in Table (1). The initial LBW ranged between 22.5 to 24.0±1.53 kg without significant differences among groups. Silage groups were greater in final weight than the control group, which was fed mainly berseem hay (BH). Total gain was superior in 2nd ration (R2) which increased 12% than the control ration. Similar trend was observed with ADG. It was observed that the lowest values of ADG was in summer months (July, August and September) in all groups and these agreed with the predicted ADG in this period that ranged between 0.054 to 0.115 kg/d. Thereafter, ADG increased linearly in silage-based diets groups compared with control group in winter months which decreasing ambient temperature. The overall mean of ADG was 0.117, 0.130 and 0.126 kg/d for R1, R2 and R3, respectively with no significant differences among groups and compatible with the mean predicted ADG (0.121kg/d). Likewise, RGR increased gradually in all groups with decreasing air temperature, however, the better growth rate was in silage groups. The highest value of RGR was in R3 (0.580 vs. 0.514 and 0.546 for R3, R1 and R2, respectively) with no significant differences among groups. The results are in agreement with those found by Gabra and Hafez (2000) who showed that the ADG was 107 g/d in Ossimi lambs which fed berseem hay *ad libitum* plus 1% CFM of LBW. As well as, Sormunen-Christian and Jauhiainen (2001) noticed the growth of the weaned Finnish lambs fed timothy grass silage was higher compared to those fed the same material in dry hay form. Petit and Castonguay (1994) found that ADG and feed efficiency of cross-breed lambs were significantly greeter when fed grass silage plus CFM than those fed grass silage only (*ad libitum*). Similar results were reported by Khan *et al.* (2011) when they used corn silage with or without concentrate. On contrary, Mustafa *et al.* (2008) observed that cross-breed lambs fed CFM *ad libitum* plus 100 g grass hay gained significantly higher than those fed ray grass silage *ad libitum* plus 100-450 g CFM (382 *vs*. 109 g/d). Abdul-Aziz *et al.* (1999) found that ADG of growing Barky lambs was insignificantly higher when fed berseem hay plus CFM compared with halophytic silage plus CFM (162 *vs.* 140 g/d). Ranjit *et al.* (2002) found that lambs grown by 140 g/d when fed 85% maize silage treated with *Lactobacillus buchneri* inoculant plus 15% soybean meal, whereas untreated group grew 83 g/d.

Table 1. Effect of feeding tested rations on the average live body weight (LBW), daily gain (ADG) and relative growth rate (RGR) of the growing lambs.

Month	Air Temp., °C	LBW, kg				ADG, kg				RGR				Predicted ADG*
		R1	R2	R3	SE	R1	R2	R3	SE	R1	R2	R3	SE	
Initial, July(5mo)	32.0	23.0	24.0	22.5	1.53	-	-	-	-	-	-	-	-	
Aug.	33.0	24.6	25.8	25.5	1.53	0.053	0.061	0.100	0.026	0.221	0.261	0.484	0.129	0.055
Sept.	33.5	28.2	29.3	27.7	1.53	0.106	0.103	0.064	0.026	0.471	0.426	0.287	0.129	0.048
Oct.	28.0	33.8	32.8	31.8	1.53	0.181	0.113	0.134	0.026	0.756	0.480	0.628	0.129	0.115
Nov.	21.0	38.0	37.3	37.8	1.53	0.105	0.112	0.150	0.026	0.476	0.460	0.644	0.129	0.170
Dec.	22.0	41.0	42.8	42.2	1.53	0.125	0.229	0.181	0.026	0.564	0.958	0.874	0.129	0.165
Final, Jan. (11 mo)	20.0	44.7	48.3	46.5	1.53	0.132	0.162	0.127	0.026	0.600	0.694	0.562	0.129	0.175
Total gain		21.7	24.3	24.0	-	-	-	-	-	-	-	-	-	-
Overall mean						0.117	0.130	0.126	0.011	0.514	0.546	0.580	0.053	0.121

Predicted ADG (g) = 129.94 + 9.27 T – 0.35 T^2 ; T = ambient temperature in °C (Ames and Brink, 1977)

