GRADUAL SUBSTITUTION OF REED SILAGE WITH ALFALFA HAY FED WITH OR WITHOUT PROBIOTIC TO AWASSI LAMBS.
1- Daily feed intake, live weight gain and feed conversion ratio

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ABSTRACT

The effect of three ratios of alfalfa hay to reed silage (40:0, 20: 20 and 0: 40 H: S ratios) fed with two levels of Iraqi local probiotic (0 and 7.5 g IP / kg DM) on daily feed intake, live-weight gain and feed conversion ratio were investigated in a 2x3 factorial experiment. Twenty four individual Awassi male lambs were used. They were weighing approximately 17kg live weight and 3-4 months of old at start of the experiment. The diets were formulated to be given as a 40 parts alfalfa hay or/and reed silage DM to 60 parts concentrate DM. There were no differences between treatments in daily DM, OM, NDF, ADF, Hemicellulose, cellulose and lignin intake when expressed as g/day or g/kg $W^{0.75}$. The daily intake of total N was followed the intended treatments composition. The live weight gain differences for overall period and feed conversion ratio were not significantly affected by substitution gradually percentages of reed silage with alfalfa hay; However, live weight gain (29.8g/day) and feed conversion ratio (6.0gDM intake/gLWG) were significantly improved for lambs fed diets supplemented with probiotic as compared with those fed diets without probiotic (27.7g/day, 7.0gDM intake/gLWG) respectively. It's recommended that substitution alfalfa hay with reed silage have no effect on live weight gain and feed conversion ratio. Diets supplemented with Iraqi probiotic were clearly improved live weight gain and feed conversion ratio of Awassi lambs.

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إحلال نسب تصاعدية من سايلج القصب محل دريس الجت المغذات بدون او مع المعزز الحيوي للحملان العواسيه

1- كمية الغذاء المتناول اليومي والزياده الوزنيه اليوميه وكفاءة التحويل الغذائي

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المستخلص

تم أستخدام اربعة وعشرين حملاً عواسياً بعمر 3-4 اشهروبمتوسط وزن جسم 17كغم. وضعت الحملان في أقفاص مفرده لدراسة تأثيراحلال نسب تصاعديه من سايلج القصب محل دريس الجت (40 :0 و 20:20 و 0: 40 % دريس الجت: سايلج القصب)، وغذيت مع مستويين من المعزز الحيوي المحضر محلياً (0 و 7.5 غم /كغم ماده جافة) في كمية الغذاء المتناول اليومي ومعدل الزيادة الوزنية اليوميه وكفاءة التحويل الغذائي .قسمت الحملان عشوائياً الى 6 مجاميع متساويه وغذيت على 6 علائق مكونة من 40 جزء اً من دريس الجت مع/او سايلج القصب و 60 جزء علف مركز. أظهرت النتائج عدم وجود اختلافات معنويه بين المعاملات المختلفه في المتناول اليومي من الماده الجافه والعضويه والياف المستخلص المتعادل والحامضي والهميسليلوز والسليلوز واللكنين عند حسابها على اساس غم/يوم او غم/كغم وزن جسم ايضي . اما كمية المتناول اليومي من النتروجين فقد تبعت تركيزه في المعاملات. ان احلال نسب تصاعديه من سايلج القصب محل دريس الجت لم يؤثر معنوياً في معدل الزياده الوزنية اليوميه وكفاءة التحويل الغذائي . في حين اظهرت الحملان المغذاة على المعزز الحيوي المحضر محلياً تحسناً معنوياً في معدل الزياده الوزنية اليوميه وكفاءة التحويل الغذائي مقارنةً مع الحملان المغذاة على علائق لاتحوي على المعزز الحيوي.

Key word: **Reed, silage, probiotic and live weight gain.** مفاتيح الكلمات : سايلج القصب، المعزز حيوي، معدل الزيادة الوزنية
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Introduction

