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EFFECT OF PARTIAL OR COMPLETE REPLACEMENT OF CLOVER HAY BY CHAMOMILE CAKE ON DIGESTIBILITY, RUMEN FERMENTATION AND PERFORMANCE OF EWES AND THEIR OFFSPRINGS.

Mohamed, A. H. ; Hanna. El-Amary and K. Ibrahim
Animal Production Research Institute, Agricultural Research Center, Giza, Egypt.

ABSTRACT

Thirty-two ewes before lambing averaged 45.3 kg live body weight (LBW) and aged 3-4 years were divided randomly into four similar groups. The control diet (DI) consisted of concentrate feed mixture (CFM) berseem hay (BH) and wheat straw , whereas the tested groups(D2, D3,D4)animals received the same CFM, while the BH was substituted either by 30, 65 or 100% with chamomile cake (CC) for D2,D3 and D4, respectively. Animals were fed according to NRC (1989) allowances for sheep. Four digestibility trials were conducted each with three mature rams to evaluate the nutritive value of the experimental diets and their effect on digestion coefficients, some rumen liquor parameters were also studied .

Results showed that the digestibility coefficients of CP . NDF, hemicellulose, NFE and nutritive values (TDN , ME, and DCP) for D2 and D3 groups were significantly ($P<0.05$) improved as compared with the DI group (control). Meanwhile propionic acid was significantly increased with animals fed D2 diets as compared with the control diet, whereas butyric acid was decreased. As a result to the significant improvement of digestibility and nutritive value of D2 and D3 groups, average daily milk yield (ADMY) and total milk yield (TMY) were significantly ($P<0.05$) higher as compared with the control group. Also, the average daily gain (ADG) for offspring of D2 and D3 groups during the period from birth up to weaning were significantly improved as compared with D1 group, which reflects the improvement in (ADMY) for D2 and D3 groups than D1 group. Moreover, average daily feed cost decreased by 9.10, 19.1 and 30.0% for D2 , D3 and D4, respectively as compared with control diet , leading to decreased feed cost /kg milk by 29.80, 30.53 and 37.02%, for D2 , D3 and D4 , respectively than D1 group (control). In conclusion, the CC could be successfully and economically substitute 30 or 65% of berseem hay in ewes diets.

Key words : Chamomile cake, berseem hay, digestibility, nutritive value, rumen fermentation ,milk yield and offsprings

INTRODUCTION

Egypt have varying quantities of agro- industrial by – products of good nutritive value which can supply valuable supplementary ingredients to be used in animal rations. Therefore, several studies were carried out to evaluate agro- industrial by – products to be used as non traditional feed ingredients and to enable their better utilization at small farm level and at the same time decrease feeding cost which are of prime importance for livestock development in Egypt. Aromatic plants by–products are of these agro- industrial by–products, including chamomile cake (CC) which are

available in Egypt. Chamomile cake, which remains after volatile oil extraction, contains from 9.7 to 13.52% crude protein, 22.56 to 32.50% crude fiber and nitrogen free extract from 32.67 to 49.42% , which lead to use it as a medium quality forage Wideneki et al., (1998). Some studies were conducted to evaluate supplementation of aromatic plants by- products to calves ration (Wojcik et al ., 1984), to cows ration (Tiwari et al ., 1996) and to sheep ration (Djouvinov, et al ., 1997).

The aim of this study was to evaluate the effect of partial or complete replacement of berseem hay (BH) with chamomile cake (CC) on nutrient digestibilities, feeding values and production performance of ewes. The economical evaluation of the diets was also considered.

MATERIALS AND METHODS

Thirty-two ewes at the last two months of gestation, were divided into four similar groups (8 animals each) according to body weight, parity and milk production during the last season at Sids Experimental Research Station, Animal Production Research Institute, Agricultural Research Center. Ewes averaged 45.30 kg live body weight and aged 3-4 years . Animals of each group were allotted at random to receive one of the four tested diets. The control diet (D1) composed of concentrate feed mixture (CFM) to cover 50% of protein and energy allowances recommended by NRC,(1989) for ewes (in group feeding). Restricted amount (450 g/ head / day) of berseem hay was offered and wheat straw (WS) was fed *ad. Libitum*. Three tested diets, were formulated as D1 diet but 30, 65 or 100% of BH was replaced by CC (on DM basis) for D2, D3 and D4 groups., respectively. During lactation period all ewes were milked twice weekly by hand milking, after removing away their offsprings the day before, to determine the average daily milk yield for each group. Fresh water was always available and animals were under veterinary care during the whole experimental period (5 months). Feed conversion was calculated and expressed in terms of DM (g), TDN (g) and ME (k cal) (calculated according to MAFF, 1975) and DCP (g) required to produce one (kg) of milk. At the end of the work , simple economical evaluation was calculated for the tested diets according to the prevailing prices of feeds during the time of the experiment .

