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The Calcium, Phosphorus and Magnesium Status of Awassi Ewes and Their Newborns, at Parturition and Early Lactation, Raised under Intensive and Semi-intensive Systems

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Abstract. A field study was conducted to evaluate the Calcium (Ca), Phosphorus (P_I) and Magnesium (Mg) status of Awassi ewes and their lambs at parturition and early lactation raised under intensive and Semi-intensive systems in the northern part of Jordan. Twenty Awassi ewes were selected randomly from a herd, at parturition, raised under intensive systems (group1; fed concentrate ration) and another twenty raised under a Semi–intensive system (group 2; grazed natural pasture and by-product). Blood samples from ewes and their newborns were collected at parturition, 30 and 60 days postpartum. Moreover, milk samples were collected at time of blood sampling. Samples were prepared and analyzed for Calcium (Ca) and Magnesium (Mg) by AAS and Phosphorus (P_i) 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. Milk Ca% of ewes in-group 1 were significantly higher (P< 0.01) at parturition and 60 days postpartum, P% at parturition and 30 days postpartum (P< 0.05), while Mg% 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% only at 60 day postpartum (P< 0.001). In conclusion, ewes raise under a semi–intensive system in northern part of Jordan require Ca and Mg supplementation at early lactation to improve their general performance.

(**Keywords**: Minerals, Awassi ewes, Parturition, Early lactation, Systems)

Introduction

Milk is the main source of nutrients for the newborn lambs up to weaning. Ewes early lactation requires high levels of nutrients through feeding to face the high demand for milk production and recovery. Grazing Awassi ewes in Jordan, usually give during winter when the range grasses and shrubs are overgrazed and whether is cold [1]. Supplementary program with barley, wheat bran and straw are usually start by mid of November and it goes for three month during early lactation [2] The amount of supplement feed is insufficient to cover the nutrients requirements of ewes during this critical period due to the high cost. Calcium (Ca) and Phosphorus (P_i) are the two most abundant minerals in the animal body. 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. A great change happened in the sheep production system in Jordan, from the extensive system to a semi-intensive and recently to the intensive system because of destruction in the range.

It has been reported in the literature 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. Sanson et al., [3] reported 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, the milk composition of minerals varies with season [4], stage of lactation [5], species [6], breed [7] and many other internal and external factors [8, pp. 56-31].

Very little information is available on mineral status of Jordanian Awassi 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 Awassi ewes and their newborns, at parturition and early lactation, raised under the intensive and semi-intensive systems in Jordan.

Material and Methods

Twenty Awassi ewes (3.5$\pm$1yr. old) were selected randomly at parturition from a herd raised under the typical intensive system. These Ewes and their newborn lambs were fed a ration consisted of barley grain (65%), soybean meal (18%), wheat bran (15%), calcium carbonate (1.4%), sodium chloride (0.5) and trace element and vitamins (0.1%). The approximate daily intake was 1.2 kg concentrate/ ewe/ day beside wheat straws *ad-libitum*. The chemical composition of the concentrate were: 14.9% crude protein; 0.63% Ca; 0.33% P and 0.114% Mg (as fed basis). The feeding program of ewes was calculated to cover the nutrient requirements in this stage according to NRC [9, p.42]. Another twenty ewes (3.5$\pm$1yr. old) at parturition were selected randomly from a herd raised under a semi–intensive system in northern Jordan. These Ewes and their newborn lambs were grazed natural pasture, cereal stubble, crop residue, vegetable by-products and some barley (300g/ewe/day) and wheat bran (200g) as a supplement (Table 1). Lambs were weighed 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.

Table 1. Chemical composition of available feed and supplements consumed by grazing sheep

Ingredients	CP	P	Mg	Ca
			%	
Barley grain	12.0	0.35	0.20	0.23
Barley straw	4.1	0.07	0.25	1.70
Wheat bran	15.2	0.94	0.49	0.43
Wheat straw	3.5	0.13	0.22	0.66
Natural pasture	15.7	0.40	0.43	2.42
Lentile straw	5.0	0.04	0.52	3.20
Irrigated grass	25.0	0.47	0.52	3.14

All samples were prepared according to AOAC [10, p.88] 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 dry- ashed at 450ºC/4 hrs and diluted by using concentrate HCl for analysis. Feed samples were dry- ashed at 600ºC/6 hrs. Calcium and Magnesium concentrations were measured by Atomic Absorption Spectrophotometry (AAS). Serum inorganic phosphorus was measured by colorimetry according to Fiske and Subbarow [11].

