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RESPONSE IN BLOOD · PARAMETERS, MILK CHARACTERISTICS AND GROWTH OF SUCKLING LAMBS TO PROTEIN LEVEL IN RAHMANI EWES RATIONS.

Maareck ,Y. A.[1] and Y. M. Hafez[2]

[1]**Animal Production Department, National Research Centre, Dokki, Cairo, Egypt.**

[2]**Animal Production Department, Faculty of Agriculture, Cairo University, Giza, Egypt.**

ABSTRACT

A total of 18 pregnant multiparous Rahmani ewes (40.65 ± 1.16 Kg, live body weight) belonging to the Agriculture Experimental and Research Station, Faculty of Agriculture, Cairo University were utilized to investigate the effect of different levels of dietary protein on some blood hematological and biochemical measurements, lactation performance and growth of offspring. The experiment began 4 weeks before the expected lambing date and lasted till 105 days after lambing (15 days after lamb weaning). Treatments were 100% (control), 80% and 120% of NRC (1985) crude protein recommended allowances for sheep.

Results indicated that changes in blood hematocrit percent of ewes due to dietary crude protein level were not significant with a tendency to be decreased with the low dietary protein level. Meanwhile, blood hemoglobin and plasma total protein and globulin concentrations increased with the high level of protein fed while plasma albumin decreased due to decreasing dietary crude protein level by 20% relative to those fed the control diet. Both the increase or decrease in dietary protein decreased plasma A/G ratio. Changes in plasma urea showed an increase due to increasing dietary protein. Decreasing protein content of the diet by 20% increased plasma creatinine relative to the other groups. Activity of both liver enzymes (GOT and GPT, IU/ L) decreased with the high level of dietary protein.

Ewes daily milk production changed with feeding different levels of protein from -6.0 % to +7.9 relative to the control for 80 and 120 % crude protein, respectively. Better milk constituents (total solids, fat, solids not fat and protein) and milk gross energy accompanied the highest dietary protein level (120 %).

Final body weight of ewes fed the highest crude protein level was the highest (34.7, 33.8 and 34.2 Kg on high, low and control diets, respectively).

Decreasing crude protein in ewes diets decreased lamb birth weight by 7.4% relative to the other groups. Lamb weaning weight, weight gain till weaning, average daily gain and relative growth rate as a percentage of birth weight were linearly increased with increasing protein in dams rations.

It can be concluded that decreasing CP of Rahmani ewes rations by 20% of NRC (1985) starting 4 weeks prepartum throught suckling resulted in decreasing lamb birth and weaning weights with decreasing the ability of the dams to recompensate their weights lost during lactation. Meanwhile, ewes fed on the recommended level showed satisfactory performance, but those fed on 120% of the allowences showed better performance as lactation performance which was reflected on greater growth of lambs.

Keywords: Rahmani ewes, dietary protein, blood responses, lactation, lambs, growth.

INTRODUCTION

Ewes had certain physiological transformations i.e. pregnancy and lactation that needs special nutrients requirements to cover such demands. During late pregnancy, nutrients are partitioned for the mass growth of fetus, udder development as well as the production of pre-colostrum. Furthermore, lactation also increases the need for nutrients. The efficient use of nutrients to cover the fetus and lactation requirements is likely depend on the availability of adequate supplies of amino acids.

Ewes in early lactation often lose large amounts of body fat and the efficient use of the energy of this fat for milk synthesis is likely depend on the availability of adequate supplies of essential amino acids to the mammary gland (Cowan *et al.*,1980).

On the other hand, Rahmani sheep is fat-tailed, coarse wool breed reared under semi arid environment. Therfore, crude protein allowances for Rahmani sheep is likely to be different.

Therefore, this study aimed to investigate the response of Rahmani ewes in terms of some physiological measurements, lactation performance, changes in dam weights and offspring growth to the changes in the daily protein allowances relative to NRC (1985) allowances for sheep (± 20 %).

MATERIALS AND METHODS

Animals

A total of 18 pregnant multiparous Rahmani ewes (40.65 ± 1.16 Kg, live body weight) from the herd of Agriculture Experimental and Research station, Faculty of Agriculture, Cairo University, Giza, Egypt were used. Ewes were divided into three similar groups (6 each) according to live body weight, then assigned randomly to three treatments.