Feed intake and feed conversion:

Total dry matter intake (TDMI) and its ratio to ADG (feed conversion) are presented in Table (2). Feed intake as fresh matter was similar among tested groups, however the TDMI was slightly lower in 3rd group which fed BSB compared with others being 0.956,1.053 and 1.056 kg/d for R3, R1 and R2, respectively. These results might be due to lower DM% in silage supplemented with inoculant bacteria. The best value of feed conversion ratio was found in lambs fed BSB (R3) which recorded 7.77 kg TDMI/ kg gain, while the worst value was in control group (R1) which was fed berseem hay as a basal diet (9.425 kg DM/kg gain). The improvement in feed conversion in R3 may be due to lactic acid bacteria and yeast and their effects on digestibility of ration and rumen parameters.

These findings are in agreement with Petit and Castonguay (1994). Similar trend was observed by Khan *et al.* (2011) who found that DMI ranged between 1.050 to 1.225 kg/d of different types of silage with or without concentrate, as well as feed conversion ratio ranged between 6.67 and 8.75 with significant differences among rations. Abdul-Aziz *et al.* (1999) calculated feed conversion of 8.30 and 9.50 kg DMI/kg gain of growing Barky lambs fed either BH plus CFM or halophytic silage plus CFM, respectively. Speijers *et al*. (2005) reported that lambs fed red clover silage had a feed conversion efficiency of approximately 8.0 kg feed/kg gain, whereas those fed grass silage had over 10.0 kg feed /kg gain. The results were also concordant with those of Mustafa *et al.* (2008) who reported DMI was 1.0 kg/d and feed conversion was 7.7 kg DM/kg gain in lambs fed rye grass silage *ad libitum* compared with 1.9 kg/d and 5.3 kg DM/kg gain, respectively in lambs fed CFM *ad libitum* plus 100 g grass hay.

Table 2. Effect of feeding tested rations on the average daily total dry matter intake and feed conversion (kg DMI/kg ADG) of the growing lambs.

Month	Air Temp.,^{o}C	TDMI/d			Kg DMI / kg ADG		
		R1	R2	R3	R1	R2	R3
Initial, (5 mo) July	32.0	0.433	0.471	0.451	-	-	-
Aug.	33.0	0.562	0.581	0.550	10.613	9.518	5.502
Sept.	33.5	0.736	0.713	0.634	6.944	6.926	9.904
Oct.	28.0	1.039	1.009	0.903	5.739	8.926	6.736
Nov.	21.0	1.299	1.178	1.059	12.367	10.516	7.057
Dec.	22.0	1.300	1.394	1.268	10.388	6.085	7.004
Final, (11mo) Jan.	20.0	1.385	1.460	1.324	10.49	9.012	10.42
Overall mean	-	1.053	1.056	0.956	9.425	8.497	7.771

Adjusted net energy and production efficiency:

The predicted net energy for both of maintenance and growth and production efficiency are presented in Table (3) and Fig. (1). The net energy maintenance (NEm) that adjusted with ambient temperature showed the highest value in R2 which based on BSC followed by R3 based on BSB (1.134, 1.114 and 1.100 Mcal/d for R2, R3 and R1, respectively) with no significant differences among groups. The NEm increased linearly ($P<0.01$) with the advancement of age and LBW. The rate of increasing in NEm was higher in R2 and R3compared with R1. Adjusted net energy for growth (NEg) was higher in R1 than either R2 or R3 (0.842 *vs.* 0.817 and 0.615 Mcal/d, respectively). The lowest value ($P<0.01$) was in R3 (Fig 1_a). The differences between R1 and R2 were not significant. The overall mean of NEg increased significantly ($P<0.01$) in first 2 months (August and September) and thereafter there was no significant differences among months. While, the calculated NEIg values were 0.715, 0.865 and 0.720 Mcal/d for R1, R2 and R3, respectively.

