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Colostral Immunoglobulin as Affected by Nutritional Status in Border Licester Merino Ewes Deliver at Kuwait

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Abstract: Sixty two Border Licester Merino ewes were scored for body condition weekly till lambing. Body condition score (BCS; nutritional status) at lambing showed a suggestive influence on the colostrom concentration collected from the ewes within twelve hours of lambing (P=0.06). Ewes scored 2.5-3.5 were superior regarding IgG concentration than both of those who scored higher and lower than this category. Lambs that were born to ewes with BCS of 2.5-3.5 at lambing weaned heavier than those who were born to ewes of either higher or lower BCSL (p= 0.02). Weaning weights (at age of 95 days) for these lambs were heavier because of the quality of colostrum they were fed. Sex of lambs born not affecting the quality of colostrum. In general, colostrum from ewes gave birth to twins was of higher quality than colostrum of ewes that gave birth to singles. Although not significant, male lambs tended to be born heavier than those female lambs whether they were born single or twins. Male lambs weaned heavier than female lambs (23.7 Vs. 20.65 Kg).Time of milk collection is a significant factor in colostrum concentration. Samples that were collected closer to the time of lambing tend to have higher colostrum concentration (p=0.002).

Key words: Sheep · Colostrums · Kuwait · Body condition score · IgG.

INTRODUCTION

Colostrum is the first milk suckeled by newborn lambs. It is high in immunoglobulin(Ig), particularly IgG, which provides passive immunity to the newborn lambs; the level of passive immunity attained is proportional to the concentration and quantity of immunoglobulin and the time interval after birth in which the colostrum is consumed [1]. The composition of colostrum changes rapidly to that of normal milk during the first few days of lactation. Lambs should receive colostrum within 12 hr after birth. Ig G is absorbed from the intestine for only a short time after birth and the efficiency of absorption decreases linearly with time. A negative relationship between the interval from calving to first milking and Ig content was recorded [2]. The quantity of colostrum was positively related to the colostral IgG production [1,3]. Although Esser *et al.* [1] did not find a significant affect of body condition score (BCS), litter size and sex of the lamb and genotype of the ewe on the colostral IgG. Gilbert *et al.*[4] observed higher IgG concentrations in yearling ewes than older ones. Gallo and Davies [5] found a lower colostral production in single-bearing than twin-bearing ewes. In 1995, AL-Sabbagh *et al.* [6] found that colostral IgG concentration would diminish to zero mg/ml by 23hrs postpartum. Moreover, they found that BCS which varied from 2.5-3.5 at lambing, had neither affect on colostral IgG concentration, nor on the total weight of Polypay sheep lambs born and their mortality.

BCS and live weight are two systems for measuring nutritional status in livestock. BCS, the assessment of fat and muscle in the loin region, is a system which estimates the degree of muscling and fat development in an animal [7,8]. It is a subjective, accurate and an inexpensive estimator of nutritional status than body weight because the skeletal size adds to the live weight without being a determinant of the nutritional status. It is a good predictor of fertility and total fat deposits in the animal [9]. BCS was developed [10], using a scale of one to five, where 1 is thin and five is obese where this was refined [7] by adding half point gradations. This system has proven to be useful and reasonably repeatable [11].

The most crucial period is late gestation when the greatest fetal growth occurs [12, 13]. Many studies have shown a positive correlation between BCS and embryonic survival [14-18].

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In general, body condition loss should not exceed 0.5 units in early lactation in order to minimize negative reproductive effects. Excessive body condition losses often result in greater negative energy states and longer delays in return to positive energy states.

Overall, body-condition scoring is a method of to fine-tune sheep and dairy herd nutrition and health. Research and field experiments have shown that body condition influences productivity, reproduction, health and longevity. Thinness or fatness can be a clue to underlying nutritional deficiencies, health problems, or improper herd management. If done on a regular basis, body-condition scoring can be used to troubleshoot problems and improve the health and productivity of the dairy herd.

Over-conditioning, or fatness, may result from poor nutrition or reproduction management. A fat animal is more susceptible to metabolic problems and infections and is more likely to have difficulty at calving or lambing. Over-conditioning usually begins during the last three to four months of lactation, when milk production has decreased, but grain and total nutrient levels have not been reduced accordingly. Other causes of over-conditioning are prolonged dry periods or overfeeding during dry periods.