Four digestion trials were conducted with six healthy mature Seldi male sheep (average body weight 50.50 kg) to evaluate the nutritional value of the four experimental diets using, 3 sheep for each of the four digestion trials. Two trials were run simultaneously followed by another two. Each trial lasted for two weeks as preliminary period followed by one week as collection period. Animals of each group were allotted at random to receive one of the tested diets. Tested diets were formulated to cover the maintenance requirement according to allowances recommended by NRC, (1989) for sheep. Animals were fed twice daily at 8.00 a.m.and 3.00 p.m.and refusals were recorded every day. Daily feces was weighed, sampled and analyzed. Fresh water was available and animals were under veterinary care.

Chemical composition of ingredients used and experimental diets are presented in Table (1). Rumen liquor samples were obtained from rams at 4 hours post–morning feeding by using rubber stomach tube. The pH values for collected rumen liquor samples were measured immediately and 1 ml concentrated HCl was added to each the rumen liquor sample to stop microbial activity, then strained through two layers of cheese cloths for NH3-N concentration. Filtered rumen liquor samples were sub-sampled and kept frozen at (–20C^0) for later determination of total volatile fatty acids T.VFA's and VFA's fractions.

Chemical analysis

Representative samples of feeds and feces were air dried and kept for chemical analysis according to A.O.A.C.(1995). Nutrient detergent fiber (NDF) and acid detergent fiber (ADF) were determined according to Goering and Van Soest, (1975) and hemicellulose calculated by difference between (NDF-ADF). The rumen liquor samples were strained for immediate determination of pH value, using pH meter (Orion research, model 201/digital). Ammonia –N concentration was determined according to Conway method (1963). The strained rumen liquor samples were prepared for the T.VFA's according to Warner, (1964) and VFA's fractions analysis using high pressure liquid chromatography (HPLC) according to Bush et al ., (1979) .

The data were statistically analyzed to test the significant using one way analysis of variance according to *Snedecor and Cochran (1967)*. Duncan's multiple range test was applied to test significant among means *(Duncan, 1955)*.

RESULTS AND DISCUSSION

Chemical analysis, digestion coefficients and nutritive values.

The chemical analysis of ingredients and calculated nutrients contents (in percentage on DM basis) of the experimental diets are presented in Table (1). The cake (CC) had slightly lower CP, CF , NDF , hemi-cellulose and higher ash contents as percentage compared to berseem hay (BH), used in this study. The nutrients content of experimental diets were almost similar in percentage of CP , CF ,NFE and EE , ranged between (14.42 – 15.14%); (17.76 - 19.36%); (53.13 – 54.18%) and (2.21 - 2.46 %), respectively.

Digestiion coefficients and nutritive values for experimental diets are presented in Table (2). Digestion coefficients of CP, CF, NDF, hemicellulose and NFE for D2 and D 3 groups, were significantly (P< 0.05) higher as compared with those of the control group. Meanwhile, results in Table (2) showed that the digestion coefficients of different nutrients were not significantly affected by BH replacement with CC for D4 diet. The improvement ranged between 7.23-11.84%; 6.12–11.60%; 4.74 – 7.81% ; 4.87–7.33% and 5.37–7.61% for CP,CF, NDF, hemi-cellulose and NFE digestibility, respectively for D2 and D3 groups.

Table (1) : Chemical analysis of ingredients and experimental diets (% on DM basis)

Chemical analysis	Ingredients				Experimental diets (calculated)			
	CFM*	BH.	WS	CC	D1	D2	D3	D4
DM	90.41	88.71	91.22	87.63	100	100	100	100
OM	91.28	88.18	83.46	85.57	89.84	89.48	89.13	88.82
CP	18.23	12.28	3.9	11.72	15.14	14.95	14.62	14.42
CF	10.28	29.53	43.92	26.62	19.36	18.62	18.27	17.76
NDF	38.39	55.32	71.14	49.26	46.73	45.23	43.52	42.27
ADF	17.87	25.63	52.33	22.73	21.82	21.33	20.45	19.76
Hemi-cellulose	20.52	29.69	18.81	26.53	24.91	23.90	23.07	22.51
EE	2.38	1.86	2.04	2.03	2.21	2.32	2.38	2.46
NFE	60.39	44.51	33.60	45.20	53.13	53.59	53.86	54.18
Ash	8.72	11.82	16.54	14.43	10.16	10.52	10.87	11.18

*Concentrate feed mixture consisted of 25% undecorrected cotton seed cake,35% wheat bran, 30% corn, 3% rice bran, 4% molasses , 2% limestone and 1% salt.