As shown in Table (4) the calculated maintenance of NE based on ADF% of tested rations were 1.735, 1.614 and 1.676 Mcal/kg diets for R1, R2 and R3, respectively. These values were higher than adjusted NEm (based on temperature). However, the ratio of NEIm/NEI and NEIg/NEI was slightly higher in adjusted NE than that of calculated from ADF%. The adjusted NEI values were lower than both calculated values and that from digestive trials, owing to the energy losses as methane (CH_4) during the fermentation of forages (Ferrell and Oltjen, 2008). The OM%, NDF%, ADF% or CP% were not useful as predictors of NE. The problem becomes how to best model these interactions (Patton *et al.,* 2003). The NRC (2001) used as a truly digestible nutrient system to predict the NE content of feeds. This would include the lignin content of fiber and the amount of protein bound to both ADF and NDF. The 2001 edition of NRC also included a processing factor that made it possible to reflect the effects of different processing methods on the fermentable of NFC protein of feedstuffs.

Table 3. Net energy and production efficiency adjusted with thermal temperature.

Items	R1	R2	R3	SE	Mean of time
Adjusted NEm(Mcal/kg diet)					**
Month, July (5 mo)	0.853	0.894	0.885	0.037	0.877^{F}
Aug.	0.940	0.983	0.941	0.037	0.955^{E}
Sept.	1.078	1.064	1.039	0.037	1.061^{D}
Oct.	1.166	1.164	1.174	0.037	1.168^{C}
Nov.	1.237	1.291	1.276	0.037	1.268^{B}
Dec.	1.327	1.411	1.370	0.037	1.369^{A}
Mean of treatment	1.100	1.134	1.114	0.015^{NS}	
Adjusted NEg (Mcal/d)					
Month, July (5 mo)	0.615	0.621	0.509	0.042	0.582^{D}
Aug.	0.741	0.698	0.551	0.042	0.663^{C}
Sept.	0.902	0.905	0.696	0.042	0.834^{A}
Oct.	1.014	0.941	0.673	0.042	0.876^{A}
Nov.	0.922	0.935	0.677	0.042	0.845^{A}
Dec.	0.858	0.804	0.583	0.042	0.749^{B}
Mean of treatment	0.842^{A}	0.817^{A}	0.615^{B}	0.017	**
Adj. Production efficiency%					
Month, July (5 mo)	18.31	20.98	24.42	0.914	21.24^{A}
Aug.	15.23	18.67	22.60	0.914	18.83^{B}
Sept.	12.67	14.42	17.98	0.914	15.02^{C}
Oct.	11.25	13.91	18.82	0.914	14.66^{C}
Nov.	12.37	14.08	18.71	0.914	15.05^{C}
Dec.	13.36	16.36	22.64	0.914	17.45^{B}
Mean of treatment	13.87^{C}	16.40^{B}	20.86^{A}	0.373	**

^{A,B,C} and ^{D}: values in the same row or column with different superscripts differ significantly (P<0.01).
NEm = 0.077 * $LBW^{0.75}$ (Ames *et al.,* 1981)
Adjusted NEm = NEm + NEm (CF (Temperature – 20), CF=0.001 (Ames *et al.,* 1981)
Adjusted NEg = MEI - NEIm
Retained energy, Mcal/d = $LBW^{0.2955}$ x 0.544 x $DWG^{1.262}$ (Overton, 1999)
Adjusted production efficiency % = Retained energy / adj. NEg x 100

(a) (b)

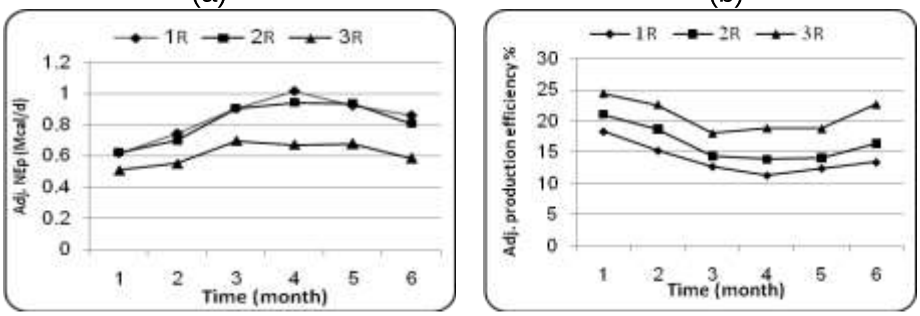

Fig. 1. The adjusted NEg (a) and production efficiency (b) of growing lambs fed CFM plus either berseem hay, BSC or BSB.

