J. Animal and Poultry Production, Mansoura Univ., Vol. 1 (9): 383 - 393, 2010

THE CALCIUM, PHOSPHORUS AND MAGNESIUM STATUS OF OSSIMI EWES AND THEIR NEWBORNS, AT PARTURITION AND EARLY LACTATION, RAISED UNDER INTENSIVE AND SEMI-INTENSIVE SYSTEMS IN UPPER EGYPT

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ABSTRACT

The present study was carried out at the Experimental farm of Animal Production Department, Faculty of Agriculture, South Valley University, Qena during the period from October to December 2009. A field study was conducted to evaluate the Calcium, Phosphorus and Magnesium status of Ossimi ewes and their lambs at parturition and early lactation raised under intensive and Semi-intensive systems in upper Egypt. Forty Ossimi Ewes of 3 to 3.5 years age were selected randomly from a herd, at parturition. The animals were devided into two equal groups the first group was raised under intensive system fed concentrate ration and the second was raised under Semi–intensive system grazed natural pasture and by-product. Blood samples from ewes and their newborns were taken at parturition, 30 and 60 days postpartum. Moreover, milk samples were collected at time of blood sampling. Samples were prepared and analyzed for Calcium and Magnesium by AAS and Phosphorus by Spectrophotometer.

A significant different ($P<0.01$) was found in Ca concentration in blood serum of ewes in group 1 only at 30 days postpartum compared with group 2. The levels of serum Ca of ewes' in-group 2 were below the normal level especially at 30 days postpartum. Phosphorus concentrations in serum of ewes and the newborns in both groups were adequate throughout early lactation. Magnesium concentration in blood serum of ewes and their lambs in group1 were significantly ($P< 0.05$) higher and adequate at parturition and early lactation compared with ewes from group 2. The milk Ca% in-group1 were significantly higher ($P< 0.01$) at parturition and 60 days postpartum, as well as the P% at parturition and 30 days postpartum ($P< 0.05$), while Mg% was only at parturition ($P< 0.01$). Milk DM% of ewes in-group 1 were significantly ($P< 0.01$) higher compared with group 2 at parturition and at 60 days postpartum ($P< 0.001$), while OM% was only at 60 day postpartum ($P< 0.001$).

Keywords: Minerals, Ossimi ewes, Parturition, Early lactation, Systems .

INTRODUCTION

Sheep production, as most agricultural enterprises, is affected by economic forces as well as environmental factors (Marai,1987). Sheep milk is an excellent source of nutrients in human nutrition related to its superiorty to supply all the ten essential amino acids, calcium and phosphorus. (Jandal, 1996). The principal characteristic of ewes' milk is its high fat and calcium content (Miocinovic *et al.*, 2007). Milk is the main source of nutrients for the newborn lambs up to weaning. Early lactation ewes requires feeds of high levels of nutrients to face the high demand for milk secration and recovery. However, supplementary feeding program with only barley, wheat bran and

straw are usually start by mid of November for three months during early lactation (Sansom *et al.*, 1982). In fact the amount of supplement feed is insufficient to cover the nutrients requirements of ewes during this critical period. Mineral resources supplementation corrects minerals negative balances (El-Masry *et al.*, and Habeeb, 1989.). The calcium and Phosphorus are the two most abundant minerals in the animal body. Contrarily, Baumgartner and Parnthaner (1994) noted that the inorganic phosphorus level which was significantly ($P<0.05$) lower during summer than in winter, in Karakul sheep could be to calcium and Phosphorus. Their deficiencies usually occur in sheep fed largely grain diets with limited grazing available which cause a severe growth stunting, skeletal abnormalities and death of newborn and young weaned lambs. In upper Egypt the system sheep production were gratly changed from the extensive system to a semi-intensive and recently to the intensive system under the stress of destruction of the range. The refor, it is important to put in our consideretion the occurance of hypocalcaemia and hypophosphataemia in pregnant ewes during late gestation because of a high demand for Ca and P_i for fetal skeleton. In addition, Sanson *et al*., (1982) obtained a low plasma Ca and P_i in pregnant ewes at the last weeks before lambing and then increased to/ and after lambing. But the opposite trend was found for Mg concentration. Moreover, in the case of the milk minerals composition, it is well known that it varies with season (Varo ,1980), stage of lactation(Tiscorina, 1977) species, (Rincon,1994), breed (Mousa,1993) and many other internal and external factors (Underwood,1977). A matter of fact, very little information is available on mineral status of Egyptain Ossimi ewes and their newborn lambs rise under the intensive and the semi-intensive systems during early lactation. The objectives of this study was to evaluate the Ca, P_i and Mg status of Ossimi ewes and their newborns, at parturition and early lactation, raised under the intensive and semi-intensive systems in upper Egypt .