All animal diets have the same basic goal; to provide nutrients in adequate amounts and proportions to meet the maintenance and production requirements of the animals while avoiding waste and over feeding. Roughage is the main source of ruminant animal's feeds. The Iraqi policy during the last 25 years has been given more attention to planning strategically crops as a main source for human foods. This of course led to a huge lack and shortages in planning roughages crops for ruminant. For this reason more attention were given to agricultural by products (15, 17, 23, 26, 37) and manufacture (30,6) byproduct and some natural plants such as reeds (7,16,25,31,32) which both have potential as ruminant feeds. Reed (Phragmites Cummins) is an erect perennial clumpy perennial with coarse rhizomes. It spreads by rhizomes as well as by seeds. Al-safar et al. (11) reported that 900 thousand ton of reed per year is available. During the last twenty years several studies have been carried out using reeds hay (7) or alkali –treated ground reed (25,31) or alkali – treated ground reed supplemented with molasses, urea soybean meal (16,32) as a source of roughage in fattening diet of Awassi lambs. Moreover, reed straw in stead of barley straw was used in the fatting diets of growing beef cattle (10). All previous studies indicated that low voluntary feed intake and slightly low animal performance was associated with increasing substitution of reed to some extend with good quality roughage such as alfalfa hay. The possible reasons for low animal performance might be related to the low nutrients content of reed particularly protein and low OM digestibility. Therefore, the objective of this experiment was to study the effect of substitution different levels of reed silage with alfalfa hay supplemented with or without Iraqi probiotic (IP) on daily feed intake, lives weight gain and feed conversion ratio of Awassi lambs.

Materials and Methods

Experimental Design and Diets

The effect of three alfalfa hay to reed silage ratios and two levels of Iraqi local probiotic (IP) on daily feed intake, live-weight gain and feed conversion ratio were investigated in a 2x3 factorial experiment using a randomized block design with 4 replicates per cell of the design. Diets were formulated to provide three alfalfa hay to reed silage ratios (H: S, 40:0, 20:20 and 0:40) and two levels of IP (0 and 7.5 g IP/ kg DM). Iraqi Probiotic containing**:** ***Lacto bacillus bacilli*** 10^{10}**,** ***Saccharomyces cerevisia*** 10^{9} ***acidophilus*** 10^{10} ***Bacillus ubtilus*** 10^{10}**.** The barley, yellow corn and soybean meal and other protein supplements and minerals were mixed and offered as a concentrate (table 1) fed separately from the alfalfa hay and reed silage. The diets were formulated to be given as 40 parts roughage (Hay and/or Silage) to 60 parts concentrate DM. Chemical composition of the feedstuff and formulation of concentrate diets is shown in Table 1. Formulation and chemical composition of complete diets (concentrate and roughages) is presented in Table 2

Table1. Chemical composition of feedstuffs and Formulation of concentrate diet

Chemical composition	%	DM	OM	CP	EE	C.F	NFE
Ingredients							
Barley	**28**	**91.7**	**86.4**	**11.1**	**1.6**	**8**	**65.7**
Yellow corn	**20**	**90.5**	**85.0**	**9.3**	**3.9**	**3.1**	**68.7**
Wheat bran	**20**	**90.7**	**84.9**	**11.9**	**3.8**	**14.6**	**54.7**
Rice bran	**10**	**93.1**	**86.9**	**10.4**	**3.1**	**17.3**	**56.1**
Soybean meal	**20**	**89.9**	**83.1**	**40.1**	**1.9**	**5.1**	**36.0**
Minerals and vitamin	**1**	**–**	**–**	**–**	**–**	**–**	**–**
Calcium carbonate	**1**	**–**	**–**	**–**	**–**	**–**	**–**

Table 2. Formulation and chemical composition of experimental diets.

Levels of Iraqi probiotic (IP)	Without probiotic			With probiotic		
Hay : silage ratios (H:S)	40:0	20:20	0:40	40:0	20:20	0 : 40
Diet no.	1	2	3	4	5	6
Ingredients %						
Concentrate	60	60	60	60	60	60
Alfalfa hay	40	20	0	40	20	0
Reed silage	0	20	40	0	20	40
Iraqi Probiotic additives	0	0	0	0.75	0.75	0.75
Chemical composition (g/kg DM)*						
Dry matter (DM)	92	92.3	92.6	92	92.3	92.6
Organic matter (OM)	86.88	86.57	86.27	86.88	86.57	86.27
Total protein (TN)	157.2	154.6	152.2	157.2	154.6	152.2
Metabolizable energy (MJ)**	11.17	10.95	10.71	11.17	10.95	10.71
Neutral detergent fiber(NDF)	305	359	413	305	359	413
Acid detergent fiber (ADF)	158.4	198.3	238.2	158.4	198.3	238.2
Hemicelluloses	146.9	160.8	174.8	146.9	160.8	174.8
Cellulose	74.3	85.5	96.5	74.3	85.5	96.5
Lignin	84.1	112.9	141.7	84.1	112.9	141.7