Under-conditioning, or thinness, can frequently lower production and milk-fat levels because of insufficient energy and protein reserves. Thin cows often do not show heat or conceive until they start to regain-or at least maintain-body weight. In feeding these animals, care must be taken to maintain production while increasing body reserves.

Previous work at Kuwait Institute for scientific research, FA007C and in task 5 in particular named: Determination of factors affecting lamb survival the author presented a work relating lamb losses to husbandry inadequacy, stillbirth, hypothermia, pneumonia and infectious diseases. He suggested good nutritional regimes for ewes before lambing to produce stronger lambs as well as after lambing to support quality colostrum development. To gain more information in this field it will be good if we relate the body condition score of the ewes at lambing (within a week of lambing) to the antibodies, mainly IgG concentration, specially that colostrum will be affected by the prepartum practices rather than postpartum since it is suckled immediately after parturition.

The main purpose of this experiment was to provide us with more information about the affect of different parameters on the humeral immunity indicator namely IgG, not only that but to make us able to pin point use the best parameters to improve lamb immunity and hence improving survivability of the newborn lambs.

MATERIALS AND METHODS

This experiment took place in Kuwait Livestock and Trading Company (KLTT). A leading company that is importing more than one million lambs from Australia each year to Kuwait to face the gap between the demand and quantity of lambs raised locally. More than 90 animals were scored weekly from the beginning of the experiment till the day of lambing. The activity of scoring is repeated to insure the repeatability of the scoring system. The score just before lambing will be recorded and considered to be the BCS at lambing. Scoring, in lambs, is done by using the balls of the fingers (feeling the end of the short ribs) and thumb (feeling the back bone). Assessment is done by feeling the muscle and fat cover around these areas as well as the fullness of the muscle at the loin region [10].

During lambing season all ewes were weighed and scored for body condition. They were identified by special tags in their ears to specify later the type of breed, litter size and age of each ewe. Colostrum was collected from each udder immediately after lambing and before lambs have access to their dams. Not all scored ewes were sampled for colostrum since some of the samples were missed or more than 12 hours are passed before the team member com and collect it. Sixty two collected colostrum samples were identified and frozen at -20°C for subsequent analysis of IgG concentration. The concentration of IgG is usually determined using the radio-immuno-diffusion (RID) method developed by Mancini *et al.*[19] and modified by Fahey and McKelvey [20]. Colostrum quality can be also determined by enzyme-linked immunosorbant assay (ELISA) or radioimmunoassay (RIA), that are extremely precise, or less precisely by specific gravity [18]. Overall, the RID method is simple and requires a minimal investment in equipment [21].

Data were analyzed using statistical analysis system. General linear model was used using age, litter size, breed and BCS at lambing as independent variables and the Ig concentration and total weight of lambs born and total

weight of lambs weaned as a dependent variables. Weights of ewes were used as covarite to correct any weight differences that were started with in the model. Correlation coefficient analysis were used to variate BCS at lambing, time from lambing to sample collection, ewe weight, total weight of lambs born, total weight of lambs weaned, litter size, sex of litter and Ig concentration to each other using Pearson model.

RESULTS

Body condition score at lambing showed a suggestive influence on the colostrom concentration collected from the ewes within twelve hours of lambing (P=0.06). Table 1 shows hat ewes scored 2.5-3.5 were superior regarding IgG concentration than both of those who scored higher and lower than this category. There was a tendency that ewes with high body condition score at lambing give birth to lesser total weight of the born lambs while the heavier lambs were born by ewes with lower BCS at lambing within the window of scoring that had worked with lambs that were born to ewes with BCS of 2.5-3.5 at lambing weaned heavier than those who were born to ewes of either higher or lower BCSL. Although the superiority in the colostrom concentration were suggestive there, the weaning weights of lambs fed on this colostrom showed significant superiority in weight at time of weaning (P=0.02).

Table 1: Means of colostrum concentration (mg/dl), Total weight of lambs born (Kg) and total weight of lambs weaned (Kg) of different category (Body condition score at lambing (BCSL), Litter size and sex of the lambs

Category	Colostrom	Total wt born	Total wt weaned
BCSL			
<2.5	1,273(4)	6.68(4)	23.02(4)[a]
2.5-3.5	2,748(41)	5.63(41)	26.70(36)[b]
>3.5	2,369(17)	5.38(17)	25.80(13)[c]
Litter size			
Single	2,358(39)	4.93(39)[a]	22.129(31)[a]
Twin	2,873(23)	6.81(23)[b]	31.927(22)[b]
Sex of lambs			
1	2,045(17)	2.27(17)[a]	23.70(15)[a]
2	2,599(22)	4.67(22)[a]	20.66(16)[a]
3	3,081(14)	6.89(14)[b]	29.60(14)[b]
4	3,219(2)	6.95(2)[b]	38.25(2)[b]
5	2,358(7)	6.60(7)[b]	35.33(6)[b]

Numbers between brackets represents number of samples collected.