Treatments and Feeding

Ewes were fed on three experimental rations; control (100%), low protein (80%) and high protein (120%) of NRC (1985) allowences for sheep. All rations were iso-caloric. The calculated undegradability of CP in the three tested rations was almost similar being 35.97, 35.09 and 36.13% for 100%, 80% and 120% rations, respectively. Each of the three rations was offered as a group feeding, based on a constant daily amount of 1.410 Kg DM/ ewe/day during gestation and late stage of suckling period (60 to 90 days postlambing) till 15 days postweaning while it was offered at 1.920 Kg DM/ ewe/ day during the early stage of suckling period (first 60 day post-lambing). No feed residues were left for each ewe group. The experimental ewes were fed during late pregnancy (4 weeks before expected lambing date) at the tested levels assuming expected lambing rate of 124% for Rahmani ewes (Karam, 1957). While at parturition, three ewes (one from each treatment group) had twin lambs and were excluded from the experiment and all the remainder experimental ewes (15) reared single lambs till weaning at 90 days postpartum.

Live body weights of ewes were 39.2 ± 2.01, 39.7 ± 1.9 and 39.5 ± 2.16 for control, low protein and high protein groups, respectively. Ewes and thereafter with their born lambs were housed in large pens, each group in a separate pen.

Composition of the daily rations is given in Table 1. while the chemical analysis of feed ingredients and the whole rations is presented in Table 2.The proximate analysis of rations ingredients was determined according to AOAC (1996) methods which was used to calculate nutrients compositions of the experimental rations. According to the feeding regime applied in the station, green berseem (*Trifolium alexandrinum*) was offered at 8 a. m. while the concentrate portion was well mixed and offered at 10 a.m. Rice straw was offered at 2 p.m. Fresh water was freely available all time.

Table 1. Formulation of the experimental rations on dry matter basis

Component, %	Rations (CP % of NRC)		
	100	80	120
CFM*	23.53	18.08	24.13
Barley	27.30	39.00	19.42
Soybean meal	7.40	1.15	14.68
Berseem	17.37	17.37	17.37
Rice straw	24.40	24.40	24.40

*Concentrate feed mixture consisted of (as fed): 36 % yellow corn, 12 % cotton seed meal, 5 % soybean meal, 6 % sunflower meal, 23 % wheat bran, 13 % rice bran, 3 % molasses, 1 % limestone, 0.5 % sodium chloride and 0.6 % mineral mixture.

Table 2. Proximate analysis and nutritive value of feed ingredients and experimental rations (R).

Item	DM, %	Nutrients (% on DM basis)						ME, M cal/Kg DM
		OM	Ash	CP	CF	EE	NFE	
CFM	90.56	92.60	7.40	16.33	9.90	3.42	62.95	2.54[a]
Barley	91.67	96.60	3.40	9.60	8.51	1.96	76.52	3.15[a]
Soybean meal	90.61	93.57	6.43	45.80	6.92	3.96	36.89	3.07[b]
Berseem	16.50	87.70	12.30	15.15	25.55	2.10	44.9	1.95[a]
Rice straw	92.71	81.61	18.39	3.73	36.60	1.52	39.76	1.56[a]
R 1 (100% CP)	51.15	90.23	9.77	13.39	18.53	2.37	55.93	2.40
R 2 (80% CP)	51.19	90.64	9.36	10.76	18.56	2.16	59.15	2.44
R 3 (120% CP)	51.12	89.99	10.01	16.07	18.43	2.52	52.97	2.40

[a] Metabolizable energy, calculated using TDN values of Abou Raya (1967) and using a value of 3.608 Mcal ME / Kg TDN (NRC, 1985).
[b] NRC of sheep (1985).

All experimental ewes were weighed prior to the morning feeding (7:00 a.m.) at the beginning of the experiment, on day of parturition, thereafter every two weeks till weaning of their born lambs and finally on the 15th day post-weaning. The offspring were weighed before suckling at birth and thereafter every two weeks till weaning at 90 days old.

Blood sampling and analysis

Blood samples were collected via jugular vein from all ewes at biweekly intervals starting from day 15 to 90 postlambing using EDTA as anticoagulant. All blood samples were taken before morning feeding (7:30 a.m.). Blood hematocrit (Frankle and Reitman, 1963) and hemoglobin (Benjamin, 1985) values were measured using whole blood while the remainder of blood was centrifuged at 3000 rpm for 20 minutes to separate plasma which was frozen (-20 °C) till analysis. Plasma was analysed for total proteins (Doumas, *et al.*,1971) and albumin (Doumas, 1975), while globulin and albumin : globulin ratio (A/G) were calculated. Concentrations of plasma urea (Fawcett and Scott, 1960) and creatinine (Bartles, *et al.*, 1972) were determined. Activities of plasma glutamic oxaloacetic transaminase (GOT) and glutamic pyruvic transaminase (GPT) were determined according to the method described by Reitman and Frankle (1957).