* included concentrate and roughage diets according to percentages used in each treatment

** Calculated according to MAFF (35).

Preparation of Reed Silage

Growing reeds was used in this study. The silo that used was a trench dug on the floor, 10 m long 5m wide and 1.5m deep. The floor and the wall were covered with a polyethylene sheet. Molasses, which is a byproduct of the sugarcane and sugar beet industries, is a relatively cheap source of fermentable carbohydrates which is widely available in Iraq and which is not a staple of the human diet. The molasses was diluted with an equal amount of water then was added at the rate of 5% by weight of the reeds (as green matter basis) in the silo before application. The polyethylene sheeting was then overlaid on the green material before covering with soil which was then tightly pressed by trampling on it using tractor and left for two months. The chemical composition of reed silage and alfalfa hay is shown in Table 3.

Table 3. Chemical composition of wild reed, reed silage and alfalfa hay

	Reed	Reed silage	Alfalfa hay
Chemical composition %			
Dry matter g/kg fresh	**94.1**	**96.5**	**95.0**
Organic matter (OM)	**85.95**	**85.46**	**86.99**
Total nitrogen (TN)	**0.64**	**2.05**	**2.25**
Metabolizable energy(MJ)* (ME)	**0.89**	**0.90**	**0.10**
Dry matter digestibility	**28.9**	**36.3**	**63.3**
Organic matter digestibility	**31.3**	**41.8**	**66.7**
PH	**6.4**	**4.6**	**6.2**
Neutral detergent fiber (NDF)	**70.8**	**72.7**	**45.77**
Acid detergent fiber (ADF)	**49.9**	**49.8**	**29.86**
Hemicellulose	**20.9**	**22.91**	**15.91**
Cellulose	**17.24**	**18.06**	**11.66**
Lignin	**32.66**	**31.74**	**18.2**

*Calculated according to MAFF (35).

Animals and Management

Twenty four individual Awassi male lambs were used. They were weighing approximately 17 kg live weight and 3-4 months of old at the start of the experiment. Four lambs were randomly allocated from live weight block to each treatment. The lambs were individually housed in pens (1.5x2 m) that allowed access to diets supplied in plastic bucket fixed in side the pen. Water was available at all times. The diets were gradually introduced to the lambs over a period of 3 weeks before the start of the experiment. During this time the lambs were vaccinated against clostridia diseases. The diets were offered once daily at about 08.00 hour (h) in quantities calculated to support maintenance and daily gain of 200 g (8). Allowances were recalculated each 2 weeks according to live weight. Alfalfa hay and reed silage and feeds refusal were collected and weighed back daily. Offered and refusal feeds were sampled and stored at $-15C^0$ for subsequent chemical analysis. The lambs were weighed weekly to nearest 0.5 kg, at the same time each day. Recording of daily intake and live weight gain was maintained for 9 weeks.

Chemical Analysis

Samples of feedstuffs, feed offered and refusals were dried at 50 C^o until constant weight before chemical analysis. Samples then ground through a 1mm screen for chemical analysis. DM, OM, TN, EE, CF and NFE were determined for all feedstuffs according to A.O.A.C. (1). Neutral detergent fiber (NDF), Acid detergent fiber (ADF) and lignin were determined for alfalfa hay and reed silage by the method of Goering and Van Soest (14).Invitro DM and OM digestibility of alfalfa

hay and reed silage were determined by the method of Tilley and Terry (41).

Statistical Analysis

Data was statistically analyzed using Completely Randomized Design Model (CRD) procedure by (38). Duncan's multiple range tests was used to determine the significance of differences between treatments means Duncan (12).Analysis of variance was carried out on all data. The treatment was partitioned into main effects and their interaction.

Results and Discussion

Intake

The lambs were consumed all the diets offered. The overall daily intake of DM, OM, NDF, ADF, lignin, ME, and protein are presented in Table 4. There were no differences between treatments in daily DM, OM, NDF, ADF, Hemicelluloses, cellulose and lignin intake when expressed as g/day or g/kg $\mathbf{W^{0.75}}$. The daily intake of total N was followed the intended treatments composition.