Production efficiency (PE%) adjusted with thermal temperature improved significantly (P<0.01) in R3 followed by R2 and R1 (20.86, 16.40 and 13.87, respectively) as shown in Table (3). The interaction between treatment and time (months) was not significant but it had a similar trend with NEm. The highest mean of PE% was in the first month (21.24%) and decreased significantly (P<0.01) with the advancement of age. The results had a similar trend but higher values than obtained by Regadas Filho *et al.* (2011). They reported that NEm requirement of growing Santa Ines lambs (at 30 kg BW and 150 g/d ADG) was 0.669 Mcal/d and the NEg was 0.519 Mcal/d. Petit and Castonguay (1994) reported that growth of lambs fed high-protein silage may be more dependent on intake of N compounds than on NEg intake. Ferrell and Jenkins (1984) indicated that the maximum efficiency in daily gain may occur at less than maximum energy or feed intake. The rate of protein accretion depends on the relative rates of protein synthesis and degradation, rapidly growing animals must have a greeter ratio of protein synthesis to protein degradation than slower growing animals (Castro Bulle *et al.,* 2007).

Table 4. The calculated NE based on ration ADF% compared with adjusted NE based on ambient temperature.

Items	Calculated (as ADF%)			Adjusted (as Temperature)		
	R1	R2	R3	R1	R2	R3
TDMI, kg/d	0.826	1.024	0.841	1.053	1.056	0.956
NEm, Mcal/kg	1.735	1.614	1.676	1.100	1.134	1.114
NEIm, Mcal /d	1.433	1.653	1.410	1.158^{B}	1.197^{A}	1.065^{C}
NEg, Mcal/kg	0.866	0.845	0.856	-	-	-
NEIg, Mcal /d	0.715	0.865	0.720	0.842^{A}	0.817^{A}	0.615^{B}
NEI, Mcal/d	2.148	2.518	2.130	2.051	2.070	1.730
NEIm / NEI	0.667	0.656	0.662	0.565^{B}	0.578^{B}	0.616^{A}
NEIg / NEI	0.333	0.344	0.338	0.411^{A}	0.395^{A}	0.355^{B}
NEI (Diges. T.), Mcal/d	1.607	2.012	1.517	-	-	-

^{A,B} and ^{C}: values in the same row with different superscripts differ significantly (P<0.01).

The economic evaluation for the experimental diets is illustrated in Table (5). The present results revealed that the price of kg DM and total feed cost of control ration based on berseem hay were higher than silage rations (R2 and R3). On contrary, the price of ADG and the profit (as total cost/lamb) were greater by about 44% and 39.3% for R2 and R3, respectively. In addition, the best economic efficiency was calculated for silage based rations which was even more economic than the control ration (98.6, 98.1 *vs.* 62.0% for R2, R3 *vs.* R1, respectively). The difference between silage rations reflected nearly similar values. Similar findings were obtained by Gaafer *et al.* (2010) who reported that average daily feed cost was higher (P<0.05) but net revenue and economic efficiency were lower (P<0.05) for lambs fed fresh berseem, berseem hay or fresh sorghum compared with those fed fresh or dried sugar beet tops. Results are in agreement with Abd El-Malik *et al.* (2003); Mohsen *et al.* (2006); El-Sherif *et al*. (2008) and Abdelhamid *et al.* (2009) who concluded that biological supplement (like bacteria plus fungi, yeast culture or EM1 which contained lactobacillus bacteria, yeasts and fungi) to ensiling process of by-products improved growth performance and economic efficiency without any negative effects on animal health. Abou El-Enin (2005) showed that the best economic efficiency and lowest daily feed cost recorded with the rations based on berseem silage supplemented with ground yellow corn or whey of chees compared with hay when fed lactating buffaloes.