Data were analyzed as a complete randomized design (CRD) using SPSS® (version 7.5). Raising systems and time of sampling were used as independent variables, and blood serum and milk Ca, Mg and Pi were used as dependent variables. Means were compared using the least significant differences (LSD) test of SPSS. Significance were declared at $P < 0.05$ unless otherwise noted.

Results and Discussions

Serum mineral contents

Table 2 shows the concentrations of Ca, P_i and Mg (mg / dl) in the blood serum of ewes and their newborns in the intensive and semi intensive systems at parturition, 30 and 60 days postpartum. The Ca concentration in blood serum of sheep is considered to be deficient when Ca less than 6.0 mg/dl, but above 8 mg/dl are considered adequate [12, p. 47]. Calcium concentrations in blood serum of ewes and their newborn lambs in the two systems didn't show any significant differences ($p>0.05$) throughout early lactation, except at 30 days postpartum when a significantly lower concentration ($p<0.01$) in blood serum of ewes raised under the semi-intensive system was detected compared with ewes in the intensive system (5.8 vs 8.4 mg /dl respectively).

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 [13]. Diets and bones are the main source of Ca and other nutrients in mammals and birds [14]. 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 [14, p. 1]. 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 [15]. Many researchers reported a high reduction in blood plasma Ca, P_i and Zn of dairy cows around parturition because of transfer of a large amount of these minerals to colostrum [16- 19]. Salih *et al.* [13] found that serum Ca level of cows at parturition was higher than that 3 months postpartum. In this study, 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.* [20] in which 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 [21]. Moreover, McDowell [22] reported that young lambs with high Ca requirements absorb Ca at higher rate and greater efficiency than mature sheep.

Table 2. The concentrations of calcium (mg/dl), phosphorus (mg/dl) and magnesium (mg/dl) in blood serum of ewes and their lambs at early lactation (parturition, 30 and 60 days postpartum)

	0 Day				**30 Days**				**60 Days**			
	E[1]		**NB[2]**		**E**		**NB**		**E**		**NB**	
	X[3]	**SE**	**X**	**SE**	**X**	**SE**	**X**	**SE**	**X**	**SE**	**X**	**SE**
Ca (mg/dl):												
Intensive	8.5	0.4	8.6	0.5	8.4	0.5	9.0	0.3	8.5	0.3	8.4	0.6
Semi-intensive	7.3	0.9	7.9	0.4	5.8	0.6	8.7	0.3	7.2	1.0	8.3	0.6
SE	0.50		0.32		0.57		0.21		0.54		0.40	
Level of Sig.	NS		NS		**		NS		NS		NS	
P (mg/dl):												
Intensive	6.9	0.24	7.6	0.34	7.1	0.32	7.2	0.21	7.9	.19	6.6	0.15
Semi-intensive	6.1	0.19	6.9	0.41	6.8	0.41	6.1	0.23	7.4	.12	6.3	0.21
SE	0.45		0.33		0.46		0.51		0.43		0.39	
Level of Sig.	NS		NS		NS		NS		NS		NS	
g (mg/dl):												
Intensive	2.77	.24	2.4	.17	2.3	.31	2.8	.26	2.4	.4	3.3	.43
Semi-intensive	1.53	.19	1.4	.16	1.7	.19	1.3	.14	1.5	.14	1.5	.10
SE	0.24		0.18		0.19		0.29		0.24		0.36	
Level of sig.	*		*		*		**		*		**	

1 Ewes

2 Newborns

3 mean.

SE = Standard error of means.

[abc] Mean values with superscripts within column are significantly different as follow:

* Significant at P< 0.05.