Table (2) : Dry matter intake, digestion coefficients and nutritive values of experimental diets

Item	Experimental diets				±SE
	D1	D2	D3	D4	
Av. CFM. Intake g / h	535	587	553	542	
Av. BH. Intake g / h	399	264	135	-	
Av. CC. Intake g / h	-	135	265	399	
Av. WS. Intake g / h	251	237	239	216	0.52
Total . DM. Intake g / h	1185	1253	1192	1157	0.37
Digestion coefficients					
DM	58.72^{b}	63.38^{a}	61.52^{ab}	60.83^{b}	0.87
OM	62.52^{b}	67.42^{a}	65.36^{ab}	64.67^{b}	0.94
CP	63.25^{c}	70.74^{a}	67.82^{b}	$65..65^{bc}$	1.42
CF	51.47^{b}	57.44^{a}	54.62^{ab}	53.37^{b}	1.23
NDF	68.47^{b}	73.82^{a}	71.72^{ab}	70.72^{c}	1.12
ADF	49.42^{a}	51.22^{a}	49.87^{ab}	48.72^{b}	0.85
Hemi-cellulose	70.28^{b}	75.43^{a}	73.70^{b}	71.41^{c}	1.08
EE	79.33	80.22	80.62	81.18	0.78
NFE	74.12^{b}	79.76^{a}	78.10^{a}	76.15^{ab}	1.15
Nutritive values					
TDN	62.92^{c}	68.01^{a}	66.34^{ab}	64.76^{bc}	1.38
*ME	9.74^{b}	10.50^{a}	10.18^{a}	10.08^{ab}	0.95
DCP	9.60^{b}	10.60^{a}	9.92^{ab}	9.50^{b}	1.22

*ME calculated according to MAFF (1975)

a,b ,c Means in the same row having different superscripts are significantly different ($P<0.05$)

The nutritive values expressed as TDN, ME and DCP reflect the alteration in nutrients digestibility. The nutritive values of D2 and D3 groups were significantly ($P<0.05$) improved as compared with the control group. On the mean time, there were no significant differences between D4 group and the control group, which could be as a result to the decreasing of nutrients intake. These results are in agreement with those reported by

Wojcik et al. (1984) and Djouvinov, et al ., (1997) who observed that the supplement of some aromatic plants by–products (*Ocimum Bonsilicum* and *Menthor Piperits*) to sheep ration, improved the digestibility and nutritive value. These results were confirmed by the findings of Wideneki et al . (1998) and Mohamed and Ibrahim ,(2003) who reported that the improvement in digestion coefficients and nutritive values with diets contained CC could be due to the residual effective groups (Azulene, Cynaroside, Umbelliferone and Niugellone) in the chamomile cake CC .

Rumen liquor parameters

Influence of feeding the experimental diets on pH, NH3-N, T.VFA's and VFA's proportion of rumen liquor are presented in Table(3). The recorded pH values (6 –7) were within the normally functioning rumen (Abou-Akkada and Blackburn, 1963). Results in Table (3) showed that experimental diets did not significantly affect rumen pH values.

Table (3) : Effect of experimental diets on some rumen liquor parameters.

Items	Experimental diets			
	D1	D2	D3	D4
pH	6.77	6.17	6.43	6.33
Ammonia – (N mg/100ml)	27.75^{a}	24.42^{b}	23.88^{b}	23.53^{b}
Total VFA's mq / 100 ml	9.46^{c}	10.53^{a}	10.15^{ab}	9.64^{bc}
VFA's. proportion				
Acetic	47.52	45.85	45.34	44.82
Propionic	24.57^{b}	27.62^{a}	26.43^{ab}	25.72^{b}
A/P ratio	1.93	1.66	1.72	1.80
Butyric	13.82^{a}	11.46^{c}	12.92b	13.53^{ab}
Valeric	6.66	7.08	6.83	6.73

a, ,b ,c Means in the same row having different superscripts are significantly different (P<0.05)

