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Effect of Common Reed (*Phragmites australis*) Silage on Performance of Growing Lambs

Y.I. El-Talty, M.H. Abdel-Gwad and A.E.M. Mahmoud
Department of Animal Production, Faculty of Agriculture, Cairo University, 12613, Egypt

Corresponding Author: M.H. Abdel-Gwad, Department of Animal Production, Faculty of Agriculture, Cairo University, 12613, Egypt

ABSTRACT

The present study aimed to evaluate the effect of common reed silage on the performance of growing lambs. Twenty Barki (33±0.57 kg) and 9 months old were divided into four equal groups in 90 days experimental period. The treatments were; (C) as a control group were animals fed clover hay plus Concentrate Feed Mixture (CFM), while, the experimental animals were fed (R1) reed (*Phragmites australis*) silage with molasses (RSM) plus CFM, R2) Reed Silage with Molasses and Formic acid (RSMF) plus CFM and (R3) Reed Silage with Molasses and Lactic acid bacteria (RSML) plus CFM. The chemical composition indicated that control ration was insignificantly little pitting lower in crude fiber and its constituents and higher in NFE comparing to the other rations. The digestibility coefficients (%) of nutrients (EE, CF, NDF, ADF, Cellulose and hemicellulose) were insignificantly different. On the other hand, DM, OM and CP digestibilities were significantly higher with R1 comparing to the control ration. There was no significant difference for nutritive value estimates of TDN, DCP, GE and DE among all tested rations. Similarly, the nitrogen balance was insignificantly differed among all treatments. Rumen pH of all treatments was significantly decreased at 3 h post feeding and then increased at 6 h post feeding. In contrary both ruminal ammonia nitrogen and total volatile fatty acids increased at 3 h post feeding and then decreased at 6 h post feeding. Blood metabolites of Albumin, Globulin and GOT were insignificantly differed for all tested rations, while total proteins and creatinine were significantly higher in R2, urea significantly higher in control ration and GPT significantly higher with R1. In digestion trail, feed intake as DM and TDN was significantly higher in the control group, while DCP intake was insignificantly differed. Treatments feed conversion was insignificantly differed. It is concluded that reed silage was quite suitable as an alternative fodder for lambs growing with some minor additives that keep protein and energy on the demanded requirements.

Key words: Common reed, silage, lambs, digestion

INTRODUCTION

Livestock sustainability is a major concern in many parts of the tropics because of: (1) The ever increasing population, (2) The limited availability of feed resources, (3) Recurrence of drought in the area and (4) Outbreaks of transboundary animal diseases and new emerging diseases (Kayouli, 2007). In Egypt feed and food production are highly associated, since increasing one of them will lead to decreasing the other due to competition on limited cultivated land, for example, increasing the cultivated area of berseem (clover) will lead to decreasing the cultivated area of wheat. Therefore, searching for un-conventional plants or new source of green crops to feed animals is must and should be exploited hardly (Moussa *et al.*, 2011). Improved feeding systems based on adding locally available feed resources will enhance milk and meat production at a considerably low cost and partially fill the gap in protein and energy shortage (El-Talty *et al.*, 2007; Allam *et al.*, 2007). Huge amount of the aquatic weed (*Phragmites australis*) is found on the Nile river, lakes banks and salt marches (Gihad *et al.*, 1991; Abdel-Gawad *et al.*, 2003). Haslam (1972) mentioned that, common reed (*Phragmites australis*) is a large perennial rhizomatous grass, commonly found in alkaline and brackish environments. Ahmed *et al.* (2002) said that, reed grass is a palatable green forage and it can be successfully utilized by farm animals. Recently, Shwerab *et al.* (2010) stated that, growing Barki lambs fed rations formulated from ensiled reed plants with olive cake or whole date meals showed normal growth rates.

The main objective of this study was to determine the effects of reed (*Phragmites australis*) silage as alternative feed source on growth performance of Barki lambs compared with clover hay.

MATERIALS AND METHODS

This part was carried out at two places. Firstly, the growth trial was carried out at El-Gamea El-Arabia Farm in Wadi El-Nitroun and secondly the digestion trials were done at the Experimental Station of Animal Production Department, Faculty of Agriculture, Cairo University, Giza, Egypt, to investigate performance of growing lambs fed rations containing reed plants silages. The experiment lasted for 90 days.

