

EFFECT DEGRADABLE PROTEIN LEVEL G/MJ METABOLIZABLE ENERGY THROUGH DIFFERENT STAGES OF LACTATION ON MILK YIELD AND COMPOSITION OF AWASSI EWES

O. D. M. Almallah

Assist. Prof.

Dept. of Animal production, College. of Agric. and Forestry , University of Mosul , Iraq.

dromaralmallah@gmail.com

ABSTRACT

This study investigated the effect of feeding two levels of rumen degradable protein in the rations during different stages of lactation on milk yield and components , twenty four cross breed Awassi ewes (Turkish Awassi × Iraqi Awassi) were used with their single lambs after birth aged 3-5 years, ewes were divided into two groups with average body weights 66.00 ± 2.32 kg and 67.10 ± 2.62 kg respectively, first group was control fed adequate level of degradable protein (10 g / Mj metabolizable energy) and second group fed high level of degradable protein (12.5 g / Mj metabolizable energy) , Lactation period had been divided into three stages (early, 1-50 day) , (mid , 51-100 day) and (late , 101-150 day), ewes were fed twice daily with restricted amount 2 kg in the early and mid and 1.5 kg in late lactation . Results showed that feeding adequate level of rumen degradable protein led to significant ($P < 0.05$) increase in milk yield 785 g/day and lactose 5.81% as compared with high level 619 g/day and 5.58% respectively, also milk yield decreased ($P < 0.05$) while milk fat increased ($P < 0.05$) with advance milk period. Blood parameters were not affected significantly by feeding degradable protein while serum glucose, total protein and albumin decreased ($P < 0.05$) at late stage of milk production. Best results of interaction for rumen degradable protein and milk stages in milk yield and components yield were noted with feeding adequate level of rumen degradable protein in the early lactation.

Key words: Protein type, lactation periods , Ewes Performance.

الملاح

مجلة العلوم الزراعية العراقية - 2020: 51 (5): 1314-1320

تأثير مستوى البروتين المتحلل غم/ميكاجول طاقة ايضية خلال مراحل ادرار الحليب المختلفة على انتاج الحليب ومكوناته

في النعاج العواسية

عمر ضياء محمد الملاح

استاذ مساعد

قسم الانتاج الحيواني/ كلية الزراعة والغابات / جامعة الموصل / العراق .

المستخلص

توضح هذه الدراسة تأثير التغذية على مستويين من البروتين المتحلل في الكرش خلال مراحل ادرار الحليب المختلفة في انتاج الحليب ومكوناته، استخدم اربعة وعشرون نعجة عواسية مضرية (عواسي عراقي × عواسي تركي) مع مواليد الفردية بعدة الولادة مباشرة اعمارها تراوحت بين 3-5 سنوات. قسمت النعاج الى مجموعتين معدل اوزانها $66,00 \pm 2,32$ و $67,10 \pm 2,62$ كغم على التوالي، المجموعة الاولى كانت السيطرة غذيت على عليفة احتوت مستوى كافي من البروتين المتحلل 10غم/ميكاجول طاقة ايضية والمجموعة الثانية غذيت على مستوى مرتفع 12.5غم/ميكاجول طاقة ايضية . فترة ادرار الحليب قسمت الى ثلاث مراحل ، الاولى استمرت من (1-50 يوم) والثانية (51-100 يوم) والثالثة (101-150 يوم). غذيت النعاج على كمية محددة من العلف بلغت 2 كغم / يوم خلال مرحلتي الادار الاولى والثانية و1,5 كغم/ يوم في المرحلة الاخيرة لإدرار الحليب. اشارت النتائج ان تغذية النعاج على المستوى الكافي من البروتين المتحلل ادى الى تحسن معنوي ($P > 0.05$) في انتاج الحليب 785 غم/ يوم ونسبة الدهن بالحليب 5,81% مقارنة بالتغذية على المستوى المرتفع اذ كانت 619 غم/ يوم و 5,58% على التوالي . كذلك انخفض معنويا انتاج الحليب وازداد الدهن في الحليب مع تقدم مرحلة ادرار الحليب. قياسات الدم لم تتأثر معنويا بالبروتين المتحلل لكن تراكيز الكلوكونز والبروتين الكلي والالبومين انخفضت معنويا مع تقدم مرحلة ادرار الحليب . افضل نتائج للتداخل فيما يخص انتاج الحليب وحاصل مكوناته كانت عند التغذية على المستوى الكافي من البروتين المتحلل خلال المرحلة الاولى للإدرار.