Milk sampling and analysis

Weekly milk yield was estimated for each ewe till weaning of their born lambs using lamb suckling technique according to Owen and Ingelton, (1963). The lambs were separated from their dams for 8 hrs, weighed, allowed to suck to evacuate the udder as completely as possible and weighed again. The difference between the two weights were added to the weight of stripped milk recovered by hand milking represents milk yield synthesized in 8 hrs. This milk yield was multiplied by 3 to give the estimated milk yield produced by the mammary gland during 24 hrs. The above estimation was repeated in two successive days. Milk samples were obtained from each ewe once weekly after separating their lambs for another 8 hrs, at 15, 30, 45, 60, 75 and 90 days of lactation. Udder of each indvidual ewe was completely hand milked, well stired and sampled in 50 ml plastic bottles. Milk samples were frozen just after taking (-20 °C) till analysis for total solids, fat, solids not fat, protein and lactose in g/ 100 ml using Milkoscan®, N. Foss electric, Denmark. The energy output in milk was calculated from the yields of lactose, protein and fat, using the factors of 16.54, 24.52 and 38.12 MJ/ Kg, respectively (McDonald *et al.*, 1995).

Statistical analysis

Data for birth weight, weaning weight and weight gain of lambs were statistically analysed as one way analysis of variance using the general linear model of SAS (1998) while differences among means were tested using Duncan (1955). The following model was used,

$Y_{ij} = \mu + T_i + E_{ij}$ where:

Y_{ij} = the observation ij, μ= the overall mean, T_i=effect due to treatment i (crude protein level of the dam), E_{ij} = the random error due to the treatment for the ij^{th} observation.

The other traits of lambs and ewes were subjected to analysis of variance as repeated measurements (split plot in time) according to Neter *et al.* (1985) using SAS (1998), while differences among means were tested using Duncan (1955). The following statistical model was used to describe the data:

$Y_{ijk} = \mu + T_i + e_{ik} + P_j + (T*P)_{ij} + E_{ijk}$, where: .

Y_{ijk} = the observation ijk, μ= the overall mean, T_i =effect due to treatment i (crude protein level), e_{ik} = the random error due to the treatment for the ik^{th} observation.

P_j =effect of experimental period no. j, $(T*P)_{ij}$ = the effect due to the interaction between treatment (i) and experimental period (j), E_{ijk} =experimental error associated with Y_{ijk} observation, assumed to be normally distributed (0, σ^2).

RESULTS AND DISCUSSION

Blood characteristics

Changes in blood hematological and biochemical parameters of ewes are presented in Table 3., while changes in plasma urea and creatinine starting 15 days postlambing till 90 days are illustrated in Figures 1 & 2. Blood hematocrit (Ht, %) was lower by 6.3 % than the control due to the reduction of dietary protein by 20 %. However, increasing dietary protein by 20 % over the requirements resulted in a slight increase (1.4%) in hematocrit value. Increasing dietary protein level from 80 to 120 % significantly increased hemoglobin (Hb) value by 7.5%. On the other hand, blood Hb was decreased by 5% with the reduction in protein requirements by 20%. The present values of Ht and Hb were higher than those reported by Frandson and Spurgeon (1992) for sheep (32 g/ 100 ml and 11%, respectively). These differences may be due to species and environmental differences. On the contrary, Kuleta *et al.* (1992) reported a decline in blood Hb in Merino ewes fed on a diet containing 120% CP in addition to protected DL-methionine compared to a control diet.

Table 3. Blood hematological and biochemical changes* of Rahmani ewes as a response to different dietary protein levels.