MATERIALS AND METHODS

The present study was carried out at the Experimental farm of Animal Production Department, Faculty of Agriculture, South Valley University, Qena during the period from October to December 2009. Forty Ossimi ewes of 3 to3.5 years of age and 49 ± 5.83 kg average body weight were selected at randem and divided into two equal groups equal . The ewes of groups and their newborn lambs were raised under typical intensive feeding system fed a ration consisted of barley grain (65%), soybean meal (18%), wheat bran (15%), calcium carbonate (1.4%), sodium chloride (0.5) and trace element and vitamins (0.1%). The daily feed intake was approximate 1.2 kg per/ ewe and the wheat straws was offared *ad-libitum.* The concentrate mixture contains 14.9% crude protein; 0.63% Ca; 0.33% P and 0.114% Mg (as fed basis). However ,the feeding program of ewes of this group was calculated according to NRC (1995). The ewes of group 2 and their newborn lambs were raised under a semi–intensive system by grazed natural pasture, cereal stubble, crop residue, vegetable by-products, in addition to some barley

(300g/ewe/day) and wheat bran (200g) as a supplement. The offared feed of group 2 contains 14.2% Crude protein, 0.38 % Calcium, 0.30 % Phosphorus and 0.14Magnesium. The body weight of lambs were recorded at parturition and at weaning (60 days old).

Blood samples were taken from ewes and lambs from the jugular vein into vacuum tubes at parturition, 30 and 60 days postpartum. Serum was separated by centrifugation and stored at –20°C until analysis. Milk samples were also collected at parturition, 30 and 60 days postpartum. All samples were prepared according to AOAC (2000) for mineral analysis. Serum was prepared by mixing 4 parts of Trichloroacetic acid with 1 part serum and centrifuged (3000Xg/15 minutes). Milk samples were dried to ashed at 450ºC/4 hrs and then diluted using concentrate HCl for analysis. Feed samples were dried to ashed at 600ºC/6 hrs. thenafter Calcium and Magnesium concentrations were measured by Atomic Absorption Spectrophotometry (AAS). Serum inorganic phosphorus was measured by colorimetry according to Fiske and Subbarow (1925).

The results were statistically analyzed according to the General Linear Model (G.L.M) by using SAS (1998) and the differences between means were detected by Duncan`s Multiple Range Test (Duncan , 1955).

RESULTS AND DISCUSSION

Serum mineral contents.

It is well known that rations must contain adequate amounts of nutrients to meet the needs for maintenance, pregnancy, growth and other productive functions. Stage of growth and the type of production affect also these requirements. Table 1 shows the concentrations of Ca, P_i and Mg (mg/dl) in the blood serum of ewes and their newborns in the intensive (group1) and semi intensive (group2) systems at parturition, 30 and 60days postpartum. The Ca concentration in blood serum of sheep is considered to be deficient when Ca was less than 6.0 mg/dl, but above 8 mg/dl are considered adequate (Puls ,1990). Calcium concentrations in blood serum of ewes and their newborn lambs in the two groups systems didn't show any significant differences ($p>0.05$) throughout early lactation, except at 30 days postpartum when a significantly lower Ca concentration ($p<0.01$) in blood serum of ewes raised under the semi-intensive system (group2) was detected compared with ewes in the intensive system (group1) 5.8 vs 8.4 mg/dl respectively. In this respect, many researchers reported a high reduction in blood plasma Ca, P_i and Zn of mammals dairy cows around parturition because of transfer of a large amount of these minerals to colostrum (Shappel,1987; Goff,1990 ; Tucker, 1992 ; Horst,1994). In the present study (Table1) an adequate level in blood serum of the grazing lambs from the intensive and semi-intensive systems were detected throughout the first 60 days. Moreover, the blood serum Ca of the lambs from the semi-intensive system was higher than their ewes. This finding agreed with the observation of Van Niekerk *et al.* (1989) that the grazing lambs showed higher concentration of P_i and Ca than ewes. The similar trend for the Angora kids and adult does were observed in South Africa Van Niekerk *et al.* (1990).