Ammonia –N concentration tended to be significantly lower (P<0.05) as a result of the substitution of hay with CC in D2 , D3 and D4 diets than D1 diet . Ammonia –N concentration was decreased gradually as a result to substituting 30, 65 and 100% of BH with CC. This could be explained by the fact that the heat treatment of CC during processing of oil extraction may have caused a partial protection of protein from degradation in the rumen. The NH3-N concentration values recorded for tested diets would satisfy microbial needs for N and hence maximize fermentation in the rumen. The optimal NH3-N concentration for maximal rates of fermentation of feeds in the rumen, was recorded to be 23.5 mg /100 ml LR for concentrated diets (Mehrez et al.,1977) and 15.20 mg /100 ml RL for roughage diets (Alvarez et al .,1983). Also, this agree with Willams and Newbld (1992) who reported that the reduction of ammonia in the rumen liquor appear to be a result of increased incorporation of ammonia into microbial protein and it was considered a direct results of stimulated microbial activity .

Regarding the total volatile fatty acids and molar proportions % of individual VFA,s as presented in Table (3). Data revealed that D2 and D3

diets, produced significantly ($P<0.05$) higher (T.VFA's) than D1 diet. Differences in propionic and butyric acids were significant which might be due to the replacement of 30 and 65% BH by CC with D2 and D3 treatments. The D2 treatment showed the highest T.VFA's, proportion of propionic and the least of butyric in comparison with other groups. On the meantime, D4 group showed the least difference concerning the values of T.VFA's and VFA's proportions compared to D1 treatment. These results could be used as an indicator for better utilization of the diet and improvement of fermentation in the rumen.

Concerning the rank of groups according to A/P ratio indicated that the improvement of propionic acid proportion with replacement of BH by CC. Consequently, the A/P ratio for the D1 group represent the highest value followed by D4, D3 and finally D2, respectively. Results obtained from this study , confirmed those of Djouvinov et al ., (1997) ,El -Ayek, (1999) and Mohamed and Ibrahim , (2003).

Feeding trial

Data concerning milk yield (during 16 weeks) are presented in Table (4) and Fig (1). The milk yield MY kg / head obtained during the first 10 weeks and last 6 weeks of lactation period, were significantly ($P<0.05$) higher for D2 for D3 gras compared with D1 group. Also, the MY for D4 during the first 10 weeks of lactation period, was significantly ($P<0.05$) higher as compared with D1 group. Meanwhile , there were no significant differences in MY between D1 and D4 groups during the last 6 weeks of lactation season. In consequences a significant differences in the total milk yield TMY was detected between all tested groups and control group during the 16 weeks of lactation season. Average daily milk yield (ADMY g/h/ day), almost followed the same trend, the highest value of ADMY was recorded for D2 group , whereas the lowest value of ADMY was recorded for D1 group.

Table (4): Effect of experimental diets on milk yield

Items	Experimental diets			
	D1	D2	D3	D4
No of ewes	8	8	8	8
Av. Body W. kg	45.5	45.33	45.0	45.16
Milk yield kg				
First 10 weeks kg /h*	30.80^{c}	40.60^{a}	37.80^{ab}	35.70^{b}
Last 6 weeks kg /h	16.20^{c}	$20..4^{a}$	$17,10^{b}$	16.40^{c}
TMY 16 weeks kg /h	47.00^{c}	61.00^{a}	54.90^{b}	52.10^{b}
Av. Daily milk yield g				
First 10 weeks g /h /d*	440^{c}	580^{a}	540^{a}	510^{b}
Last 6 weeks g / h/d	386^{c}	485^{a}	407^{b}	390^{bc}
Av. DMY (16weeks) g/h/d	420^{c}	545^{a}	490^{ab}	465^{b}

*h = head, d= day

a ,b ,c Means in the same row having different superscripts are significantly different ($P<0.05$)

It was noticed that replacing 30 or 65% of BH with CC as a cheaper ingredient improved ewes performance than did D4 diet (with 100%

replacement of CC). As a result to the improvement of ADMY, the TMY increased by 29.80 and 16.80% for D2 and D3 groups, respectively than the control group during the whole lactation season. These results are in agreement with the findings by Wojcik et al., (1984) and Tiwari et al., (1996) who reported that incorporated *Ocimum bassilicum* by-products with cow ration improved milk yield.