Table 5. The profit and economic efficiency of growing lambs fed tested rations.

Items	R1	R2	R3
Price / kg DM , LE	1.235	1.116	1.198
DMI, kg/d	1.053	1.056	0.956
Total cost, LE/d	1.300	1.178	1.145
ADG, kg/d	0.117	0.130	0.126
Price of DG, LE	2.106	2.340	2.268
Profit (LE) as total cost/lamb	0.806	1.162	1.123
Economic efficiency, %	62.0	98.6	98.1

Market price pt/kg fresh of : CFM = 174; BH = 74; BSC = 22.5; BSB = 20.5 and kg live body weight gain = 18.00 LE (during early 2009).Economic efficiency % = (Price of DG – Daily feed cost)/ Daily feed cost x 100.

Slaughter results and carcass evaluation:

The slaughter and carcass evaluation of growing lambs are presented in Table(6). The present feeding system did not effect on fasting weight and carcass weight. While, the hot dressing%, Longissimus dorsi (L.D) tend to be higher in R2 than others. As well as, the DM and Crude protein% of L.D were higher in R2 than other groups (being 51.88 and 40.06%, respectively). Carcass evaluation did not differ significantly among groups. These findings are in agreement with Price *et al*. (2006) who proposed that carcass characteristics of lambs did not differ among dietary treatments feeding two varieties of field peas. Petit and Castonguay (1994) found that Romanov crossbreed lambs fed only silage had higher percentages of carcass with poorer muscling compared to lambs fed silage supplemented with CFM. The results are in agreement with those findings by Abdul-Aziz *et al*. (1999) who found that hot carcass, dressing%, loin cut internal fat and eye muscle area did not differ significantly between lambs fed either BH plus CFM or silage plus CFM.

Otherwise, Fluharty *et al.* (1999) reported that lambs fed corn silage had a heavier ($P<0.01$) hot carcass weight and a greater ($P<0.01$) dressing% compared with lambs offered alfalfa haylage. These findings may be due to corn silage contains higher amount of metabolizable energy compared with alfalfa haylage or berseem silage.

Table 6. Carcass characteristics in growing lambs fed berseem silage treated with deferent additives.

Items	R1	R2	R3	±SE
Fasting weight, kg	54.83	50.67	54.00	1.748
Carcass Length, cm	51.00	48.3	49.3	1.07
Rump round, cm	29.00	27.00	29.00	1.35
Hot Carcass, kg	29.32	28.09	29.74	0.885
Carcass compactness [a]	0.573	0.583	0.603	0.021
Hot dressing %[b]	53.73	55.39	55.13	2.031
Fore right quarter (FR), kg	6.48	6.26	6.45	0.174
Fore left quarter (FL), kg	6.44	6.45	6.58	0.203
Hind right quarter (HR), kg	6.05	5.82	6.54	0.272
Hind left quarter (HL), kg	6.63	6.10	6.58	0.327
FR/ hot carcass %	22.12	22.31	21.69	0.184
FL/ hot carcass %	21.94	23.01	22.11	0.554
HR/ hot carcass %	20.63	20.69	22.02	0.475
HL/ hot carcass %	22.63	21.65	22.13	0.537
Loin cut, kg	2.42	2.29	2.36	0.062
Longissimus dorsi (L.D) muscle, kg	1.138	1.172	1.082	0.060
L.D. fat, kg	0.300	0.367	0.350	0.048
Liver, kg	0.917	0.808	0.880	0.077
Heart, kg	0.234	0.243	0.229	0.018
Kidney, kg	0.142	0.120	0.131	0.008
Moisture%	54.06	48.12	53.90	1.83
Crude protein%	35.19	40.06	35.08	1.606
Water/Protein ratio	1.54	1.21	1.55	0.108
pH	5.28	5.27	5.47	0.097