[abc]Mean in column in the same category with different superscripts Differ (P<0.05)

Table 2: Pearson Correlation analysis of Body Condition score at lambing (bcsl), Time of collection from lambing (time), ewe weights (ewewt), total weight born (Totborn), total of weight weaned (totwn), litter size (litter), Sex of lambs born (sex), colostrum concentration (conc) with Body Condition score at lambing (bcsl), Time of collection from lambing (time), ewe weights (ewewt), total weight born (Totborn), total of weght weaned (totwn), litter size (litter), Sex of lambs born (sex), colostrum concentration (conc)

	bcsl	Time	Ewewt	Totborn	Totwn	litter	Sex	conc
Bcsl		-0.24	0.069	0.056	0.082	-0.024	0.173	0.051
		0.033	0.0001	0.662	0.548	0.055	0.166	0.658
Time			0.067	0.024	0.262	0.144	0.024	0.425
			0.602	0.851	0.052	0.248	0.847	0.0001
Ewewt				0.103	0.125	0.182	0.055	0.074
				0.425	0.372	0.156	0.669	0.567
Totborn					0.467	0.586	0.410	0.156
					0.0003	0.0001	0.0008	0.213
Totwn						0.577	0.511	0.241
						0.0001	0.0001	0.074
Litter							0.843	0.116
							0.0001	0.355
Sex								0.057
								0.652

Sex of lambs born was not affecting the quality of colostrum. In general, colostrum from ewes gave birth to twins is with higher quality than colostrum of ewes that gave birth to singles. Male lambs tended to be born heavier than those female lambs whether they were born single or twins. Male lambs weaned heavier than female lambs (23.7 Kg vs 20.65 Kg). Twin lambs with same sex tended to be weaned heavier than lambs of different sex.

Ewes that gave birth to twins tended to have higher colostrum quality than those who gave birth to singles 2873mg/dl and 2358mg/dl, respectively.

Table 2 shows that time of milk collection is a significant factor in colostrum concentration. Samples that were collected closer to the time of lambing tend to have higher colostrum concentration (p=0.002).

DISCUSSION

The superiority of the ewes that scored 2.5-3.5 regarding IgG was not a factor that affected on the total weight of lambs born, but it was a factor in the total weight of the weaned lambs. That could be due to a better milk quality and general health accordingly that helped in that since newborn lambs depend on milk for the most of their early nutrition [22]. The tendency of the higher scored ewes gave birth to lesser total weight of lambs

born could be explained by the use of the lambs of the dam's reservoir directly to gain their weight and that is shown clearly at lambing. Since there was a superiority of the colostrum concentration within BCS at lambing of 2.5-3.5, this explains the higher weight at weaning for lambs born to ewes within this category. Although the superiority in the colostrom concentration were suggestive there, the weaning weights of lambs fed on this colostrom showed significant superiority in weight at time of weaning (P=0.02). It may be due to the quality of colostrum they were fed.

Twin lambs with same sex tended to be weaned heavier than lambs of different sex due to the harmony of lambs with the same sex while the aggressive competition of the members of different sex banned this affect.

In conclusion, ewes with body condition ranges from 2.5 to 3.5 at lambing are superior in the quality of colostrum. Lambs born for these ewes were weaned heavier than those born for ewes out of this range. According to these results it is a good idea to keep the ewes at the range of 2.5 to 3.5 at the lambing time so that colostrum quality will be better and consequently survivability which is consistant to the previous finding of [23-25].