Experimental animals and rations: The three reed silages type were prepared in 50 bags and incubated for 10 weeks to use it in growth trail. Twenty Barki lambs averaged 33±0.57 kg body weight; 9 months old were divided into 4 groups of 5 animals each according to live weight for 90 days trial. Animals in the control group (C) were fed clover hay plus Concentrate Feed Mixture (CFM), while, the experimental animals were fed (R1) Reed Silage with Molasses (RSM) plus CFM, (R2) Reed Silage with Molasses and Formic acid (RSMF) plus CFM and (R3) Reed Silage with Molasses and Lactic acid bacteria (RSML) plus CFM to cover the total requirements of energy and protein needed for sheep growth according to (NRC., 1985).

Feeding procedures: The growing lambs were fed (in groups) CFM and forage twice daily and water was allowed freely all the day round. Orts were collected just before offering the next day's feed. Lambs were weighted biweekly before morning feeding after 17 h fasting period. The CFM was adjusted biweekly according to body weight changes. Feed intake was recorded, daily body weight gain and feed efficiency were calculated.

Digestion trials: Four Rahmani rams were used in (4×4) Latin square design to evaluate the experimental rations through four metabolism trials. During this trial the experimental rations as dry matter intake (divided into 66% CFM and 34% roughage) were offered at 2% of Live Body Weight (LBW) according to Ghoneim (1964) allowance for domestic sheep requirements.

Chemical analysis: Feeds and feces were analyzed for proximate analyses (AOAC., 1990). Nitrogen free extract was calculated by difference. Fiber fractions were analyzed according to Van Soest and Wine (1967) method.

Rumen liquor sampling: In part I and II and at end of collection period, rumen liquor samples were taken just before morning feeding, three and six hours post feeding. Rumen liquor samples were collected through rubber stomach tube attached to electric suction pump. Samples of rumen liquor were strained through two layers of cheesecloth and its pH was immediately recorded after collection with Beckman pH meters. Strained Rumen Liquor (SRL) samples were acidified with 0.1 N hydrochloric acid and concentrated orthophosphoric acid and stored by freezing for determination of total volatile fatty acids (TVFA's). The rumen liquor pH value of rumen liquor samples was determined using pH meter. Concentration of ammonia-N in rumen liquor was determined according to Conway (1957), the concentration of total VFA's was determined in rumen liquor by the steam distillation method (Warner, 1964) using Mrkham micro distillation apparatus.

Blood analysis: At the end of each period in the three parts, blood samples were withdrawn from all the experimental animals. The blood samples were taken from the jugular vein in dry clean glasses tubes using heparin as anticoagulant and then centrifuged for 15 min at 4000 rpm to obtain plasma. Biochemical constituents of blood plasma were determined using commercial kits, total protein and creatinine as described by Tietz (1986) and Tietz *et al.* (1990), albumin was determined according to Doumas *et al.* (1971), blood plasma urea was determined according to Patton and Crouch (1977). Alanin amino transferase (ALT) and activity of aspartate transferase (AST) were determined by the methods of Young (1990).

Statistical analysis: Data was analyzed using the general liner model procedure of SAS (1996). One way ANOVA procedure used to analyze data based on the following model:

$$Y_{ij} = \mu + R_i + E_{ij}$$

where, μ is the overall mean of Y_{ij}, R_i is the treatment effect, E_{ij} is the experimental error. The differences among means were separated according to Duncan's New Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Chemical composition of the experimental feedstuffs and rations: The chemical composition of CFM, tested forages and the experimental rations are presented in Table 1 and 2. Data in Table 1 refers to similarity in organic matter percentage in all tested rations being 89.52, 88.56, 89.93 and 87.71% in C, R1, R2 and R3 ration, respectively.