Moreover, McDowell (1992) reported that young lambs with high Ca requirements absorb Ca at higher rate and greater efficiency than mature sheep.

Phosphorous concentration in blood serum of the ewes and lambs (table1) were within the normal adequate levels and no significant effect of system on these levels throughout early lactation. Puls (1990) concluded that, sheep with blood serum P_i less than 3.0 mg/dl are deficient; serum levels greater than 4.0 mg/dl are considered to be adequate .That found of the present results Our findings agreed with Albel *et al*. (1979) who reported an adequate supply of phosphorus to sheep throughout the year, especially during the summer season. Sanson *et al*. (1982) reported a significant increase in blood serum P_i of ewes at lambing and continued to increase with the progress of lactation.

Table (1): Means (±SE) for concentrations of calcium (mg/dl), phosphorus (mg/dl) and magnesium (mg/dl) in blood serum of Ossimi ewes and their lambs at early lactation (parturition, 30 and 60 days postpartum .

Items	Ewes		Level of sig.	Newborns		Level of sig.
	Intensive	Semi-intensive		Intensive	Semi-intensive	
No animals	**20**	**20**		**20**	**20**	
Calcium(mg/dl) at :						
Parturition	8.5±0.4	7.3±0.5	NS	8.6±0.50	7.9±0.41	NS
30 days postpartum	8.4±0.5	5.8±0.3	**	9.0±0.31	8.7±0.23	NS
60 days postpartum	8.5±0.3	7.2±0.6	NS	8.4±0.61	8.3±0.21	NS
hosphorus(mg/dl)at:						
Parturition	6.9±0.24	6.1±0.19	NS	7.6±0.34	6.9±0.41	NS
30 days postpartum	7.1±0.32	6.8±0.41	NS	7.2±0.21	6.1±0.23	NS
60 days postpartum	7.9±0.19	7.4±0.12	NS	6.6±0.16	6.3±0.21	NS
Magnesium (%)at :						
Parturition	2.77±0.24	1.53±0.24	*	2.40±0.17	1.4±0.16	*
30 days postpartum	2.31±0.32	1.71±0.32	*	2.81±0.26	1.3±0.14	**
60 days postpartum	2.40±0.40	1.5±0.19	*	3.31±0.43	1.5±0.10	**

Mean values with superscripts within row are significantly different as follow:
*** = Significant at(P< 0.05). ** = Significant at (P< 0.01).**
*****= Significant at (P< 0.001). NS = Not significant (P> 0.05).**

Table 1 showed that, the ewes raised under the semi-intensive system showed significant ($p<0.05$) lower concentration of Mg and marginally deficient compared with the ewes raised under the intensive system during the whole early lactation period . The same trends were detected on the newborns ($p<0.01$). According to the results of Plus (1990) sheep with serum Mg levels less than 1.5 mg/dl will be deficient and between 1.5 and 1.8 mg/dl will be marginal and from 2.0 to 3.5 mg/dl will be adequate. However, growing lambs raised under the semi-intensive system showed fluctuation in blood serum Mg below the adequate level throughout the 60 days before weaning. These findings agreed with the results of Albel *et al*.(1979) who reported a very low concentration of Mg in blood serum of grazing cattle and

sheep in winter and early spring because of the internal parasites and the chemical composition of new grown green grazing plants. In, another study Sanson *et al*. (1982) reported a higher concentration of Mg in blood serum of ewes at late gestation and decreased at parturition and 3 weeks postpartum. Therefore, many dietary and physiological factors can influence Mg absorption. Doses of vitamin D have been reported to increase Mg absorption; however, retention of the Mg may be reduced by increased urinary excretion Hardwick, *et al*. (1991). Feeding high Ca and P increased fecal Mg excretion and decreased blood serum Mg. Magnesium and Ca may compete for the same absorption sites along the small intestine (McDowell,1992 ; Church and Pond ,1988). In addition, a high concentration of K in green grasses may cause a reduction in the absorption of Mg in the digestive system of grazing animals Albel *et al*.(1979).