REFERENCES

1. Esser, D., F.W. Schmit, K.J. Peters and S. Von Korn, 1989.Immunoglobulin G status of ewes and their lambs. J. Anim. Breed. Genet., 106: 120.
2. Tonjes, D.A., S. Strasser and D.L. Bath, 1991.Specific Gravity: a better test of first milk quality. Calif. Agric., 45: 23.
3. Shubber, A.H., D.L. Doxey, W.J.M. Black and J. FitzSimons, 1979. Immunoglobulin level in ewe colostrums And in lamb serum. Res. Vet. Sci., 27: 283.
4. Gilbert, R.P., C.T. Gaskins, J.K. Hillers, C.F. Parker and T.C. McGuire, 1988. Genetic and environmental Factors affecting immunoglobulin G1 concentrations In ewe colostrum and lamb serum. J. Anim. Sci., 66: 855.
5. Gallo, C. and D.A.R. Davies, 1987 Relationship of litter Size and colostrum characteristics in Cambridge And Suffolk x Cambridge ewes. Arch. Med. Vet., 10: 47.
6. AL-Sabbagh, T., L.V. Swanson and J.M. Thompson, 1995. The effect of ewe body condition at lambing On colostral Immunoglobulin G Concentration And lamb performance. J. Animal Sci., 73: 2860.
7. Russel, A.J.F., J.M. Doney and R.G. Gunn, 1969. Subjective Assessment of body fat in live sheep. J. Agric. Sci. Camb.,72: 451.
8. Ducker, M.J. and J.S. Boyd, 1977 The effect of body size And body condition on the ovulation rate of ewes.Anim. Prod., 24: 377.
9. Barth, K. and D. Neumann, 1991. Body condition score is superior to body weight data. The effects of body Weight and body condition on fertility in ewes.T ierzucht, 45: 224.
10. Jeffries, D.L., 1961. Body condition scoring and its use in Management. Tasmanian J. Agric., 32: 19.
11. Oriordan, E.G. and S. Murphy, 1987. Repeatability of body Condition score. Anim. Prod. Res. Rep., Dublin, Irish Republic.
12. Robinson, J.J., I. McDonald, C. Fraser and M.J. Crafts, 1977. Studies on reproduction in prolific ewes. 1. Growth of products of conception. J. Agric Sci. Camb., 88: 539.
13. Mellor, D.J., 1990. Nutritional constraints on survival of Newborn lambs. Vet. Rec., 123: 304.
14. Guerra, J.C., C.J. Thwaites and T.N. Edey, 1971. The effect of live weight on the ovarian response to PMSG and On embryo mortality in tha ewe. J. Agric. Sci. Camb., 76: 177.
15. Gunn, R.G., J.M. Doney and A.J.F. Russel, 1972 Embryo Mortality in Scottish Blackface ewes as influenced By body condition at mating and by post – mating Nutrition. J. Agric. Sci. Camb., 79: 19.
16. Cumming, I.A., M.A.B. Blockey, C.G. Winfield, R.A. Parr and A.H. Williams, 1975. A study of relationship of breed, time mating, level of nutrition, live Weight, body condition and face cover to embryo Servival in ewes. J. Agric Sci. Camb., 84: 559.
17. Gunn, R.G. and T.J. Maxwell, 1989. A note on the effect of The direction of live weight change about the time Of mating on reproductive performance of Greyface Ewes. Anim. Prod., 48: 471.
18. West, K.S., H.H. Meyer and M. Nawaz, 1991. Effect of Differential ewe condition at mating and early post-mating nutrition on embryo survival. J. Anim. Sci., 69: 3931.
19. Mancini, G., A.O. Carbonara and J.F. Heremans, 1965.Immunochemical quantitation of antigens by single Radial immunodiffusion. Immunochemistry. 2: 235.
20. Fahey, J.L. and E. McKelvey, 1965. Quantitative Determination of serum immunoglobulin in antibody-Agar plates. J. Immunol., 94: 84.

21. Check, I. and M. Piper, 1986. Quantitative of Immunoglobulins *in* Manual of Clinical Laboratory Immunol. 3rd ed. Rose, N., Friedman, H And Fahey, J.(Ed.) Am. Soc. Microbiol. Washington, DC, pp: 138.
22. Brown, D.L. and D.E. Hogue, 1985. Effect of roughage level and physical form of diet on Finnsheep lactation. SID Res. Digest., 2: 11.
23. Alexander, G., 1964. Lamb Survival: Physiological consideration. Proc. Aust. Soc. Anim. Prod., 5: 113.
24. Hohenboken, W.D., J.N. Clarke, P.V. Rattray, J.F. Smith and M. Wheeler, 1988. Responsivness of ewe genotypes to varying nutritional management and coentional genotype X environment interaction in sheep. Anim. Prod., 47: 253.
25. Jordan, D.J. and D.G. Mayer, 1989. Effect of udder damage and nutritional plan on milk yield, lamb survival and lamb growth of Merinos. Aust. J. Exp. Agric., 29: 315.

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