Crude protein in experimental rations ranged from 12.79-13.49%, also EE ranged between 4.64-5.16%. Crude fiber content in tested reed silage rations increased by 3% than clover hay ration, this due to the high content of CF in reed silages being 36.06, 38.39 and 34.20% in RSM, RSMF and RSML, respectively than clover hay (25.71%). The same trend was noticed with ash % in R1, R2 and R3 than C being 10.42, 11.52, 10.07 and 12.29%. Similar results were observed with El-Kholany (1998) using rations of CFM+Berseem, CFM+Reeds, CFM+Berseem+Reeds, CFM+Sorghum or CFM+Reeds+Sorghum. Crude fiber content in the control diet was little bit higher than the tested diets, while in contrary nitrogen free extract was higher in the control diet (clover), comparing to the tested diets. That means most of the chemical composition of all diets including control are almost similar.

Table 1: Chemical composition of feedstuffs and experimental rations consumed by growing lambs (DM basis)

		Composition (% DM basis)					
Item	DM (%)	OM	CP	EE	CF	NFE	Ash
CFM	89.96	90.28	14.10	5.23	7.20	63.75	9.72
CH	88.65	88.04	12.31	3.95	25.71	46.07	11.96
RSM	36.32	84.98	10.21	5.01	36.06	33.70	15.02
RSMF	32.57	89.24	10.26	3.49	38.39	37.10	10.76
RSML	34.30	82.67	11.01	4.09	34.20	33.37	17.33
Experimental rations (calculated)							
C	89.52	89.52	13.49	4.80	13.47	57.76	10.48
R1	71.80	88.56	12.79	5.16	17.02	53.59	11.44
R2	70.44	89.92	12.79	4.64	17.81	54.68	10.08
R3	71.08	88.93	13.05	4.84	16.36	54.68	11.07

CH: Clover hay, RSM: Reed silage with molasses, RSMF: Reed silage with molasses and formic acid, RSML: Reed silage with molasses and lactic acid bacteria, CFM: Concentrate feed mixture, R1: Ration 1, R2: Ration 2 and R3: Ration 3

Table 2: Fiber fractions of the experimental feedstuffs and rations consumed by growing lambs on DM basis

	Feed stuffs				
Items	NDF	ADF	ADL	Cellulose	Hemicellulose
CFM	28.03	12.22	9.13	3.09	15.81
CH	46.89	37.78	13.47	24.31	9.11
RSM	77.63	57.96	18.88	39.08	19.67
RSMF	78.97	54.94	18.22	36.72	24.03
RSML	76.03	52.04	17.78	34.26	23.99
Experimental rations (calculated)					
C	34.42	20.88	10.60	10.28	13.54
R1	44.92	27.79	12.45	15.34	17.13
R2	45.36	26.75	12.22	14.53	18.61
R3	44.31	25.73	12.06	13.67	18.58

CH: Clover hay, RSM: Reed silage with molasses, RSMF: Reed silage with molasses and formic acid, RSML: Reed silage with molasses and lactic acid bacteria, CFM: Concentrate feed mixture, R1: Ration1, R2: Ration 2 and R3: Ration 3

Rations being used in this trial is composed of control (C): The 66% FCM+34% CH, R1: 66% FCM+34% RSM, R2: 66% FCM+34% RSMF, R3: 66% FCM+34% RSML. CFM 14% consisted of 50% corn grain (8%CP) +24% wheat bran (15%CP) +15% cotton seed meal (26%CP) +6% soy bean meal (44%CP) +5% additives (1% mix of vitamins and minerals +1% salt +3% limestone). Fiber fraction content of tested feedstuffs and experimental rations in Table 2 indicated that Neutral Detergent Fiber (NDF) in tested reed silage rations were increased by 10% than clover hay. The same trend was observed with ADF, cellulose and hemicelluloses of reed silage rations which increased by 5% than clover hay ration.

Digestion coefficients and nutritive values: Data concerning nutrients digestibilities and nutritive values are presented in Table 3. The results indicated that dry matter digestibility was significantly lower ($p<0.05$) with control ration (65.26%) compared to reed silage rations 76.65, 67.47 and 70.23% for R1, R2 and R3, respectively. The same trend was obtained by El-Kholany (1998) using rations containing reeds, berseem, berseem + reeds, sorghum and sorghum + reeds fed to bucks.