** Significant at P< 0.01.

NS = Not significant (P> 0.05)

Phosphorous concentration in blood serum of the ewes and lambs were within the normal adequate levels and no significant effect of system on these levels throughout early lactation. 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 [12, p. 174]. Our findings agreed with Albel *et al*. [23] who reported an adequate supply of phosphorus to sheep throughout the year, especially during the summer season, at the northern part of Jordan. Sanson *et al*. [3] reported a significant increase in blood serum P_i of ewes at lambing and continued to increase with the progress of lactation.

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 their newborns with higher level of significancy ($p<0.01$). Sheep with serum Mg levels less than 1.5 mg/dl are deficient; serum levels greater than 1.5 and less than 1.8 mg/dl are considered marginal; serum levels from 2.0 to 3.5 mg/dl are adequate [12, p. 147]. 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*. [23] 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. Moreover, another study done by Sanson *et al*. [3] reported a higher concentration of Mg in blood serum of ewes at late gestation and decreased at parturition and 3 weeks postpartum. 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 [24]. 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 [22; 25]. 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 [23].

The Awassi ewes and their newborn from both 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

Many factors influence the mineral composition of milk that varied with season [4], stage of lactation [5], animal species [6], breed [7] and other internal and external factors [8]. Table 3 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 down ($p<0.01$) 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. The averages milk Ca% for cows, sheep and goats raised in Britain were 0.12, 0.21 and 0.16% respectively [6].

Phosphorous % in colostrum of ewes raised 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 down with the progress of the lactation period ($P<0.01$ and $P<0.05$ respectively). Moreover, the same trend ($P<0.05$) was found on the milk of 30 days postpartum (0.17 vs 0.14%, respectively). Moreover, ewes raised under the intensive system showed high level of blood serum P_i compared with ewes in the semi-intensive system. Akinsoyinu [26] found that colostrum of dairy goats contained more Ca and P_i (141 and 118 mg/dl) than regular milk (130 and 93 mg/dl). Moreover, Salih *et al.* [13] reported a relatively constant percentage of Ca, and P_i in milk that little affected by diet, but they differ between regular milk and colostrum. These findings agreed with our results for the ewes raised under the intensive system and only P for the ewes raised under the semi-intensive system.

Table 3. Milk calcium, phosphorus and magnesium percentages at parturition, 30 and 60 days postpartum

System	I[1] X[4]	II[2] X	III[3] X	SE	Level of sig.
Calcium (%):					
Intensive	0.22^a	0.15^b	0.16^b	0.003	***
Semi-intensive	0.20	0.19	0.22	0.01	NS
SE	0.01	0.01	0.07		
Level of sig.	***	NS	***		
Phosphorus (%):					
Intensive	0.21^a	0.17^b	0.17^b	0.01	**
Semi-intensive	0.16^a	0.14^b	0.16^{ab}	0.01	*
SE	0.01	0.01	0.01		
Level of sig.	*	*	NS		
Magnesium (%):					
Intensive	0.033	0.04	0.036	0.004	NS
Semi-intensive	0.030	0.04	0.040	0.009	NS
SE	0.04	0.005	0.07		
Level of sig.	**	NS	NS		

[1] At parturition
[2] 30 days postpartum
[3] 60 days postpartum
[4] Mean
[abc] 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 was detected compared with the semi-intensive system (0.033 vs 0.030 % respectively). No significant effect of system or time (progress of lactation) was found on milk Mg%. Moreover, there was no effect of time of milk sampling on Mg% for both systems separately. The average milk Mg% for cows, sheep and goats raised in Britain were 0.01, 0.02 and 0.014%, respectively [6].