However it is important to meantion that the Ossimi ewes and their newborn from both group systems didn't show a clinical sign of diseases caused by fluctuation of Ca, P and Mg intake. Nevertheless, there were significant changes in all three constituents with progress of lactation and production system.

Mineral contents of colostrum and milk:

A matter of fact the lactation period in ewes is the most critical physiological states that cause a great fluctuation in Ca and other mineral requirements to satisfy the high demand by mammary gland to produce milk. Milk is well known to be a main natural source of high quality Ca and P_i for growing mammals (Salih,1987). Therefore, diets and bones are the main source of Ca and other nutrients in mammals and birds (DeLuca,1984). The enhancement of intestinal Ca absorption and bone Ca resorption are process under the influence of Ca regulating hormones, Parathyroid hormone and 1,25 $(OH)_2$ D which is produced in kidneys (DeLuca,1984). The hypocalcemia, low Ca level in serum, results from the disturbance of the Ca homeostatic mechanism which required to replenish Ca lost for milk production during lactation (Horst,1986). Moreover, many factors influence the mineral composition of milk it varied with season (Varo *et al*., 1980), stage of lactation (Tiscorina,1977), animal species (Rincon *et al.*,1994), breed (Mousa *et al.*,1993) and other internal and external factors (Underwood,1977).

Table (2) shows the milk Ca, Mg and P percentage at parturition, 30 and 60 days postpartum. Ewes raised under the intensive system showed a significant drop ($p<0.01$) in milk Ca % from parturition up to 60 days (0.22% to 0.16%, respectively), but the trend was not the same for the ewes from the semi-intensive system. Calcium percentage in milk of ewes raised under the semi-intensive system was significantly differ ($p<0.01$) at parturition and at 60 days postpartum, but not at 30 days postpartum. Rincon et al,(1994) recorded 0.12, 0.21 and 0.16% averages milk Ca% for cows, sheep and goats, respectively .

Phosphorous % in colostrum of ewes under the intensive system was higher ($P<0.05$) compared with the ewes from the semi-intensive system (0.21 vs 0.16%, respectively). Further more, the two systems showed a significant drop with the progress of the lactation period ($P<0.01$ and $P<0.05$

respectively). The same significant trend (P<0.05) was found on the milk of 30 days postpartum (0.17 vs 0.14%, respectively). Akinsoyinu. (1981) found that colostrum of dairy goats contained more Ca and P_i (141 and 118 mg/dl) than normal milk (130 and 93 mg/dl). Salih *et al*. (1987) also recorded similar results. These findings agreed the present results for Ca and P of the ewes raised under the intensive system and only P for the ewes raised under the semi-intensive system.

Table (2): Means (±SE) for milk calcium, phosphorus and magnesium percentages at parturition, 30 and 60 days postpartum of Ossimi ewes under intensive system and semi-intensive systems .

Items	System		Standard error	Level of sig.
	Intensive	Semi-intensive		
No animals	20	20		
Calcium (%)at :				
Parturition	0.22	0.20	0.01	***
30 days postpartum	0.15	0.19	0.01	NS
60 days postpartum	0.16	0.22	0.07	***
Standard error	0.01	0.03		
Level of sig.	***	NS		
Phosphorus (%)at :				
Parturition	0.21	0.16	0.01	*
30 days postpartum	0.17	0.14	0.01	*
60 days postpartum	0.17	0.16	0.01	NS
Standard error	0.01	0.02		
Level of sig.	**	*		
Magnesium (%)at :				
Parturition	0.033	0.030	0.04	**
30 days postpartum	0.040	0.04	0.05	Ns
60 days postpartum	0.036	0.040	0.07	Ns
Standard error	0.004	0.009		
Level of sig.	NS	NS		

Mean values with superscripts within row or column are significantly different as follow:
*** = Significant at(P< 0.05). ** = Significant at (P< 0.01).**
*****= Significant at (P< 0.001). NS = Not significant (P> 0.05).**

A significant (P<0.01) higher percentage of Mg in colostrum of ewes raised under the intensive system than ewes under the semi-intensive system (0.033 vs 0.030 % respectively) was noticed (table2). No significant effect of system or time progress of lactation was found on milk Mg%. The average milk Mg% of present results is nearlys similar to that of cows, sheep and goats were 0.01, 0.02 and 0.014%, respectively raised in Britain (Rincon *et al.*,1994).