Table 3: Digestibility and nutritive value of the experimental rations consumed by sheep

	Experimental rations			
Items	C	R1	R2	R3
Digestibility (%)				
DM	65.29^{b}	72.65^{a}	67.47^{ab}	70.23^{ab}
OM	75.48^{a}	76.06^{a}	70.64^{a}	73.52^{a}
CP	76.44^{b}	82.40^{a}	79.08^{ab}	79.80^{ab}
EE	86.47^{a}	87.05^{a}	88.06^{a}	88.28^{a}
CF	52.22^{a}	58.39^{a}	51.10^{a}	53.06^{a}
NFE	80.42^{a}	79.50^{a}	73.79^{b}	77.47^{b}
NDF	57.30^{a}	62.76^{a}	55.95^{a}	59.33^{a}
ADF	55.83^{a}	59.53^{a}	52.42^{a}	53.70^{a}
Cellulose	54.85^{a}	53.44^{a}	51.77^{a}	52.66^{a}
Hemicelluloses	59.77^{a}	68.00^{a}	58.34^{a}	67.12^{a}
Nutritive values				
TDN (%)	73.13^{a}	72.60^{a}	68.75^{a}	71.22^{a}
DCP (%)	10.31^{a}	10.54^{a}	10.12^{a}	10.41^{a}
GE (Mcal/kg DM)	3.98^{a}	3.79^{a}	3.81^{a}	3.73^{a}
DE (Mcal/kg DM)	2.21^{a}	2.56^{a}	2.21^{a}	2.62^{a}

^{a,b}Means in the same row with different superscript are significantly different ($p<0.05$). Rations: C: 66% FCM+34% CH, R1: 66% FCM+34% RSM, R2: 66% FCM+34% RSMF, R3: 66% FCM+34% RSML

There were no significant differences among experimental rations in organic matter digestibility. In addition, both EE and CF were insignificantly differed among experimental rations. In the same time RSM ration (R1) was highly significant ($p<0.05$) in crude protein digestibility (82.40%) with insignificant difference for R2 and R3, whereas control ration (C) given the lowest value (76.44%). Nitrogen Free Extract (NFE) was significantly lower in RSMF (R2) and RSML (R3) rations being 73.79 and 77.47% compared with control and R1 rations being 80.42 and 79.50%. Similar results reported by Shwerab *et al.* (2010) when he fed sheep diets containing reed ensiled with olive cake and whole date meal. Which were somewhat different than those obtained by Ahmed *et al.* (2002), who recorded that DM, OM, CP, EE, CF and NFE digestibility for reed grass silage fed to bucks were 50.23, 55.53, 44.75, 52.56, 62.15 and 62.98%, respectively. However, El-Nagar (1991) found that the differences in digestibility coefficients of DM, OM and NFE were not significant among rations containing reeds, berseem straw, water hyacinth or bean straw. In addition to that, El-Nagar (1991) indicated that no significant difference between reeds and clover hay rations in CP digestibility. On the other hand, Tag-El-Din (1990) found that the digestion coefficients of DM, CP, EE and NFE were increased but CF was decreased with decreasing the level of reeds in tested rations of sheep. Results related to fiber fraction digestibility showed that there were no significant ($p<0.05$) differences between control ration and tested reed silage rations (R1, R2 and R3) in NDF, ADF, cellulose and hemicelluloses digestibility. The same trend was obtained by Marei (2007) when offered reed plant silage to rams and digestion coefficients of fiber fractions were 61.02, 52.15, 73.56 and 60.99% for NDF, ADF, hemicelluloses and cellulose. Also, Shwerab *et al.* (2010) recorded the following results with growing lambs fed (three diets containing 70% reed silage +20, 15 or 10% olive cake and 10, 15 or 20% whole date meal with CFM). The nutritive values of tested rations presented in Table 3 indicated that there is no significant difference for TDN, DCP, GE and DE values among all rations. Similar results were obtained by El-Kholany (1998). On contrast Ahmed *et al.* (2002) and Shwerab *et al.* (2010) reported lower values of TDN and DCP for reed silage in sheep ration.