[a] Carcass weight / length ratio (Vieira *et al.*, 2005) ; [b] Hot carcass/fasting weight*100

Conclusion:

The present study may lead to conclude that the calculated NE for maintenance based on ADF% of tested rations was higher than adjusted NEm. Feed conversion and production efficiency adjusted with thermal temperature improved significantly in feeding R3 followed by R2. Growth performance and economic efficiency were better in R2 than others. As well as, R2 showed better values of hot dressing%, L.D weight, DM and CP%. In general, the best profit, performance and economic efficiency under the local thermal temperature was recorded with animals fed berseem silages compared with those fed berseem hay as a basal diet.

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تأثير التغيرات الموسمية ونوع مواد العلف الخشنة على:
1- النمو والتمثيل الغذائي ومواصفات الذبيحة للحملان

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تم في هذه الدراسة اختيار 18 رأس من الحملان النامية الخليطة (عند متوسط وزن 23.2± 0.91 كجم وعمر 5 شهور) لدراسة معدلات النمو والكفاءة التحويلية والتمثيل الغذائي ومواصفات الذبيحة عند التغذية على انواع مختلفة من مواد العلف الخشنة تحت ظروف مناخية مختلفة. تم توزيع الحيوانات على ثلاث مجموعات متساوية (6 حملان فى كل مجموعة). المجموعة الأولى (م1) كانت تغذى على مخلوط علف مركز ودريس البرسيم (مقارنة)، اما المجموعة الثانية (م2) غذيت على العلف المركز وسيلاج برسيم مضاف اليه 5% مجروش ذرة صفراء اثناء السيلجة ، والمجموعة الثالثة (م3) غذيت على العلف المركز وسيلاج البرسيم مضاف اليه 2% مخلوط بكتيريا وخمائر أثناء السيلجة. وقد تم تسجيل الظروف المناخية مثل درجات الحرارة والرطوبة النسبية شهريا. تم حساب معدلات النمو اليوميوالنسبي والمأكول اليومي وكذلك الكفاءة التحويلية. أيضا تم حساب الكفاءة الانتاجية والاقتصادية. كما تم حساب الطاقة الصافية الحافظة والخاصة بالنمو على اساس درجات الحرارة الجوية حسابيا. وقد أظهرت النتائج أن معدلات النمو اليومي والنسبي والكلى للحملان المغذاه على سيلاج البرسيم وخاصة في م2 كان أعلى من حملان مجموعة المقارنة ولكن بدون فروق معنوية. أما الكفاءة التحويلية كانت أعلى فى م3 عن بقية المجاميع (7.771 ، 9.425 ، 8.497 للمجموعات م3، م1 ، م2على التوالي). فى حين أن م3 كانت تستهلك أقل كمية مادة جافة. وقد تفوقت م2 قليلا عن بقية المجاميع فى الطاقة الصافية الحافظة. في حين كانت م3 أقل معنويا (P<0.01) فى الطاقة الصافية الخاصة بالنمو. بينما الطاقة المحتجزة والكفاءة الانتاجية كانت أعلى معنويا (P<0.01) فى م3 ويليها م2. لم تتأثر معظم مواصفات الذبيحة بنظام التغذية، مع ان م2 أعطت أفضل نتائج في نسبة التصافي ووزن العضلة العينية ونسبة المادة الجافة والبروتين الخام فى تلك العضلة.

يمكن أن نستخلص من هذه الدراسة أن كلا من المعاملة بمجروش الذرة والمعاملة البيولوجية أثناء سيلجة البرسيم حسنت كلا من الكفاءة التحويلية والانتاجية للحملان. وكان أفضل معدلات نمو وعائد وكفاءة اقتصادية للحملان النامية تحت ظروف التغيرات الموسمية المحلية في المجاميع المغذاه على سيلاج البرسيم وخاصة المعامل بالذرة المجروشة (م2) بالمقارنة بتلك المغذاه على دريس البرسيم كمصدر أساسى للعلف الخشن.

قام بتحكيم البحث

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