الكلمات المفتاحية: نوع البروتين، فترة الادار، الاداء الانتاجي للنعاج.

INTRODUCTION

The transition and early stage of lactation are critical period of ewes life , so that about third body fat and protein may mobilized to meet the requirements according to their milk production even with good nutrition the shortage in energy inevitability occur especially in the early stage of lactation (6), after that milk production decrease gradually as a result of shrinkage of epithelial cell of mammary gland either because of the lower number of epithelial cell or its activity, this will accompanied with a changes in milk components, the proportions of fat, protein increase while lactose decrease (28), on other hand milk production affect by many factors may the most important are availability of protein, energy and minerals (10), energy deficient and the imbalance in degradable to undegradable protein intake negatively correlated with milk production (24). Using protein sources such as soybean, cotton seed, sunflower seed meal may rise the cost of rations so it replace with urea as source of nitrogen which increase the ration content of degradable protein (RDP) to a level more than recommendations 9.6% of dry matter (23), although rumen microorganism useful of urea nitrogen in protein synthesis but the efficiency is less 20% as compared with protein sources. This study was proposed to evaluate the effect of degradable protein level in Awassi ewes rations in performance during different stages of lactation

MATERIALS AND METHODS

This study was done using twenty four cross breed Awassi ewes (Turkish Awassi × Iraqi Awassi) with their single lambs after birth aged 3-5 years, reared in the animal farm of livestock research division at department of agriculture research , ministry of agriculture , Nineveh , Iraq . Ewes were allocated randomly into two groups, average body weight 66.00 ± 2.32 kg and 67.10 ± 2.62 kg respectively , first group was control fed with ration obtain adequate level of degradable protein (10 g / Mj metabolizable energy) and second fed with high level of degradable protein (12.5 g / Mj metabolizable energy). Rations were comprised of barley grain, wheat bran, soybean meal and wheat straw as shown in table (1). Lactation period had been divided into three stages

(early, 1-50 day), (mid, 51-100 day) and (late, 101-150 day), ewes were fed twice daily with restricted amount 2 kg in the early and mid and 1.5 kg in late lactation, fresh water was provided all experimental period. Milk production was determine biweekly, lambs were separated from their dams for 12 hour at two consecutive days , milk sample (10% of total yield for each ewe) were taken and analysis using Eko-Milk analyzer system to determine protein, fat , lactose and solid not fat, at that time blood sample were drawn from Jugular vein and centrifuged (3000 r / minute) for 15 minute for serum separation and kept under freezing until analysis, serum concentration of glucose , total protein , albumin and urea were determine using French Biolabo kit , also body weight of ewes and lambs were recorded biweekly . Statistical analysis was done using computer, data of milk production, composition, and serum parameters were analyzed using General Linear Model of statistical analyses system SAS (31) for factorial design, while for body weight was done using complete randomized design with general linear model SAS (31), and the significance of differences between means was determined by Duncan test (13).

Table.1. components and chemical composition of experimental rations

feedstuffs	Rumen degradable protein	
	Adequate	High
ground barley grain	65	65
wheat bran	20.5	19.65
soybean meal	6.5	6.5
wheat straw	6.5	6.5
Urea	0.5	1.35
Salt	0.5	0.5
limestone	0.5	0.5
Chemical analysis % of dry matter		
Dry matter	91.35	91.53
Organic matter	94.05	94.15
Crud protein	14.26	16.51
Ether extract	2.38	2.35
Degradable protein	10.44	12.81
Undegradable protein	3.82	3.70
Metabolizable energy	10.30	10.18
Mj / kg		

Chemical composition were measured laboratory according AOAC (8), and degradable and undegradable protein were calculated from NRC (23), energy is calculated according Alkhawaja (2).