Nitrogen balance: Data concerning nitrogen balance in Table 4, showed significant difference in N-intake among tested rations being 25.47, 22.62, 22.80 and 23.76 g h^{-1}, for C, R1, R2 and R3, respectively. In this respect clover hay recorded slight high significance ($p<0.05$) by 3% than R1 and R2, whereas RSML ration (R3) was significantly higher than other reed silage rations. This could be attributed to CP content in the previous rations being 13.94, 12.79, 12.79 and 13.05% with control, R1, R2 and R3, respectively. Similar results were obtained by Nour *et al.* (1995) with sheep rations containing 40% reed with 60% CFM (20.30 g h^{-1}). Also, similar results recorded by Shwerab *et al.* (2010) with sheep fed on reed ensiled with olive cake and whole date meals plus CFM, were the nitrogen intake being 23.79 g h^{-1}.

On the other hand no significant difference ($p<0.05$) was detected in N-intake either per kg weight or kg $w^{0.75}$ between sheep fed control ration C (0.50 g kg^{-1} w and 1.33 g kg^{-1} $w^{0.75}$) or reed silage rations 0.50 g kg^{-1} w and 1.29 g kg^{-1} $w^{0.75}$, 0.53 g kg^{-1} w and 1.53 g kg^{-1} $w^{0.75}$ or 0.55 g kg^{-1} w and 1.41 g kg^{-1} $w^{0.75}$ with R1, R2 and R3, respectively. There was no significant difference ($p<0.05$) in total N-excreted among reed silage rations R1, R2 and R3 and control ration.

The obtained results of nitrogen balance either per head; kg w or kg $w^{0.75}$ were positive without significant difference among tested rations. The values were 9.47, 8.91, 8.27 and 9.10 g h^{-1}, 0.18, 0.20, 0.19 and 0.21 g kg^{-1} and 0.50, 0.52, 0.50 and 0.54 g kg^{-1} $w^{0.75}$ with C, R1, R2 and R3, respectively. Such results may be due to that N-balance had the same trends as daily body weight gain being similar among all treatments; 184.62, 177.08, 165.39 and 180.78 with control, R1, R2 and R3, respectively.

Table 4: Nitrogen balance of sheep fed the experimental rations

	Experimental rations			
Items	C	R1	R2	R3
Live body weight	51.25	44.25	43.50	43.50
Metabolic body weight ($w^{0.75}$)	19.15	17.14	16.92	16.92
N-intake				
g/h/day	25.47^a	22.26^d	22.80^c	23.76^b
g/kg	0.50^a	0.50^a	0.53^a	0.55^a
g/$w^{0.75}$	1.33^a	1.29^a	1.35^a	1.41^a
N-excreted				
In feces	5.61^a	3.66^b	4.41^b	4.50^b
In urine	10.38^a	9.70^a	10.10^a	10.16^a
Urine/feces ratio	1.85^a	2.77^a	2.32^a	2.30^a
Total N-excreted				
g/h/day	16.00^a	13.35^a	14.52^a	14.66^a
g/kg	0.31^a	0.30^a	0.33^a	0.34^a
g/$w^{0.75}$	0.84^a	0.77^a	0.86^a	0.87^a
N-balance				
g/h/day	9.47^a	8.91^a	8.27^a	9.10^a
g/kg	0.18^a	0.20^a	0.19^a	0.21^a
g/$w^{0.75}$	0.50^a	0.52^a	0.50^a	0.54^a

[a,b]Means in the same row with different superscript are significantly different ($p<0.05$), Rations: C: 66% FCM+34% CH, R1: 66% FCM+34% RSM, R2: 66% FCM+34% RSMF, R3: 66% FCM+34% RSML

Rumen parameters

Rumen pH: Data dealing with the effect of the experimental rations and sampling time of rumen liquor on rumen pH values are summarized in Table 5. Results indicated that the ruminal pH values were significantly ($p<0.05$) highest with control and R3 rations at all sampling times than R1 and R2. These results may be due to the effect of fermentation characteristics in RSM and RSMF silage than RSML. In the same order, reed silage with molasses ration (R1) recorded the lowest value of rumen pH before feeding (5.77) and at 6 h (5.60) compared with other rations.