Colostrum and milk composition

The total solid, ash and organic matter percentages of Awassi sheep milk were presented in Table 4. Stage of lactation, season of lactation, animal breeds and production system effect the milk composition. Total solid % in colostrum of ewes raised under the intensive system were significantly higher (P<0.01) compared with colostrum of ewes from the semi- intensive (28.2 vs 26.2%, respectively). The same trend was found on milk total solid% at 60 days postpartum (17.7 vs 14.3%, respectively; P<0.001), but not at 30 days postpartum. A significant drop down (p<0.001) in the total solid% was detected by the progress of lactation in the ewes from the semi-intensive system (26.2, 16.23 and 14.3%, respectively), but significantly (P<0.001) decreased at 30 days postpartum and increased again at 60 days postpartum for ewes from the intensive system (28.2, 16.36 and 17.7% respectively). The total solids% of ewes' milk ranged from 14.5 to 18.9% as reported by Owen [27] and all the total solids% in this study were fallen within this range. No significant variations were found on 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 up to 30 days and increased at 60 days postpartum for the ewes from the intensive system but not the same trend for ewes from the semi-intensive system. Khalifa *et al*. [28] and Abou Dawood *et al*. [29] reported that stage of lactation affected significantly the ash content of ewe milk. They reported a low ash content of second week milk and increased with the progress of stage of lactation. This change in ash% occurred because of the peak of milk production at the second week of lactation after which the milk production gradually decreased. In this study, the values of ash in whole milk from both systems were higher compared with the values that reported by Owen ([27]; 0.67 to 0.87%).

Table 4. Milk total solids, organic matter and ash percentages at parturition, 30 and 60 days postpartum

System	**I[1]**	**II[2]**	**III[3]**		
	X[4]	**X**	**X**	**SE**	**Level of sig.**
Total Solids (%)					
Intensive	28.2[a]	16.36[b]	17.7[c]	0.41	***
Semi-intensive	26.2[a]	16.23[b]	14.3[c]	0.39	***
SE	0.45	0.44	0.34		
Level of sig.	**	NS	***		
Ash (%)					
Intensive	1.27[a]	1.03[b]	1.04[c]	0.046	**
Semi-intensive	1.71[a]	0.96[b]	0.85[c]	0.026	***
SE	0.04	0.04	0.03		
Level of sig.	NS	NS	NS		
Organic matter (%)[5]					
Intensive	27.1[a]	15.4[b]	17.2[c]	0.34	***
Semi-intensive	24.8[a]	15.2[b]	13.4[c]	0.47	***
SE	0.46	0.40	0.27		
Level of sig.	NS	NS	***		

[1] At parturition
[2] 30 days postpartum
[3] 60 days postpartum
[4] Mean
[5] Total solids% - Ash%
[abc] Mean values with superscripts within row and 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)

Organic matter% showed the same trend as ash % which significantly ($P<0.001$) dropped down from 27.1% at parturition to 15.2 % at 30 days and increased up to 17.2% at 60 days for ewes from the intensive system. The percentages of the organic matter in milk of ewes under the semi-intensive were significantly decreased ($P<0.001$) with the progress of lactation from 24.8 at parturition to 15.2 at 30 days and 13.4 at 60 days postpartum which agreed with other researchers [28]. At 60 days postpartum, milk organic matter % for the ewes raised under the intensive system were significantly higher ($P<0.001$) compared to the milk of ewes from the semi-intensive system (17.2 vs 13.4%, respectively). Hatfield *et al*. [30] reported that the organic matter% in colostrum was 27.3% and dropped down to 19.5% for milk at 28 days postpartum. Our results in this study followed the same trend but with lower values. On the other hand, the values agreed with Owen [27, pp. 16-48] who reported the range from 13.8 to 17.5%.

Lambs' body weight

The average body weight of lambs from ewes raised under the intensive system ($P<0.05$) were significantly heavier at birth ($P<0.01$) and weaning ($P< 0.05$) 60 days old, compared with lambs from the semi-intensive system (3.93 vs 3.14 Kg; 18.1 vs 16.4 Kg, respectively). This observation was expected due to the variation in dietary nutrient supply to growing lambs from each system.

Conclusion

The data reported herein indicated that ewes raise under a semi–intensive system in northern part of Jordan required Ca and Mg supplementation program at early lactation to face the high demand of Ca and Mg by mammary gland to produce milk. In addition, to improve their general performance and productivity.

References

[1] Food and Agriculture Organization of the United Nations. "Sheep Production under Extensive Systems in the Near East, Jordan Pastoral System: A Case Study". Near East Regional Office, (1994), 7-15.

[2] ACSAD. "Studies of Houd Al- Hamad–Animal Production in the Jordanian Amad"- *Annex 7-1. ACSAD*, Damascus, (1983).