RESULTS AND DISCUSSION

Results in Table 2 indicated that degradable protein level had a significant effect in milk yield, increasing degradable protein to 12.5 g/MJ metabolizable energy of diet significantly ($P < 0.05$) lowered milk yield to 619 g/day compared adequate level of degradable protein 10 g/MJ metabolizable energy of diet 785 g/day. Milk lactose increase ($P < 0.05$) with feeding adequate level of rumen degradable protein 5.81% as compared high level of degradable protein 5.58%, other milk components especially fat increase but not significantly when ewes fed with adequate level of rumen degradable protein. Also results were investigated significant decrease in milk yield as stage of lactation progresses 1273, 538 and 295 g/day, with exception fat other milk components lactose, protein and solid not fat were not affected significantly with the progresses stage of lactation, milk fat percent increase in the mid stage of lactation 5.07% compared early lactation 4.25% and this increase was significant ($P < 0.05$) in late stage of lactation 7.88%, as a result milk energy increase ($P < 0.05$) in late stage of lactation 1101 kcal/kg than first and mid stage of lactation 785 and 855 kcal/kg. Data of interaction were investigated that with progress stage of lactation milk yield was higher with feeding adequate level of degradable protein as compared with high level. Milk lactose, protein and solid non-fat were increased when ewes fed adequate degradable protein 10g/MJ metabolizable energy as compared to ewes fed high level of degradable protein 12.5g/MJ metabolizable energy in late lactation. Mei-Chu et al., (20) showed significant decrease in milk yield and protein while milk fat increase as degradable protein increase in the ration of goat, Mikolyunas-Sandrock et al.,(22) founds significant decrease in milk yield but not in milk fat and protein as degradable protein increase in the ration of ewes from 12 to 14% of dry mater, also Saleh., (29) noted significant improve in milk yield and components with exception protein as degradable protein decrease in the ration of ewes, while (17) and (3) they did not found significant effect to increase rumen degradable protein in ewes milk yield and components, this result were

noted in similar studies in dairy cows (9, 11, 18 and 23). on other hand Aljuwari., (4) found significant decrease in milk yield with progress lactation stage with negative correlation between milk yield and fat content, Guler et al., (16) noted that the significant decrease in ewes milk yield as lactation stage progress were not correlated with fat and total solid, Doosh et al., (12) noted that milk fat, lactose and total solid increase while protein unchanged from week1 to week 16 of lactation, Kuchtik et al., (19) observed that milk protein and fat increase significantly while lactose decrease with advance lactation period, similar results were noted by Oravcova et al., (25) they observed significant increase in protein and fat content as milk stage, Mikolayunas et al., (21) report that milk yield was significantly higher in early lactation than late lactation, milk fat were unaffected but protein increased significantly in late lactation, Antunovi et al.,(7) were investigated that milk fat increase from 4.31 to 5.45% as lactation period increase from 20 to 100 day and protein and lactose content were unaffected. El-Tarabany et al.,(14) noted that milk yield decrease at rate 18.4% and 31.9% in mid and late stage of lactation compared with early stage, milk protein, fat and solid not fat unaffected while lactose decreased in late as compared early and mid- lactation. Table 3 show that milk components yield of lactose, protein, fat and energy 44.94, 30.17, 41.17 g/day and 732 kcal/day were significantly ($P < 0.05$) higher when ewes fed adequate level of rumen degradable protein as compared to with high level of rumen degradable protein 35.06, 23.66, 28.75 g/day and 550 kcal/day respectively, as well as it was decreased significantly ($P < 0.05$) as milk period progress. Also noted from the interaction between protein degradability and milk period that milk components yield most values were decreased ($P < 0.05$) as milk period progress and increase the level of rumen degradable protein, this differences in milk components are related to changes in milk yield. Blood parameters are given in Table 4, the results were indicated that rumen degradable protein levels had no significant effect in serum glucose 70.97 and 70.00 mg/dl, serum total protein 8.72 and 9.09 g/dl, serum albumin 3.94 and 3.86 g/dl and