Concerning the sampling time, the values of pH before feeding was found to be high and then decreased at 3 h post feeding and returned to increase at 6 h post feeding for all experimental rations. Similar results were noticed by El-Kholany (1998), Marei (2007) and Shwerab *et al.* (2010). Owen *et al.* (1998) concluded that rumen pH is affected by the TVFA's concentration in rumen fluid. These results were caused by the intensive fermentation process of both non structural and structural carbohydrates and the production of volatile fatty acids. The means of pH values of sheep fed the different ration were within the normal range as mentioned by Hungate (1996) being 5.5-7.3. Variations in pH values obtained in the present study could be explained by that rumen pH values were varied according to the nature of diet, after feeding time and quantities of organic acids in the ingesta mentioned before by Phillipson (1970).

NH_3-N concentration: Results concerning the effect of the experimental rations and sampling time of rumen liquor on NH_3-N concentration are presented in Table 5. Regardless sampling time, there was insignificant increase in NH_3-N concentration with sheep fed experimental rations being 22.58, 18.60 and 14.96 mg/100 mL rumen liquor with R1, R2 and R3, respectively compared with control (19.60 mg/100 mL rumen liquor). In this respect, NH_3-N concentration was found to be highest with R1. Regarding sampling time, NH_3-N concentration did not significantly differ

Table 5: Rumen parameters of sheep fed the experimental rations

	Experimental rations			
Items	C	R1	R2	R3
Rumen pH				
Zero time	6.81^{a}	5.77^{c}	6.35^{b}	6.80^{a}
3 h	6.01^{a}	5.32^{b}	5.50^{b}	5.90^{a}
6 h	6.78^{a}	5.60^{c}	5.85^{b}	6.70^{a}
Mean	6.54^{a}	5.56^{c}	6.47^{a}	5.90^{b}
Rumen ammonia (NH_3-N)				
Zero time	16.67^{ab}	18.60^{a}	12.40^{b}	15.40^{ab}
3 h	25.00^{a}	29.07^{a}	18.38^{a}	26.93^{a}
6 h	17.10^{a}	20.09^{a}	14.10^{a}	13.46^{a}
Mean	19.60^{a}	22.58^{a}	18.60^{a}	14.96^{a}
Rumen total volatile fatty acids TVFA's				
Zero time	10.81^{a}	8.00^{ab}	6.94^{b}	7.47^{b}
3 h	13.56^{a}	15.31^{a}	8.47^{b}	9.28^{b}
6 h	12.10^{a}	12.94^{a}	7.56^{b}	7.84^{b}
Mean	12.16^{a}	12.08^{a}	8.20^{b}	7.66^{b}

[a,b]Means in the same row with different superscript are significantly different ($p<0.05$), Rations: C: 66% FCM+34% CH, R1: 66% FCM+34% RSM, R2: 66% FCM+34% RSMF, R3: 66% FCM+34% RSML

($p<0.05$) among control, R1, R2 and R3 at zero time (16.67, 18.60, 12.40 and 15.40 mg/100 mL rumen liquor). The R2 recorded the lowest value of rumen ammonia. Also, there were no significant differences among experimental rations at 3 and 6 h.

The ruminal NH_3-N concentration was minimum before feeding and then increased to reach a maximum value at 3 h after feeding and tended to decrease again. Decrease in ruminal NH_3-N concentration after 3 h post feeding could be related to the utilization of N by the ruminal microorganisms or a dilution from a large rumen total volume. Ammonia-N concentration was within the normal range described by Church (1975), being 10-45 mg/100 mL depending on composition of the ration, time of sampling and method of analysis used. Also, Mehrez (1992) indicated that the optimal NH_3-N concentration for maximum rate of fermentation in the rumen was affected by the dietary type and level of fermented energy in the rumen. Lower ruminal NH_3-N concentration may indicate best utilization of NH_3-N by rumen microbes (Saxena *et al.*, 1971).

TVFA's concentration: Values of TVFA's concentration in Table 5 indicated that the minimum TVFA's was recorded at zero time and gradually increased to the maximum at 3 h after feeding and tended to decrease again at 6 h after feeding. That means both rumen ammonia nitrogen concentration and ruminal TVFA were almost positively correlated within their concentration over time. The highest value of TVFA's concentration was at 3 h after feeding which was reflected on pH values at the same time (being lowest). There were insignificant ($p<0.05$) differences in TVFA's concentrations between R2 and R3 in all sampling times, while control and R1 recorded the highest value before feeding, at 3 and 6 h. Such results indicate that the inclusion of reeds in tested rations created similar rumen environment in relation to TVFA's production which showed closer values for all dietary rations either before or after feeding. Similar trends were recorded by El-Kholany (1998), who found that the differences were not significant for VFA's with feeding reed plants containing rations for goats.