[3] Sansom, B. F., Bunch, K. J. and Dew, S. M. "Change in Plasma Calcium, Magnesium, Phosphorous and Hydroxyproline Concentrations in Ewes from Twelve Weeks before until Three Weeks after Lambing". *Br. Vet. J.*, 138 (1982), 393 – 401.

[4] Varo, P., Nuurtamo, M., Saari, E. and Koivistoinen, P. Mineral Element Composition of Finnish Foods". *Acta Agriculture Scandinavica Suppl.,* 22, (1980), 115 – 126.

[5] Tiscorina, E. "Present Knowledge of the Chemical Composition of Milk-minerals". *Rivista della societa Italian di Scinza.,* 6 (1977), 423 – 449.

[6] Rincon, F., Moreno, R., Zureka, G. and Amaro, M. "Mineral Composition as a Characteristic for the Identification of Animal Origin of Raw Milk". *J. Dairy Res*., 61 (1994), 151- 154.

[7] Mousa, M. T., Abou-Naga, A. M., Hassan, F., Abdel-Hafez, G. and El-Hammosi, F. F. "Milk Production of Awassi, Chios and Local Ossimi Sheep". *Egypt. Amer. Conf. Physiol. Anim. El-Fayoum*, (1993).

[8] Underwood, E. J. *Trace Elements in Human and Animal Nutrition.* (4th ed.). New York: Academic Press, USA, 1977.

[9] NRC. *Nutrient Requirements of Sheep.* Washington, D.C.: National Academy of Science, 1985.

[10] AOAC. *Official Methods for Analysis . (15th ed.).* Washington,D.C.: Association of Official Analytical Chemists, 1990.

[11] Fiske, C. H. and Subbarow, Y. “The Colorimetric Determination of Phosphorus”. *J. Biol. Chem.*, 66, (1925), 375- 400.

[12] Puls, R. *Mineral Levels in Animal Health. Diagnostic Data*. British Columbia: Sherpa International Canada, 1990.

[13] Salih, Y., McDowell, L. R., Hentege, J. F., Mason, R. M. and Wilcox, C. J. “Mineral Content of Milk, Colostrum, and Serum as Affected by Physiological State and Mineral Supplementation”. *J. Dairy Sci.*, 70 (1987), 608-612.

[14] DeLuca, M. F. **“**The Metabolism and Function of Vitamin D**”**. In: Kumar, R. (Ed.), *Vitamin D: Basic and Clinical Aspects*. Boston. MA: Martinus Nijhoff Publ., 1984.

[15] Horst, R. L. “Regulation of Calcium and Phosphorus Homeostasis in the Dairy Cow”. *J. Dairy Sci*., 69 (1986), 604- 616.

[16] Shappell, N. W., Herbein, J. H., Deftos, L. J. and Aiello, R. J. “Effect of Dietary Calcium and Age on Parathyroid Hormone, Calcitonin and Serum and Milk Minerals in the Periparturient Dairy Cow”. *J. Nutr.,* 117 (1987), 201-207.

[17] Goff, J. P. and Stabel, J. R. “Decreased Plasma Retinol, Tocopherol, and Zn Concentration during the Periparturient Period: Effect of Milk Fever”. *J.Y. Sci.*, 73 (1990), 3195-3199.

[18] Tucker, W. B., Hogue, J. E., Adams, G. D., Aslam, M., Shin, I. S. and Morgen, G. “Effect of Dietary Cation-anion Balance during the Dry Period on the Occurrence of Parturient Paresis in Cows Fed Excess Calcium”. *J. Anim. Sci.,* 70 (1992), 1238-1250.

[19] Horst, R. L., Goff, J. P., Reinhardt, T. A. “Calcium and Vitamin D Metabolism in the Dairy Cow”. *J. Dairy Sci.,* 77 (1994), 1936-1951.

[20] Van Niekerk, F. E, Van Niekerk, C. H., Heine, E. W. P. and Coetzee, J. “Breed Differences in Plasma Calcium, Phosphorous and Magnesium Concentrations of Merino, Dohne Merino and SA Mutton Merino Sheep as Related to the Bent-leg Syndrome”. *J. S. Afr. Vet. Assoc.,* 60 (1989), 36- 40.