serum urea 53.34 and 61.41 mg/dl respectively , regarding the effect of stage of lactation it was noted that serum glucose was higher ($P < 0.05$) in early stage of lactation 82.37 mg/dl as compared mid and late lactation 67.90 and 61.17 mg/dl , serum total protein decreased with progresses milk period significantly ($P < 0.05$) in late lactation which were 10.04 , 9.84 and 6.84 g/dl respectively , serum albumin decrease ($P < 0.05$) in mid lactation to 3.74 g/dl and in late lactation to 3.50 g/dl than in early lactation 4.44 g/dl , blood urea unaffected significantly through stages of lactation although there is trend to the increase blood urea in mid lactation as compared early and late lactation period . Data of interaction showed no significant effect of degradable protein within each stage of lactation with exception of urea concentration in early lactation it was decreased ($P < 0.05$) in ewe that fed with adequate level of degradable protein 45.79 mg/dl as compared to high level 61.77 mg/dl. Salih., (30) fed Awassi ewes with low or high level of degradable protein and

found that serum glucose was not affected while total protein significantly decreased with lowering degradable protein intake . Also AlKass et al., (5) did not found effect to the different levels of degradable to undegradable protein in serum total protein , albumin and glucose with except urea that increased significantly with decrease degradable protein in the ration , Gomes et al., (15) mention that increase degradable protein intake led to significant increase in blood urea without effect in glucose concentration. Kaufman et al., (18) found no significant effect in serum glucose as a result in increased degradable protein ratio in the ration in early lactation dairy cow . On other hand Piccione et al., (26) found no effect of lactation stage in serum total protein and albumin in ewes . Antunovi et al., (7) report that serum glucose and total protein were not affected but the blood urea increased significant as advanced days of milk in ewes , El-Tarabany et al., (14) report that serum glucose and total protein were greater in early and mid than late lactation.

Table.2. Effect of rumen degradable protein and stage of lactation in milk yield and composition.

	Effect of rumen degradable protein					
	Milk Yield g/d	Lactose %	Protein %	Fat %	SNF %	Energy kcal/kg
Adequate	785 ±	5.81 ±	3.90 ±	5.89 ±	10.55 ±	933 ±
deg. protein	101.78 a	0.07 a	0.05	0.48	0.13	43.24
High	619 ±	5.58 ±	3.79 ±	5.49 ±	10.30 ±	889 ±
deg. protein	106.22 b	0.09 b	0.06	0.46	0.15	41.22
Effect of Lactation stages						
Early	1273 ±	5.61 ±	3.76 ±	4.25 ±	10.23 ±	785 ±
	51.27 a	0.05	0.03	0.15 b	0.10	16.65 b
Mid	538 ±	5.81 ±	3.92 ±	5.07 ±	10.62 ±	854 ±
	30.14 b	0.08	0.05	0.37 b	0.14	33.69 b
Late	295 ±	5.67 ±	3.86 ±	7.88 ±	10.44 ±	1101 ±
	36.69 c	0.16	0.10	0.48 a	0.24	45.18 a
Effect of interaction						
Adequate × Early	1337 ±	5.57 ±	3.75 ±	4.46 ±	10.15 ±	807 ±
	89.51 a	0.10 bc	0.06 bc	0.07 b	0.18 bc	20.45 b
Adequate × Mid	611 ±	5.82 ±	3.87 ±	5.24 ±	10.52 ±	867 ±
	38.42 b	0.12 ab	0.07 abc	0.56 b	0.21 abc	50.82 b
Adequate × Late	407 ±	6.04 ±	4.10 ±	8.25 ±	11.00 ±	1140 ±
	27.21 c	0.07 a	0.06 a	0.65 a	0.14 a	59.13 a
high × Early	1210 ±	5.65 ±	3.78 ±	4.04 ±	10.31 ±	763 ±
	44.08 a	0.05 abc	0.03 bc	0.28 b	0.09 bc	24.58 b
High × Mid	465 ±	5.80 ±	3.98 ±	4.91 ±	10.72 ±	841 ±
	19.43 c	0.11 ab	0.07 ab	0.52 b	0.21 ab	48.43 b
High × Late	182 ±	5.30 ±	3.62 ±	7.50 ±	9.88 ±	1060 ±
	11.53 d	0.23 c	0.14 c	0.73 a	0.33 c	69.67 a

SNF= solid non-fat Milk energy= 251.7+89.6×fat% +37.8× protein% (Pulina et al 2005)

Values in the same column with different superscripts differ ($p < 0.05$).