Measures	Crude protein level (% of NRC)		
	100	80	120
Heamatocrit, %	$37.00^{a} \pm 1.00$	$34.67^{a} \pm 0.90$	$37.5^{a} \pm 1.00$
Hemoglobin, g/dl	$13.80^{ab} \pm 0.30$	$13.14^{b} \pm 0.30$	$14.13^{a} \pm 0.30$
Total proteins, g/dl	$6.34^{b} \pm 0.20$	$6.78^{ab} \pm 0.20$	$6.94^{a} \pm 0.20$
Albumin, g/dl	$2.77^{ab} \pm 0.05$	$2.68^{b} \pm 0.04$	$2.89^{a} \pm 0.05$
Globulin, g/dl	$3.58^{a} \pm 0.20$	$4.11^{a} \pm 0.20$	$4.05^{a} \pm 0.20$
A/G ratio	$0.84^{a} \pm 0.05$	$0.69^{b} \pm 0.05$	$0.75^{ab} \pm 0.05$
Urea, mg/dl	$43.70^{a} \pm 1.6$	$46.3^{a} \pm 1.5$	$46.30^{a} \pm 1.6$
Creatinine, mg/dl	$0.79^{b} \pm 0.04$	$0.84^{a} \pm 0.04$	$0.77^{b} \pm 0.04$
GOT, IU/L	$49.60^{a} \pm 2.5$	$44.92^{b} \pm 2.3$	$40.91^{c} \pm 2.50$
GPT, IU/L	$8.92^{ab} \pm 1.1$	$10.21^{a} \pm 1.00$	$7.95^{b} \pm 1.10$

Means in the same row with different superscript letters differ (P<0.05).
***Values are representing periods from 15 till 90 days post-lambing.**

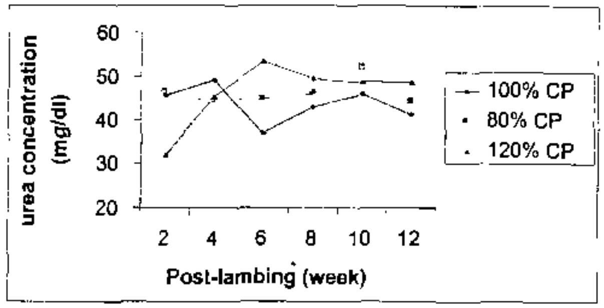

Fig.(1):Changes in plsma urea concentration due to different protein levels in ewes rations.

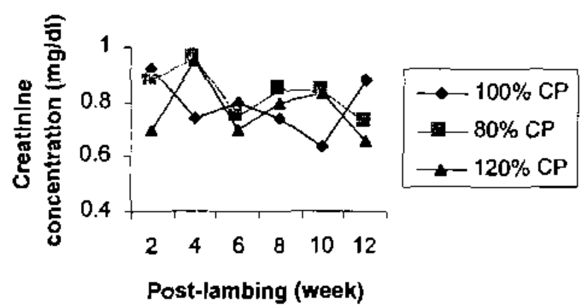

Fig.(2): Changes in plasma creatinine due to different Protein levels in ewes rations.

The decline in dietary protein content from the control level to 80% of the allowances increased plasma total proteins by 6.9 %. Serum proteins are synthesized in the liver (Kaneko, 1989). Thus the tendency for the differences in plasma total proteins among different groups indicated that liver function differed among treatments. Plasma albumin increased with increasing dietary protein level but plasma globulin (g %) did not differ significantly among treatments. Both the increase and the decrease in protein level of the ration caused a decrease in plasma albumin : globulin ratio (A/G). In agreement with the present results, Thomas, *et al.* (1988) reported that serum albumin reflected the dietary protein intake. Moreover, Hatfield, *et al.* (1998) reported a tendency for increasing serum proteins (P=0.11) of lambs with the decrease of dietary protein reqirement from 18 % to 10 %. Zorrila-Rios *et al.* (1991) reported a trend for a decrease in plasma total proteins with increasing dietary crude protein. On the other hand, Pathak and Sharma (1991) found that maternal serum protein of goats was similar among groups fed on diets containing 8.81, 11.32 or 13.58% crude protein. It should be stated that variations in maternal plasma proteins in the present study were within the normal physiological values reported by Nemi (1986) and Reece (1991) for sheep.

Plasma urea (mg%) was not significantly affected by increasing or decreasing dietary protein content by 20 % compared to the control (Table 1). However, plasma urea was higher in ewes fed 120% CP starting from the 4th week post lambing up to the 8th week compared to the other groups (Fig. 1). Hatfield *et al.* (1998) reported an increase in blood urea nitrogen due to increasing dietary protein of lambs from 10 to 18 %.

The decrease in dietary protein by 20 % caused an increase (6.3 %) in plasma creatinine, while dietary protein increase by 20 % caused a slight decrease by 2.5% relative to the control in the same measured parameter. Furthermore, changes in plasma creatinine of ewes starting two weeks post-lambing (Fig.2) showed an increase in plsma creatinine with the low level of dietary protein. Kaneko (1989) reported that blood creatinine is a product of nitrogen metabolism and the rate of creatnine production may be considered an index of endogenous protein catabolism.