[21] Van Niekerk, F. E., Cloete, S. W. P. and Heine, E. W. P. “Concentration of Blood Minerals and Metabolites, as well as Production Characteristics of Angora Goats in the Southern Cape”. *S. Afr. Tydskr, veek.* 20, No. 2 (1990), 90 – 93.

[22] McDowell, L. R. *Mineral in Animal and Human Nutrition*. New York: Academic Press, 1992, 30-73.

[23] Albel, P., Al-Tamemi, A. K., Alloush, S., Badr, E., Beiruty, M. and Al-Tamemi, Y. R. “The Mineral Status of Cattle and Sheep in Northern Jordan”. *Report. Royal Scientific Society.* Amman, Jordan, (1979), 1- 11.

[24] Hardwick, L. L., Jones, M. R., Brautbar, N. and Lee, D. B. N. “Magnesium Absorption: Mechanism and Influence of Vitamin D, Calcium and Phosphate”. *J. Nutr.*, 121 (1991), 13- 23.

[25] Church, D. C. and Pond, W. G. *Basic Animal Nutrition and Feeding, Macrominerals.* 3rd ed., New York: John Wiley and Sons, 1988, 162-173.

[26] Akinsoyinu, A. O. “Calcium and Phosphorous in Milk and Blood Serum of Lactating Red Sokoto Goats”. *J. Dairy Res.,* 48 (1981), 505.

[27] Owen, J. B. *“Sheep Production: Milk Composition”*. London, UK ELBS, 1976.

[28] Khalifa, R. M., Mokhtar, S. A., Yassen, M. A. and Swidan, F. Z. “Comparative Study Between Sinai and Rahmani Sheep. 2- Performance of Ewes during Pregnancy and Location, Birth and Weaning Weights of Lambs”. *Egyptian J. Anim. Prod.,* 31 (1994), 491–511.

[29] Abou Dawood, A. E., Ghita, I. I. and Taha, S. M. “Major and Minor Components and Trace Elements of the Egyptian Ewes and Goats’ Milk”. *Egypt J. Dairy Sci.,* 8 (1980), 109 –115.

[30] Hatfield, P. G., Snowder, G. D., Head, W. A., Glimp, H. A., Stobart, R. H. and Besser, T. "Production by Ewes Rearing Single or Twin Lambs: Effects of Dietary Crude Protein Percentage and Supplemental Zinc Methionine". *J. Animal Sci.*, 73 (1995), 1227 – 1238.

تركيز الكالسيوم والفسفور والمغنسيوم في مصل دم نعاج العواسي ومواليدها، وقت الولادة ومراحل الحلابة المبكرة، في ظل نظامي التربية المكثفة وشبه المكثفة

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ملخص البحث. تم عمل دراسة حقلية بهدف تقييم تركيز الكالسيوم والفسفور والمغنسيوم في مصل دم نعاج العواسي وحملانها وقت الولادة وخلال المراحل الأولى من الحلابة والمرباة تحت نظامي التربية المكثفة وشبه المكثفة في شمال الأردن. حيث اختيرت وبشكل عشوائي ٢٠ نعجة عواسي من القطيع وربيت عند الولادة على نظام التربية المكثف (المجموعة الأولى) والتي تتغذى علي أعلاف مركزة، و٢٠ نعجة أخرى ربيت تحت نظام التربية شبه المكثف (المجموعة الثانية) والتي تعتمد على المراعي ومخلفات المحاصيل الحقلية. تم جمع عينات الدم من النعاج ومواليدها عند الولادة وبعد ٣٠ و٦٠ 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.

وقد وضحت النتائج عن وجود فرق 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 ٣٠ 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 و٦٠يوم مقارنتا بحليب نعاج المجموعة الثانية، و الفسفور عند الولادة وبعد ٣٠ 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 ٦٠ يوما. بينما نسبة المادة العضوية معنويا أعلى ($P<0.01$) على ٦٠ يوما فقط.

وفي الخلاصة، فإنه ينصح بضرورة وضع برنامج لإضافة الكالسيوم والمغنسيوم لعلائق أغنام العواسي والمرباة تحت النظام التربية الشبه مكثفة وفي مراحل الحلابة المبكرة وذلك بهدف تحسين أدائها الإنتاجي.