Table. 3. Effect of rumen degradable protein and stage of lactation in milk components yield

	Effect of rumen degradable protein			
	Lactose g/day	Protein g/day	Fat g/day	Energy Kcal/day
Adequate deg. protein	44.94±5.55 a	30.17±3.73 a	41.17±3.78 a	732±70.54 a
High deg. protein	35.06±6.03 b	23.66±4.03 b	28.75±4.14 b	550±78.22 b
	Effect of Lactation stages			
Early	71.49±3.00 a	47.95±2.06 a	55.35±3.44 a	1001±46.66 a
Mid	31.30±1.86 b	21.10±1.21 b	26.02±2.03 b	459±28.10 b
Late	17.21±2.43 c	11.70±1.65 c	23.51±3.23 b	328±43.19 c
	Effect of interaction			
Adequate × Early	74.59±5.50 a	50.13±3.66 a	3.23±3.23 a	1074±60.83 a
Adequate × Mid	35.58±2.42 b	23.65±1.69 b	29.03±2.69 cd	525±29.03 c
Adequate × Late	24.67±1.73 c	16.74±1.23 c	33.15±2.37 c	460±26.67 cd
high × Early	68.40±2.34 a	45.78±1.86 a	49.43±5.25 b	927±60.88 b
High × Mid	27.03±1.46 c	18.54±0.99 bc	22.69±2.69 de	392±29.45 d
High × Late	9.75±0.68 d	6.68±1.82 d	13.86±1.82 e	194±20.36 c

Values in the same column with different superscripts differ ($p < 0.05$).

Table.4. Effect of rumen degradable protein and stage of lactation in some biochemical blood parameters.

	Effect of rumen degradable protein			
	Glucose mg/dl	Total protein g/dl	Albumin g/dl	Urea mg/dl
Adequate deg. protein	70.97±4.45	8.72±0.57	3.94±0.19	53.34±2.77
High deg. Protein	70.00±3.92	9.09±0.44	3.86±0.12	61.41±2.84
	Effect of Lactation stages			
Early	82.37±5.05 a	10.04±0.45 a	4.44±0.21 a	53.78±7.83
Mid	67.90±4.33 b	9.84±0.30 a	3.74±0.09 b	61.59±3.78
Late	61.17±2.30 b	6.84±0.20 b	3.50±0.05 b	56.76±2.75
	Effect of interaction			
Adequate × Early	80.87±9.64 ab	9.74±0.94 a	4.60±0.40 a	45.79±2.23 b
Adequate × Mid	71.90±7.10abc	9.93±0.74 a	3.79±0.04 bc	58.17±7.12 ab
Adequate × Late	60.14±1.54 c	6.50±0.25 b	3.39±0.03 c	55.87±3.23 ab
high × Early	83.87±4.94 a	10.33±0.17 a	4.28±0.20 ab	61.77±3.23 a
High × Mid	63.91±5.14 bc	9.75±0.46 a	3.70±0.19 bc	64.81±3.01 a
High × Late	62.20±4.66 bc	7.19±0.22 b	3.61±0.05 c	57.65±4.93 ab

Values in the same column with different superscripts differ ($p < 0.05$).

In conclusion feeding high level of degradable protein or the increase of degradable protein intake had a detrimental effect in milk yield and this may be due to the its effect on energy utilization and udder health and this may be expected from the fast decline in milk yield in the third stage of lactation, also it is observed a negative correlation between milk yield and fat content , with a clear trend to decrease serum glucose and proteins with progress lactation stage .

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