Activity of plasma GOT was significantly ($P<0.05$) decreased when dietary protein was higher or lower than the recommended level. Plasma GPT activity was increased by 14.5 % due to decreasing dietary protein from the control level to 80 % level. On the other hand, increasing dietary protein level by 20 % over the recommended caused a decrease in plasma GPT activity by 10.9 %. Generally, it was observed that increasing dietary protein concentration decreased the activities of liver enzymes in plasma.

Milk yield and composition

Data concerning daily milk yield, milk constituents and gross energy of milk are presented in Table 4. The mean daily milk yield measured by lamb suckling technique according to Owen and Ingelton (1963) in the present study is considered accurate. Since, Poulton and Ashton (1972) found that the mean milk yield determined by lamb suckling technique was higher than that determined by machine milking without administration of oxytocin.

Table 4. Milk characteristics of Rahmani ewes as a response to different dietary protein levels.

Characteristics	Crude protein level (% of NRC)		
	100	80	120
Milk yield, g/d	644.3^{a} ± 43	605.8^{a} ± 39	695.4^{a} ± 43
Total solids, g/100ml	14.94^{ab} ± 0.28	14.48^{b} ± 0.26	15.5^{a} ± 0.28
Fat, g/100ml	6.22^{a} ± 0.25	6.40^{a} ± 0.23	6.83^{a} ± 0.25
Fat yield, g/d	40.1^{a} ± 1.50	38.8^{a} ± 1.38	47.5^{a} ± 1.40
Solids not fat, g/100ml	8.73^{a} ± 0.2	8.02^{b} ± 0.18	8.64^{a} ± 0.20
Protein, g/100ml	4.20^{a} ± 0.13	4.25^{a} ± 0.12	4.38^{a} ± 0.13
Protein yield, g/d	27.1^{a} ± 0.83	25.70^{a} ± 0.76	30.50^{a} ± 0.81
Lactose, g/100ml	3.95^{a} ± 0.14	3.38^{b} ± 0.13	3.67^{ab} ± 0.14
Lactose yield, g/d	25.40^{a} ± 0.90	20.5^{b} ± 0.80	25.5^{a} ± 0.89
Gross energy, kcal/ Kg milk	966.0^{a} ± 22	965.3^{a} ± 20	1003.2^{a} ± 22

Means in the same row with different superscript letters differ ($P<0.05$).

Estimated daily milk yield of Rahmani ewes throughout the suckling period till weaning of their offspring (90 days old) were 605.8, 644.3 and 695.4 g/day for low protein, control and high protein groups, respectively. However, the linear increase in milk yield due to dietary protein increase was insignificant.

Robinson *et al.* (1979) fed ewes during the 1st two weeks of lactation on a high CP diet (158 g/Kg DM). Then half of the ewes continued on the same level of CP while the other introduced abruptly to a low protein diet (115 g/ Kg DM) as to be returned to the high protein diet after one week. They found that daily milk yield decreased by 0.53 Kg from 3- 7 days after decreasing dietary CP compared with no change for the others. Daily milk yield increased by 0.55 Kg due to reintroducing the high CP diet. They stated that in short term low protein feeding, milk production was limited by amino acids available from the diet and even in the short term, the plasma pool of free amino nitrogen was not depleted to sustain production. They also stated that the decrease in the concentration of free fatty acids in plasma that accompanied the introduction of a low protein diet is indicative of a decrease in body fat mobilization. Bass (1989) reported higher milk yield for ewes fed high protein diet (210 g/ Kg DM) compared to the control ewes fed low protein diet (150 g/ Kg DM). Also, Hadjipanayiotou and Koumas (1991) reported milk yield of 2.18, 2.89 and 3.37 Kg per day for ewes given diets containing 9.7, 12.7 or 15.9 % crude protein, respectively. Furthermore, Boylan and Kukovics (1993) reported a 32 % increase in total milk yield of lactating ewes fed 454 g/ head/ day soybean meal as a protein supplement to a shelled maize and haylage diet compared to those fed 227 g/ head/ day soybean meal.