Live Weight Gain

Live weight gain is presented for the first 4 weeks, the second 4 weeks and the overall experimental period (Table 5). The mean final live weight, total live weight gain and daily live weight gain (29.8 ,12.8 and 0.203 kg respectively) of lambs fed diets with probiotic were significantly higher than those lambs fed diets without IP (27.7 ,10.6 and 0.168 kg respectively). While increasing substitution of percentages of reed silage with alfalfa hay have no effect on final weight and total daily live weight gain. Live weight gain in the second part of the experiment was greatly higher than the first part for all treatments; except the lambs given diet 6. The pattern of responses to H: S ratios and IP were similar between the first, second parts and overall period of the experiment. In the first and second part of the experiment, the lamb on all treatments fed diets without IP grew below the predicted value of 200 g/day; moreover differences in live weight gain were not statistically significant between treatments. There were no responses to H: S ratios. In contras the lambs on all treatments (T4, T5 and T6) fed diets with IP grew above or close to the predicted value of 200 g/day, except the lambs fed diet 5 grew 10g/day below the target value of 200 g/day. But, there was a level of H: S x IP interaction ($P<0.01$). Finally, the live weight gain differences for overall period and feed conversion ratio were not significantly affected by H: S ratio. However, live weight gain and FCR were significantly improved with those lambs fed diets supplemented with IP (Diets 4, 5 and 6) as compared with those fed diets with out IP. Interaction between different H: S ratio and IP was statistically significant.

Table 4. Overall daily feed intake of nutrients.

Level of probiotic (IP)	Without probiotic			With probiotic			SE of means and significance of effects		
Hay : Silage ratios (H:S)	40:0	20:20	0:40	40:0	20:20	0:40			interaction
Diet no.	1	2	3	4	5	6	H:S	IP	H:SxIP
Dry matter (g/day)	1128	1175	1162	1174	1174	1202	(9.72)^{NS}	(8.32)**	(7.833) ^{NS}
(g/kgW$^{0.75}$ per day)	109.5	114.5	112.0	110.9	110.9	113.3	(0.822) ^{NS}	(0.74) ^{NS}	(0.553) ^{NS}
Organic matter (g/day)	1070	1108	1088	1107	1107	1126	(13.7). ^{NS}	(10.64) ^{NS}	(12.83) ^{NS}
(g/kgW$^{0.75}$ per day)	103.8	107.9	104.8	104.6	104.6	106.1	(1.40) ^{NS}	(0.98) ^{NS}	(1.78) ^{NS}
Total nitrogen (g/day)	28.41	29.18	28.29	29.07	29.07	29.26	(0.31) ^{NS}	(0.291) ^{NS}	(0.277) ^{NS}
(g/kgW$^{0.75}$ per day)	2.75	2.84	2.72	2.83	2.74	2.75	(0.028) ^{NS}	(0.024) ^{NS}	(0.027) ^{NS}
Metabolizable energy (MJ / day)	12.60	12.86	12.60	13.50	12.85	12.88	(0.156) ^{NS}	(0.131) ^{NS}	(0.123) ^{NS}
(g/kgW$^{0.75}$ per day)	1.223	1.252	1.20	1.213	1.213	1.214	(0.011) ^{NS}	(0.011) ^{NS}	(0.012) ^{NS}
Neutral detergent fiber (g/day)	344	422	480	422	422	497	(21.3) ^{NS}	(20.2) ^{NS}	(21.47) ^{NS}
(g/kgW$^{0.75}$ per day)	33.43	41.11	46.29	39.82	39.82	46.81	(0.25) ^{NS}	(2.33) ^{NS}	(0.11) ^{NS}
Acid detergent fiber (g/day)	178.7	233.1	276.9	232.9	232.9	286.5	(20.59) ^{NS}	(17.7) ^{NS}	(18.56) ^{NS}
(g/kgW$^{0.75}$ per day)	17.4	22.7	26.7	21.9	21.9	27.0	(0.152) ^{NS}	(1.7) ^{NS}	(0.29) ^{NS}
Hemicellulose (g/day)	165.6	189.0	203.1	188.8	188.8	210.2	(2.32) ^{NS}	(6.51) ^{NS}	(0.79) ^{NS}
(g/kgW$^{0.75}$ per day)	16.08	18.411	19.59	17.83	17.83	19.81	(0.116) ^{NS}	(0.633) ^{NS}	(0.578) ^{NS}
Cellulose (g/day)	83.87	100.9	112.0	100.2	100.2	115.9	(1.021) ^{NS}	(4.9) ^{NS}	(3.12) ^{NS}
(g/kgW0.75 per day)	8.14	9.82	10.8	9.46	9.46	10.92	(0.071) ^{NS}	(0.485) ^{NS}	(0.061) ^{NS}
Lignin (g/day)	94.84	132.2	164.9	132.65	132.65	170.58	(11.2) ^{NS}	(12.7) ^{NS}	(11.5) ^{NS}
(g/kgW0.75 per day)	9.21	12.88	15.89	12.52	12.52	16.07	(1.50) ^{NS}	(1.22) ^{NS}	(1.46) ^{NS}