Data concerning the average body weight (ABW) and average daily gain (ADG) for offsprings (male and female) from birth up to the weaning are shown in Table (5) and Fig (2).The birth weight ranged between (3.15–3.60kg). The highest birth weight was found with lambs of D4 followed by D3 groups then D2 group. The (ADG) for offspring of D2 and D3 groups from birth up to the first month were significantly ($P<0.05$) higher than ADG of offsprings of D1 group. Also, the (ADG) for offsprings from first month up to weaning age followed the same trend.

Table (5): Effect of experimental diets on average body weight and average daily gain for offspring

Items	Experimental diets			
	D1	D2	D3	D4
Birth weight, kg	3.15^{c}	3.35^{b}	3.40^{a}	3.60^{ab}
Birth weight, kg $w^{0.75}$	2.36^{b}	2.50^{a}	2.50^{ab}	2.61^{b}
First month w kg,	6.90^{c}	8.10^{a}	7.75^{ab}	7.70^{b}
First month w kg, $w^{0.75}$	4.30^{b}	4.80^{ab}	4.65^{a}	4.62^{a}
Av. daily gain g	125^{c}	158^{a}	145^{bc}	137^{c}
Weaning w. kg,	12.50^{c}	14.80^{a}	13.85^{ab}	13.40^{b}
Weaning w. kg, $w^{0.75}$	6.65^{b}	7.55^{a}	7.18^{a}	7.00^{ab}
Av. daily gain g	140^{c}	168^{a}	153^{ab}	143^{bc}

a ,b ,c means in the same row having different superscripts are significantly different ($p<0.05$)

The improvement in ADG for offspring of D2 and D3 from birth up to weaning, reflect the improvement with ADMY during the lactation period and confirmed that the dietary replacement of 30 or 65 % of BH with CC had significant effects on average daily gain.

Data concerning the feed intake, feed efficiency and feeding cost are shown in Table (6). It is clear that nutrients intake as (TDN ,ME and DCP) were significantly ($P<0.05$) higher for D2 and D3 group as a result to the increasing ADMY than D1 group. It was noticed that the highest intake of (TDN, ME and DCP) was recorded for animals fed D2 diet, while the lowest intake of (TDN ,ME and DCP) was recorded for animals fed D1 diet.

Concerning the feed efficiency , result in Table (6) revealed that the values were 3.96, 3.17, 3.46 and 3.61 kg DM intake / kg milk, 2.50, 2.15, 2.30 and 2.34 kg TDN intake / kg milk, 42.38, 35.49, 36.30 and 37.7 ME intake / kg milk and 448.5, 373.5, 379 and 395 g DCP intake / kg milk for D1, D2, D3 and D4 , respectively. The replacement of 30 or 65% BH with CC resulted in better feed efficiency for D2 and D3, groups by 19.95 and,12.63%, 14.00 and 8.0 % , 13.91and 8.8%, 11.81 and 10.0% for DM, TDN, ME and DCP, respectively. Meanwhile , the feed efficiency as DM,

TDN, ME and DCP were the lowest for D1 group. Such improvement of feed efficiency in tested groups (D2 and D3) is mainly due to differences in utilization with experimental treatments which reflect on ADMY and ADG. However, this beneficial effect which could due to be related to the BH replacement with CC.

Table (6): Effect of experimental diets on average feed intake and feed efficiency and feeding cost

Items	Experimental diets			
	D1	D2	D3	D4
Av. body weight kg	45.5	45.33	45.0	45.16
Av.daily milk yield g	420c	545a	508ab	469b
Av. Feed intake, g / d				
DMI g	1665	1725	1695	1680
TDN g	1048	1173	1125	1088
ME, k cal	1622	1811	1726	1693
DCP g	160	183	168	160
Feed conversion				
Kg DM / kg milk	3.96^{a}	3.17^{b}	3.46^{b}	3.61^{ab}
Kg TDN / kg milk	2.50^{a}	2.15^{b}	2.30^{b}	2.34^{ab}
Kcal ME / kg milk	3860^{a}	3323^{c}	3522^{bc}	3614^{ab}
Kg DCP / kg milk	0.381^{a}	0.336^{b}	0.343^{ab}	0.344^{ab}
Feeding cost *				
Av. feed cost / head / day LE	1.10a	1.0	0.89	0.77
Total feed cost during lactation period LE	123.2	112.0	101.0	86.0
Av. feed cost / kg milk	2.62	1.84	1.82	1.65

*Market price for CFM , BH and CC were 700, 500 and 110 LE , respectively .
a ,b ,c means in the same row having different superscripts are significantly different ($P<0.05$)

The feeding cost LE /head/ day (h/d) , was reduced as result to the replacement of BH by CC and increasing this reduction with increasing level of CC, whereas the lowest value for feeding cost was recorded for D4 group. The data in Table (6), show that the higher replacement rate was combined with lower feeding cost which was recorded with D4 group followed by D3 and D2 groups, respectively.