In the present study, ewes fed the highest protein level had better total solids, fat, solids not fat, protein and gross energy output in their milk than the other two groups (Table 4). Total solids increased linearly with the increase in dietary protein. The difference ($P<0.05$) in total solids concentration of milk between the highest and lowest dietary protein groups was 7 %. Milk lactose concentration was almost similar for the control and the high dietary protein level being higher than the low protein group. Gross energy of ewes milk increased by 3.9 % with the highest dietary protein level compared to the other two levels. Yields of nutritive constituents (fat, protein and lactose) of ewes milk increased linearly with increasing level of protein fed.The differences in the yields of fat, protein and lactose between the highest and the lowest dietary protein levels were 22.4, 18.7 and 24.4 %, respectively. Cowan *et al.* (1981) found that crude protein, fat and lactose concentrations in milk were not altered by protein content of the diet but yield of milk crude protein was higher ($P<0.01$) for ewes given high protein (145 g CP/ Kg DM) compared to low protein diet (116 g CP/ Kg DM). Bass (1989) reported higher milk protein contents in milk of ewes fed high protein diets (210 g CP/ Kg DM) compared to ewes fed on a low protein diet (150 g CP/ Kg DM). The same trend was reported by Sevi *et al.*(1998) for milk of ewes fed moderate crude protein content. They found that milk protein was positively affected by increasing dietary protein.

Changes in ewes weights

Ewes weights from the beginning of the experiment till 15 days post weaning of their lambs at 90 days postpartum are presented in Table 5. Ewes weights were almost similar for all experimental groups at the start of the experiment (around 4 weeks prepartum). Partum weights of ewes were almost similar in groups receiving 100 and 120 % CP diets, being higher by 5.7 % and 3.9 %, respectively relative to the group fed on 80 % CP diet. Changes in postpartum weights at 30 days indicated a loss in body weight in all treatments. Meanwhile, body weight loss continued till the 60th day for groups fed 100 and 120 % CP but the 80 % CP group started to regain their weights. On the other hand, at the final 45 days of the experiment starting from day 60 of lactation, all groups started to compensate their weight which was lost during the first 60 days of lactation. Physiological changes occurred after parturition could clarify the loss in ewes wight till the 60th day postpartum i.e. the weight of delivered lamb, placenta and embryonic fluids and also uterine involution which takes 30 to 45 days postlambing (Hafez, 1980).

Table 5. Rahmani ewes weights and their relative changes as a response to dietary protein levels.

Measures	Crude protein level (% of NRC)		
	100	80	120
Prepartum weight, Kg	39.20^{a} ± 2.01	39.70^{a} ± 1.9	39.50^{a} ± 2.06
Partum weight, Kg	35.50^{a} ± 3.30	33.60^{a} ±2.30	34.90^{a} ± 2.06
Postpartum weight, Kg			
At 30th day	30.90^{a} ± 2.30	30.80^{a} ± 2.30	31.90^{a} ± 2.06
At 60th day	30.80^{a} ± 2.10	32.00^{a} ± 2.10	30.00^{a} ± 2.70
At 90th day	31.40^{a} ± 2.10	31.60^{a} ± 1.90	30.50^{a} ± 2.70
At 105th day	34.20^{a} ± 2.10	33.80^{a} ± 1.00	34.70^{a} ± 2.10
Changes in ewe weight, Kg			
4 wks prepartum till partum	-5.93^{a} ± 0.88	- 5.13^{a} ± 0.88	- 5.00^{a} ± 0.79
Partum till 90 days postpartum	-2.05^{a} ± 0.93	-3.08^{ab} ± 0.93	-5.20^{b} ± 0.93
4 wks prepartum till 90 postpartum	-7.82^{a} ± 1.66	- 8.08^{a} ± 1.52	- 10.25^{a} ± 1.86
Partum till 105 days postpartum	1.00^{a} ± 1.88	-0.60^{a} ± 1.88	-0.28^{a} ± 1.69

Means in the same row with different superscript differ (P<0.05).