Colostrum and milk composition :

The total solid, ash and organic matter percentages of Ossimi ewes milk under intensive system and semi-intensive system were presented in (Table,3). Total solid % in colostrum of ewes raised under the intensive system were significantly higher (P<0.01) than the semi- intensive (28.2 vs 26.2%, respectively). The same trend was found only at 60 days postpartum

(17.7 vs 14.3%, respectively; P<0.001). A significant drop down (p<0.001) in the total solid% was detected by the progress of lactation in the semi-intensive system 26.2, 16.23 and 14.3%, respectively, but in the case of the intensive system it were significant (P<0.05) 28.2, 16.36 and 17.7% respectively. However, it is important to mentian that the total solids% of ewes' milk of the present study were in the normal range 14.5 to 18.9% as reported by Owen (1976). No significant variations were found on milk ash % between the two systems at parturition, 30 and 60 days postpartum. A significant drop down (P<0.001) was detected with the progress of lactation for the ewes of both intensive and semi-intensive systems. Similariy, Khalifa *et al*. (1994) and Abou Dawood *et al*. (1980) reported that stage of lactation affected significantly the ash content of ewe milk.

Table(3): Means (±SE) for milk total solids, organic matter and ash percentages at parturition, 30 and 60 days postpartum of Ossimi ewes under intensive system and semi-intensive systems .

Items	System		Standard error	Level of sig.
	Intensive	Semi-intensive		
No animals	20	20		
Total Solids (%):				
Parturition	28.2[a]	26.2[a]	0.45	**
30 days postpartum	16.36[b]	16.23[b]	0.44	NS
60 days postpartum	17.7[c]	14.3[c]	0.34	***
Standard error	0.41	0.39		
Level of sig.	***	***		
Ash (%)at :				
Parturition	1.27[a]	1.71[a]	0.04	NS
30 days postpartum	1.03[b]	0.96[b]	0.04	NS
60 days postpartum	1.04[c]	0.85[c]	0.03	NS
Standard error	0.46	0.26		
Level of sig.	**	***		
Organic matter (%)[1]at :				
Parturition	27.1[a]	24.8[a]	0.46	Ns
30 days postpartum	15.4[b]	15.2[b]	0.40	Ns
60 days postpartum	17.2[c]	13.4[c]	0.27	***
Standard error	0.34	0.47		
Level of sig.	***	***		

Mean values with superscripts within row or column are significantly different as follow:
*** = Significant at(P< 0.05). ** = Significant at (P< 0.01).**
*****= Significant at (P< 0.001). NS = Not significant (P> 0.05).**
[1] Organic matter % =Total solids% - Ash%

Organic matter% showed the same trend of ash % (table 3) to be which significantly (P<0.001) dropped from 27.1% at parturition to 15.2 % at 30 days and increased up to 17.2% at 60 days for ewes in the intensive system and significantly decreased (P<0.001) from 24.8 at parturition to 13.4 at 60 days postpartum. This results agreed (Khalifa, 1994) as well as Hatfield *et al*. (1995) who found that the organic matter% of colostrum was 27.3% and dropped to 19.5% at 28 days postpartum.

Lambs' body weight

Table (4) shows the average body weight of lambs from ewes raised under the intensive system. It were significantly heavier at birth and weaning 60 day old (P< 0.05), compared with lambs from the semi-intensive system (3.93 vs 3.14 Kg; 18.1 vs 16.4 Kg, respectively). The obtained results were expected due to the effect variation of dietary nutrient supply to growing lambs from each system.

Table (4): Least square means and standard errors of Ossimi lambs weight at birth and weaning and average daily gain from ewes raised under the intensive and the semi-intensive systems.