*** P<0.01, NS= Not Significant**

Table 5. Effect of different alfalfa hay: reed silage ratios and probiotic additives on live weight gain and feed conversion ratio of Awassi lambs.

Levels of probiotic(IP)	Without probiotic			With probiotic			SE of means and significance of effects		
Hay : silage ratios (H:S)	40:0	20:20	0:40	40:0	20 :20	0:40			Interaction
Diet no.	1	2	3	4	5	6	H:S	IP	H:SxIP.
Initial live weight (Lw , Kg)	17.0	17.0	17.37	17.0	17.0	17.0			
Final Lw (Kg)	27.87	27.63	27.87	30.37	29.5	29.63	NS(0.941)	(0.438)**	(0.412)**
Total LW gain (LWG , Kg)	10.87	10.63	10.50	13.37	12.50	12.63	(0.532)NS	(0.313)**	(0.300)**
LWG (g/day)									
0 – 4 weeks	168	168	165	214	184	205	(22)NS	(13)**	(14)**
4 – 8 weeks	174	175	171	227	196	205	(6.0)NS	(3.0)**	(4.0)**
0 – 9 weeks	172	168	166	212	198	200	(10.1)NS	(2.33)**	(2.08)**
Feed Conversion ratio (g DM intake /g LWG)	6.54	6.97	7.0	5.7	5.9	6.0	(0.28)NS	(0.081)**	(0.058)**

**** P<0.01, NS= Not Significant.**

Since the lambs consumed similar amount of ME and protein across treatments and no effect for increasing substitution of percentages of reed silage with alfalfa hay on final weight and daily live weight gain. So any change in responses in this experiment is mainly related to probiotic. Hassan et al. (25, 31) found that substitution gradually percentages of ground NaOH-treated reed with alfalfa hay have no effect on voluntary feed intake, live weight gain and feed conversion ratio. Greater gains during the late part compared to the early part of the growth periods have been agree with results reported by Hassan and Hassan (19,20) and different than other results reported by Hassan (27); Hassan and Bryant (28,29), And since they are generally common to all diets may merely represent changes in gut fill. Therefore, in the absence of evidence to the contrary, it would seen safe to accept the results of overall growth period as a fairer representation of substitution of reed silage with alfalfa hay and IP feed additives effects on live weight gain and feed conversion ratio. It's appeared that the lambs response to IP was and similar to that presented by (21, 22, 24). There are some reasons which may explain the beneficial effect of probiotic to improve the efficiency of utilization of nutrients in this study. El-Saadany et al.,(13); Allam et al.,(9); Aboul-Fotouh et al.,(3); Abou Ward (2); Karimi and Rahimi,(34) and Mahrous and Abou-Ammou(36) reported that feed additives such as medicinal plants and probiotic improved rumen activity and nutrient digestibility. This improvement in rumen activity and nutrient digestibility might be increased the efficiency of utilization of protein in this experiment; In addition such additives might be reduce the rate of nutrient passage in elementary tract and give more time for utilization and absorption of nutrients (39,40). Similar observation was reported by Hassan (18) when lambs fed diets supplemented with Iraqi probiotic or Nagella sativa or rosemary officinal. Some possible reasons has this responses may explain the beneficial effects of probiotic and anther additive feeds to improve the efficiency of utilization of nutrients in this study. Suskovic et al., (40) indicated that probiotic in the host animal reduced fat thickness and blood concentration of cholesterol .Moreover, Huck et al., (33) and Afaf, (4) reported that probiotic increased the total volatile fatty acid produce in the rumen which cause differences in lipids thickness and deposition in animal body; However, the mechanisms of the probiotic effect still unknown (33). Finally, ARC (5) proposes a daily requirement of phosphorus of 2.1 g/ kg DM for a lamb gaining 200 g. The control diet contained 2.5 g/kg DM. It therefore seems unlikely that phosphorus was limiting.

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