Relative changes in ewe weights in the four studied epochs are presented in Table 5. The loss in body weight from the start of the experiment till lambing was not significantly affected by protein level. The greatest loss in body weight during the period from partum till lamb weaning at 90 days (P<0.05) was recorded for the 120 % CP. Loss in weight from the start of the experiment till lamb weaning followed the same trend. At 105 days postpartum, all groups compensated most of their weights lost during suckling period. In a comparative slaughter study by Cowan *et al.* (1979), ewes on high protein diet (151 g CP/ Kg DM) lost an average of 230 g / day of fat over a 30 day period in early lactation without loss of body protein. They also added that during lactation, ewes depend on energy reserves of their bodies rather than protein to express their lactation ability. Furthermore, they mentioned that increasing dietary protein level particularly in early lactation enhances milk yield through mechanisms that improve energy utilization by mammary gland and consequently increases weight loss of ewes. Boylan and Kukaovics (1993) reported that ewes given soybean meal as a protein supplement at zero, 227 or 454 g / head / day, lost weight over a 60 day lactation period with an average loss of 4 % but without significant treatment differences. Mitchell *et al.* (1997) reported that live weight loss of ewes during lactation was not affected by level of crude protein in the concentrate (180 g *vs.* 120 g CP/ Kg DM). Also, Mitchell *et al.* (1998) found no effect of dietary protein concentration (210 g *vs.* 140 g CP/ Kg DM of concentrate) on live weight of ewes. They also reported that ewes in all groups lost weight from lambing until weaning (50 days) and regained weight thereafter. But in the present study, lambs were weaned at 90 days while their dams regained most of their weight lost during lactation within 15 days post- weaning. Mazzone *et al.* (2000) found that ewes fed 85 % of their CP requirements during the last 24 days of gestation, lost more weight ($P<0.04$) at lambing than ewes receiving either 100 or 115 % CP diets.

Lamb performance

Growth performance of lambs suckling dams fed different levels of dietary protein are presented in Table 6 while changes in average daily gain are illustrated in Figure 3. Decreasing dietary protein level of ewes than the recommended requirements (-20 %) decreased birth weight by 7.4 %. However, increasing level of protein in the ration (+20 %) did not affect birth weight which may be attributed to the higher sensitivity of late pregnant ewes to the shortage in dietary protein rather than its excess. However, lambs weaning weights were increased linearly with the increase in ration protein level of their dams which may be a reflection to the differences in milk yield and milk energy output from their dams. The difference between weaning weight of lambs born to ewes fed the highest and those fed the lowest protein level was 17 %. Weight gain, average daily gain and growth rate (relative to birth weight) of suckled lambs showed similar trends. In addition, lambs born to ewes fed 120% had the best average daily gain throughout the experimental period (Figure 3). Cowan *et al.* (1981) found that birth weight of lambs (4.48 Kg) and growth rates during lactation (221 *vs.* 210 g / day) were not significantly affected by level of protein in their dams' diets (143 vs. 116 g CP / Kg DM, respectively). Furthermore, Mitchell et *al.* (1998) reported no significant effect of CP level in ewes diets on lambs birth weight (4.9 *vs.* 4.8 Kg) or growth (280 g *vs.* 264 g / day) for high protein *vs.* low protein diets (210 g *vs.* 140 g CP / Kg DM of concentrate, respectively). Mazzone *et al.* (2000) reported that ewes fed 115 % of their CP requirements during the last 24 days of gestation produced heavier lambs at weaning compared to ewes fed 85 or 100% of their CP requirements during the same period.

Table 6. Growth performance of lambs born to ewes fed different dietary protein levels.

Measures	Crude protein level (% of NRC)		
	100	80	120
Birth weight, Kg	3.78 [a] ± 0.22	3.52 [a] ± 0.20	3.74 [a] ± 0.22
Weaning weight, Kg	16.04 [a] ± 1.10	14.38 [a] ±1.00	16.82 [a] ± 1.10
Weight gain[1], Kg	12.26 [a] ± 1.00	10.86 [a] ± 0.90	13.08 [a] ±1.00
Average daily gain[1], g	136.22 [ab] ± 7.60	120.7 [b] ± 6.90	145.33 [a] ± 7.60
Relative growth rate[2]	3.24 [a] ± 0.31	3.09 [a] ± 0.28	3.50 [a] ± 0.31

Means in the same row with different superscript differ ($P<0.05$).
[1] From birth till weaning.
[2] = weight gain/ birth weight.

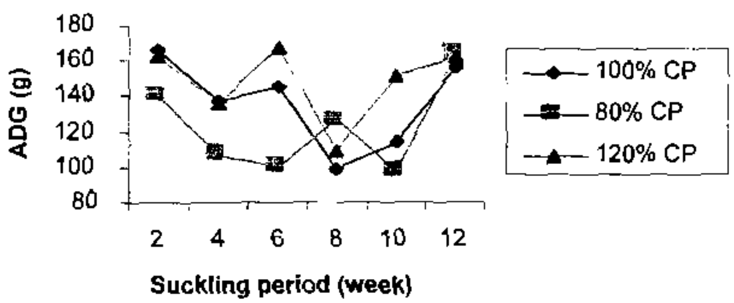

Fig. (3): Changes in lamb average daily gain (ADG) as a response to protein level in dam's rations.