Itmes	Intensive	Semi-intensive
Lambs weight at:		
Birth kg	3.93±0.27[a]	3.14±0.23[b]
Weaning kg	18.1± 1.20[a]	16.4±1.04[b]
Daily gain (g/d) for birth-60days(weaning)	236.17±6.33[a]	221.11±5.67[b]
Level of sig.	*	*

[a and b] **means in the same row followed by different letters are significantly different (p<0.05).**

Conclusion

No doubt that the obtained results herein conform the conclusion that Ossimi ewes raise under a semi–intensive system in Upper Egypt need supplement program of Ca and Mg at early lactation to face the high demand of mammary gland for milk. production, and by the way to improve their general performance and productivity.

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تركيز الكالسيوم والفسفور والمغنسيوم في مصل دم نعاج الاوسيمي ومواليدها، وقت الولادة ومراحل الحلابة المبكرة، في ظل نظامي التربية المكثفة وشبه المكثفة.
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أجريت هذه الدراسة بمزرعة الإنتاج الحيواني - كلية الزراعة - جامعة جنوب الوادي بقنا في المدة من أكتوبر حتي آخر ديسمبر2009 بهدف تقييم تركيز الكالسيوم والفسفور والمغنسيوم في مصل دم نعاج الاوسيمي وحملانها وقت الولادة وخلال المراحل الأولى من الحلابة والمرباة تحت نظامي التربية المكثفة وشبه المكثفة في جنوب مصر . استخدم في هذه الدراسة عدد 40 نعجة اوسيمى حلابة–بعد الولادة مباشرة–وتم تقسيمها إلى مجموعتين متساوية (كل مجموعة عشرين نعجة حلابه):

المجموعة الاولى G1 : حيث اختيرت وبشكل عشوائي 20 نعجة اوسيمي من القطيع وربيت عند الولادة على نظام التربية المكثف والتي تتغذى على أعلاف مركزة .

المجموعة الثانية G2 : 20 نعجة اوسيمي أخرى ربيت تحت نظام التربية شبه المكثف والتي تعتمد في تغذيتها على المراعي ومخلفات المحاصيل الحقلية . تم وزن الحيوانات عند بداية ونهاية الدراسة كما تم جمع عينات الدم من النعاج ومواليدها عند الولادة وبعد 30 و60 يوماً من الولادة، وفي نفس الأوقات تم أخذ عينات الحليب. تم تحضير عينات الدم والحليب وتحليلها لكل من الكالسيوم والفسفور والمغنسيوم بواسطة جهاز امتصاص الطيف الذرى. ويمكن تلخيص النتائج المتحصل عليها فيما يلي: وجود فروق معنوي ($P<0.01$) في تركيز الكالسيوم بدم نعاج المجموعة الأولى مقارنتا بالمجموعة الثانية. وكان مستوى الكالسيوم في مصل دم النعاج بالمجموعة الثانية منخفضا بعد الولادة وخاصة عند 30 يوما. أما تركيز الفسفور بنعاج المجموعتين ومواليدها فقد وقع ضمن الحدود الطبيعية عند الولادة وطول فترة الحلابة المبكرة. كما وجدت فروق معنوية ($P<0.05$) بتركيز المغنسيوم حيث كان عاليا بمصل دم نعاج ومواليد المجموعة الأولى مقارنتا بالمجموعة الثانية. أما الحليب فقد أوضحت الدراسة عن ارتفاع معنوي ($P<0.01$) بالكالسيوم لنعاج المجموعة الأولى عند الولادة و60يوم مقارنتا بحليب نعاج المجموعة الثانية، و الفسفور عند الولادة وبعد 30 يوم، أما المغنسيوم فقط عند الولادة. نسبة المادة الجافة كانت أعلى معنويا ($P<0.01$) بحليب نعاج المجموعة الأولى مقارنتا بالمجموعة الثانية وذلك عند الولادة وعلى 60 يوما. بينما نسبة المادة العضوية معنويا أعلى ($P<0.01$) على 60 يوما فقط. وفي الخلاصة، فإنه ينصح بضرورة وضع برنامج لإضافة الكالسيوم والمغنسيوم لعلائق أغنام الاوسيمى والمرباة تحت النظام التربية الشبه مكثفة وفي مراحل الحلابة المبكرة وذلك بهدف تحسين أدائها الإنتاجي.

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