Blood parameters: Values of plasma total proteins of sheep fed the experimental rations were significantly differed ($p<0.05$) and presented in Table 6, were the average values 6.70, 6.52, 7.10 and 6.42 g dL^{-1} for C, R1, R2 and R3, respectively. Similar results were obtained by Marei (2007). On contrast, El-Kholany (1998) recorded higher values of total protein with goats fed rations containing berseem, (9.30 g dL^{-1}), berseem + reeds (9.50 g dL^{-1}), reeds (9.50 g dL^{-1}), hay + rice straw (9.03 g dL^{-1}), sorghum (8.87 g dL^{-1}) and sorghum + reeds (9.27 g dL^{-1}). In the present

Table 6: Blood parameters of sheep fed the experimental rations

	Experimental rations			
Items	C	R1	R2	R3
Total proteins (g dL^{-1})	6.70^{ab}	6.52^{b}	7.10^{a}	6.42^{b}
Albumin (g dL^{-1})	2.77	2.62	2.57	2.50
Globulin (g dL^{-1})	3.92	3.90	4.52	3.92
Urea (mg dL^{-1})	34.50^{a}	17.00^{c}	22.50^{bc}	24.00^{b}
Creatinine (mg dL^{-1})	0.60^{b}	0.70^{b}	0.92^{a}	0.67^{b}
GPT (IU L^{-1})	7.50^{b}	13.00^{a}	8.00^{b}	8.25^{b}
GOT (IU L^{-1})	23.67	24.00	26.67	27.00

[a,b]Means in the same row with different superscript are significantly different ($p<0.05$). Rations: C: 66% FCM+34% CH, R1: 66% FCM+34% RSM, R2: 66% FCM+34% RSMF, R3: 66% FCM+34% RSML

study, total proteins in all experimental rations are within the normal range being 6-8 g dL^{-1} (Kaneko, 1989). In general, plasma proteins concentration can be used as indicator to evaluate the ruminant nutrition (Kumar *et al.*, 1980). Plasma albumin concentration in the experimental rations were insignificantly differed and showed similar trend of total plasma proteins which indicated slight variations among tested rations. The average values were 2.77, 2.62, 2.57 and 2.50 g dL^{-1} for C, R1, R2 and R3, respectively. These values agreed with those reported by Wafaa (2010) which ranged between 2.53-2.95 g dL^{-1} with Rahmni rams. Data presented in Table 6 showed that the average values of plasma globulin were 3.92, 3.90, 4.52 and 3.92 g dL^{-1} for C, R1, R2 and R3, respectively without significant differences. Likewise, Ahmed *et al.* (2002) stated that globulin values ranged from 2.96 to 4.11 g dL^{-1} for goats fed different rations.

Urea concentration in blood plasma was highly significant ($p<0.05$) with control ration being 34.50 g dL^{-1} compared with other rations, in the same order R1 recorded the lowest value of blood urea being 17.00 g dL^{-1} without significant difference with R2 but R3 was higher than R1 and R2. On contrast El-Kholany (1998) noticed the highest value of blood urea concentration with sheep fed on ration contains berseem, (40.13 g dL^{-1}), berseem + reeds (44.80 g dL^{-1}), reeds (44.33 g dL^{-1}), hay + rice straw (48.73 g dL^{-1}), sorghum (50.87 g dL^{-1}) and sorghum + reeds (48.97 g dL^{-1}). Results indicated that there was insignificant increase in blood creatinine with C, R1 and R3 being 0.6, 0.7 and 0.67 mg dL^{-1}, in the same time R2 was significantly increase than others being 0.92 mg dL^{-1}. These values were lowest than those obtained by El-Kholany (1998) and Marei (2007). There was highly significant difference ($p<0.05$) in blood alanine aminotransferase (ALT) concentration between rams fed R1 ration being 13.00 IU L^{-1} compared with C, R2 and R3 being 7.50, 8.00 and 8.25 IU L^{-1}, respectively. On the other side, the values of AST ranged from 23.67-27.00 IU L^{-1} without significant differences among rations. These results were lower than those obtained by Ahmed *et al.* (2002), Ibrahiem (2005) and Marei (2007). Blood plasma transaminase enzymes activity (ALT and AST) are the most important indicators of liver cells activity where increasing the concentration of these enzymes indicate the tissue activity are destroyed (Molander *et al.*, 1957).