CONCLUSION

It could be concluded that feeding Rahmani ewes on 80% of NRC (1985) recommended CP allowences starting 4 weeks prepartum (colostrogenesis and fetus mass growth) through lactation till lamb weaning resulted in decreasing lamb birth and weaning weights with decreasing the ability of the dams to recompensate their weights lost during lactation. Although, ewes fed on the recommended level showed satisfactory performance, those fed on 120% of the allowences had better performance in terms of milk yield, composition and calorific value which was reflected on greater average daily gain and weaning weight of lambs.

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الاستجابة في بعض قياسات الدم و خصائص اللبن و نمو الحملان لاستخدام مستويات مختلفة من البروتين في علائق النعاج الرحماني.

يحيي عبد الحليم معارك[1] ، ياسين محمد حافظ[2]

[1] قسم الإنتاج الحيواني – المركز القومي للبحوث – الدقي – القاهرة – مصر .

[2] قسم الإنتاج الحيواني – كلية الزراعة – جامعة القاهرة – جيزة – مصر .

اشتملت هذه التجربة علي عدد ١٨ نعجة رحماني عشار (٤٠,٦٥ ±١,١٦ كجم وزن حي قائم) من مزرعة محطة التجارب و البحوث الزراعية – كلية الزراعة – جامعة القاهرة لدراسة تأثير مستويات مختلفة من بروتين العليقة (± ٢٠% عن مقررات البروتين , NRC,1985) علي بعض قياسات الدم , محصول اللبن و تركيبه , ومعدلات نمو الحملان الرضيعة و التغير في وزن الأمهات. و قد بدأت التجربة قبل ميعاد الولادة المتوقع بأربعة أسابيع و استمرت حتى ١٥ يوما بعد فطام الحملان المولودة علي عمر ٩٠ يوما.

وقد أظهرت النتائج أن التغيرات في مستوي هيماتوكريت الدم نتيجة لتغير المستويات المدروسة من البروتين كانت غير معنوية وان مالت للانخفاض مع المستوي المنخفض من البروتين. و قد ازداد مستوي هيموجلوبين الدم مع المستوي العالي من البروتين المأكول (١٢٠%). عند خفض مستوي بروتين العليقة بمقدار ٢٠% عن المقررات أدى ذلك إلي زيادة مستوي كل من البروتين الكلي و الجلوبيولين وخفض مستوي الألبيومين ببلازما الدم. زيادة أو خفض مستوي بروتين العليقة بالنسب المدروسة أدت إلي زيادة نسبة الألبيومين : الجلوبيولين ببلازما الدم. زيادة بروتين الغذاء بمقدار ٢٠% عن مستوي مجموعة المقارنة لم يؤثر علي تركيز اليوريا أو الكرياتينين ببلازما الدم بينما أدي إلي خفض نشاط أنزيمات الكبد المدروسة (GOT & GPT) ببلازما الدم.

زاد محصول اللبن اليومي بمقدار ٧,٩% نتيجة لزيادة مستوي بروتين العليقة . أقترن المستوي العالي من بروتين العليقة (+٢٠%) مع تحسن مكونات اللبن و كذلك محتواه من الطاقة.

خفض مستوي البروتين في علائق النعاج بمقدار ٢٠% أدي إلي انخفاض وزن ميلاد الحملان بمقدار ٧,٤% مقارنة بباقي المجاميع. وقد لوحظ أيضا أن وزن الفطام و معدل النمو اليومي و الزيادة الكلية في الوزن حتى الفطام ومعدل النمو النسبي كنسبة مئوية من وزن الميلاد قد تحسن مع زيادة مستوي بروتين علائق الأمهات. كما زاد وزن الأمهات في نهاية التجربة نتيجة لارتفاع مستوي البروتين.

من هذه الدراسة يمكن استخلاص أن خفض مستوي بروتين العليقة بمقدار ٢٠% من المقررات للنعاج الرحماني ابتداء من الأسبوع الرابع قبل الولادة المتوقعة له تأثير سلبي علي جميع القياسات المدروسة. وعلي الرغم من أن المقررات الطبيعية للأمهات حسنت من أدائها و أداء حملانها إلا أن رفع بروتين الغذاء بمقدار ٢٠% قد أدي إلي مزيد من التحسن.