In conclusion, the replacement of 30 or 65% berseem hay (BH) with chamomile cake (CC), as nontraditional and cheaper ingredient, could be used successfully and economically for lactating ewes diets which improved animals performance as well as decreased feeding cost. Rumen parameters indicated that all animals were in good healthy conditions during the experimental period.

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تأثير استبدال دريس البرسيم جزئيا أو كليا بكسب الشيح فى علائق النعاج على قيمتها الغذائية والأداء الانتاجى للنعاج ونتاجها.

علاء الدين حسن محمد ، هناء العمارى ، خميس ابراهيم
معهد بحوث الانتاج الحيوانى ،مركز البحوث الزراعية. الدقى. جيزة . مصر

استخدم عدد ٣٢ نعجة متوسط أوزانها ٣و٤٥كجم وعمرها ٣- ٤ سنوات قسمت عشوائيا إلى ٤ مجموعات متماثلة . تكونت عليقة المقارنة ع١ من مخلوط علف مركز ودريس برسيم وتبن قمح أما المجاميع المختبرة فقد تم تغذيتها على مكونات العليقة الضابطة مع الاستبدال الجزئى أو الكلى لدريس البرسيم بكسب الشيح بمعدل ٣٠،٦٥، ١٠٠% مع المجاميع ع٢،ع٣ ، ع٤ على التوالى . وقد تم تغذية النعاج طبقا لتوصيات NRC ١٩٨٩ . كذلك تم تنفيذ ٤ تجارب هضم لتقييم معاملات الهضم والقيمة الغذائية للعلائق المختبرة باستخدام كباش تامة النمو .

وقد أظهرت النتائج تحسن معنويا لمعاملات الهضم لكل من البروتين الخام ومستخلص خالي الأزوت والألياف الذائبة في المحلول المتعادل والهيمسيللوز والقيمة الغذائية مقدرة كمركبات كلية مهضومة وطاقة ممثلة وبروتين خام مهضوم بالنسبة للمجموعتين ع٢،ع٣ مقارنة بالمجموعة الضابطة ع١ ، بينما لم توجد اختلافات معنوية فيما بين المجاميع المختبرة بالنسبة لدرجة حموضة سائل الكرش. وكان هناك انخفاضا معنويا فى تركيز الامونيا بالنسبة للمجموعتين ع٢،ع٣ . كما كانت هناك فروق معنوية فى قيمة تركيز حمض البروبيونيك والبيوتريك بالنسبة لحيوانات المجموعتين ع٢،ع٣ مقارنة بمجموعة المقارنة ع١. ونتيجة لتحسن معاملات الهضم والقيمة الغذائية للعلائق المستخدمة فقد تحسن متوسط ادرار اللبن بمقدار ٢٩،٨،١٧،٩، ١٠،٧% . للمجاميع ع٢ ،ع٣،ع٤ كما تحسن معدل الزيادة فى الوزن بالنسبة للنتاج من الميلاد حتى الفطام بمقدار ١٤،٦& ٦،٩ % للمجاميع ع٢، ع٣ مقارنة بالمجموعة ع١. وقد أدى هذا الاستبدال الى تقليل تكاليف التغذية للرأس/ اليوم بمقدار ١٩،١، ٩،١ ، ٣٠% للمجاميع ع٢ ،ع٣،ع٤ على التوالى مقارنة بالمجموعة ع١. كما انخفضت تكاليف التغذية اللازمة لانتاج كجم لبن بمقدار ٢٩،٨ ، ٣٠،٥٣ ، ٣٧% للمجاميع ع٢ ،ع٣،ع٤ على التوالى. مقارنة بالمجموعة الضابطة .

وتخلص الدراسة الى انة من الممكن استبدال ٣٠ أو ٦٥ % من دريس البرسيم بواسطة كسب الشيح فى علائق النعاج بنسب تعتمد على مدى توفر هذه المادة وكذلك ظروف الانتاج ، مما يؤدى الى تحسن الهضم والاداء الانتاجى للنعاج مع تقليل تكاليف التغذية .