Growth performance: Feed intake, average daily gain and feed conversion of lambs fed the four experimental rations were measured. Meanwhile an economic study was conducted to examine the economic potential of these fodders in sheep nutrition.

Live body weight gain: The results of live body weight values are shown in Table 7. There were no significant differences ($p<0.05$) among the lambs at the start of the experiment (IBW), being 36.40, 34.42, 35.71 and 35.33 kg and at the end of the experiment (FBW), being 53, 47, 50 and 51 kg with control, R1, R2 and R3 rations, respectively.

Intake (TDN) was significantly lower ($p<0.05$) with R2 being 766 g than R1 and R3 being 790 and 810 g compared with control being 863 g day^{-1}. On the other hand there were insignificant differences among experimental rations in Digestible Crude Protein Intake (DCPI) being 122, 115, 113 and 118 g day^{-1} for control, R1, R2 and R3, respectively. The treatment R3 showed the best performance comparing to R1 and R2 in DMI, TDNI and DCPI.

Feed conversion: Feed conversion of growing lambs fed the experimental rations expressed as DM, TDN and DCP intake g/g gain are presented in Table 7. The obtained results of feed conversion indicated that using reed silage with different additives (molasses, formic acid and lactic acid bacteria) in sheep rations had no significant effect on feed conversion as DM, TDN and DCP

Table 7: Average live body weight, feed intake, feed conversion and economic efficiency of growing lambs fed the experimental rations

Items	Experimental rations			
	C	R1	R2	R3
Body weight change				
Initial live body weight (kg)	36.40	31.42	35.71	35.33
Final live body weight (kg)	53.00	47.00	50.60	51.60
Total live weight gain (kg)	16.62	15.58	14.89	16.27
Average daily live weight (g)	184.62	173.08	165.39	180.78
Feed intake (h day^{-1})				
CFM	887	800	817	836
CH	451	-	-	-
As fed (g)				
RSM	-	1019	-	-
RSMF	-	-	1164	-
RSML	-	-	-	1125
Feed intake (h day^{-1}) on DM basis				
DM (g)	1180^{a}	1088^{d}	1114^{c}	1138^{b}
TDN (g)	863^{a}	790^{c}	766^{d}	810^{b}
DCP (g)	122^{a}	115^{a}	113^{a}	118^{a}
Feed conversion (g feed/g gain)				
DM (g)	6.40^{a}	6.29^{a}	6.71^{a}	6.29^{a}
TDN (g)	4.67^{a}	4.56^{a}	4.63^{a}	4.48^{a}
DCP intake (g)	0.66^{a}	0.66^{a}	0.68^{a}	0.65^{a}

[a,b]Means in the same row with different superscript are significantly different ($p<0.05$)

intake g/g daily gain compared with control; being 6.29, 6.71, 6.29 and 6.40 g DM, 4.56, 4.63, 4.48 and 4.67 g TDN, 0.66, 0.68, 0.65 and 0.66 g DCP, respectively. These values were higher than those investigated by Shwerab *et al.* (2010) of DMI being 8.02, 7.35 and 7.01 g DM/g gain and 5.11, 4.80 and 4.71 g TDN/g gain. Similar results were reported by El-Kholany (1998) for DM, TDN and DCP conversion and indicated that inclusion of reeds grass in goats rations along with either berseem or sorghum or alone with concentrate did not cause any adverse effect on production efficiency.

CONCLUSION

Regarding growth results indicated that reed silage was suitable for feeding growing lambs and formulated balanced rations with adequate protein and energy which is reflected on health condition and normal performance of all growing lambs in the tested rations. Enriching reed silage with some nutritional additives that tune protein content and increase palatability could be useful and economic as well.

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