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EFFECT OF MOTHERING ABILITY ON THE DEVELOPMENT OF BEHAVIOR AND PERFORMANCE OF LAMBS

(With 5 Tables)

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تأثير قدرة الأم على تطوير السلوك والأداء في الحملان

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أجريت هذه الدراسة على عدد (٤) أربعة نعاج أمهات معهم (٨) توائم وأيضا عدد (٨) نعاج أمهات معهم (٨) ثنائي حملان مفردة، لقد تم وضع كل أم وأبناءها من الحملان لمدة أسبوعين في جزء منفصل عن الآخرين ، وبعد ذلك تم تجميعهم في حظيرتين كل حظيرة تشتمل على أربعة توائم وأربعة حملان مفردة مع أمهاتهم. هذا وقد تم تمييز هذه الحملان بوضع علامات بالدهان على ظهورهم ثم تركت هذه الحملان للرضاعة من أمهاتهم التي تم توفير العليقة المركزة لهم يوميا صباحاً ومساءً. بالاضافة إلى ذلك قد تم توفير الدريس وكذلك ماء الشرب بصفة دائمة. هذا وقد تم دراسة السلوكيات بواسطة كاميرا فيديو تم تثبيتها بسقف الحظيرة من عمر (٣) ثلاثة أسابيع وحتى فترة الفطام عند عمر (٨) ثمانية أسابيع بعد الولادة. هذا وقد أثبتت النتائج المتحصل عليها من هذا البحث أن الحملان التوائم تتميز بتردد أو تكراراً عالي للرضاعة، الرقاد، الوقوف، وقضاء وقتاً أطول لفترات الرضاعة، بينما تميزت الحملان المولودة وحيدة بتردد عالي للتغذية، الشراب، المشي، الجري، الهرش، الحك ، التمتع ، سلوك الاستكشاف ونشاطات اللعب والتي تشتمل على النطح والقفز بالإضافة إلى قضاء وقت أطول في التغذية والشرب والرقاد. وقد لوحظ أيضا أن الحملان المولودة وحيدة قد اكتسبت زيادة في وزن الجسم عن الحملان التوائم في الفترة من أسبوعين حتى أربعة أسابيع بعد الولادة، وبعد ذلك الحين فصاعداً لوحظ أن الحملان التوائم قد أظهرت زيادة في وزن الجسم حتى فترة الفطام، هذا وفي العموم فإن اجمالي الزيادة في وزن الجسم كانت عالية في الحملان المولودة وحيدة عن الحملان التوائم.

SUMMARY

Four ewes had 8 twin lambs and eight mothers had 8 single lambs were placed with their own lambs in a separate partitions for 2 weeks then grouped together in two pens each pen lodged 4 twin and 4 single lambs

with their dam. Lambs were identified by painting marks on their backs, then left to suckle their dams which provided with daily supply of concentrate ration at morning and evening. Moreover, after concentrate ration, dams were regular supplied with hay, ad-libitum. The water was supplied through water troughs permanently. Behavioral observations were carried out by video camera hanged on the ceiling of the chamber from the third week till weaning period at 8th week. The obtained results indicated that twin lambs had higher frequencies of suckling, laying, standing, and spent longer time of suckling and standing while, the single born lambs had higher frequencies of feeding, drinking, walking, running, scratching, rubbing, stretching, exploratory behaviors and playing activities including butting and jumping as well as spent longer time feeding, drinking and laying. The singleton lambs gained more weight than twins during the period from the 2nd till 4th week of age, thereafter the twins gained better weight until 8th week (weaning), although the overall body weight gain was higher in the singletons than twin lambs.

Key Words: *Lambs, Behavior, Mother ability, Weaning.*

INTRODUCTION

Multiple births are common in sheep although twin fetuses experienced much higher rates of prenatal mortality / morbidity than age- and weight-matched singletons (Gardner *et al*, 2004). Moreover, as the ewe has only two teats, there is a risk of high mortality in these highly fertile breeds unless the lambs are artificially reared. Good lamb survival depends upon the maternal care and teat finding. The survival of the neonate relies on the integrated expression of appropriate behaviors from both the mother and young. In precocious species, like sheep, the speed with which the lamb stands and seeks the udder is related to lamb survival (Dwyer, 2003).

The neonatal behavior developed after parturition and later on the time spent in various activities was shown to be varied as the neonates grown up and depending on their health condition (Lickliter, 1987). Infants spent nearly 70% of the observation time lying down during the first week of age and continued to be more frequently lying down during the next 3 weeks (accounting for 60-70% of the observation time), then declined rapidly following the 4th week and progressively until the 15th week of age. The conditions in which the neonates grown up could affect their behavior, such as the sternal

recumbency which was found to be increased with age from 47% to 57.6% between the 5th and 17th week of age for calves housed in stalls and from 45.5% to 55% for those housed in pens (Albright, *et al.*, 1991). The aim of this study was to investigate the effect of maternal environment either in the uterus or after birth on the development of the lambs' behavior till weaning.

MATERIALS and METHODS

This experiment was carried out on 12 mother ewes (age average 3 years), four of them had 8 twin lambs and eight mothers had 8 single lambs. After parturition ewes were placed with their own lambs in a single partition for 2 weeks to prevent the risk of confusion between lambs and their dams. Thereafter they grouped together in two rooms each one lodged 4 twin and 4 single lambs with their dams.

Lambs were identified by colored paint on their backs and left to suckle their dams with daily supply of the mothers with concentrate ration at morning and evening and daily supplying with hay after concentrate ration ad-libitum. The water supplied ad libitum through water troughs.

For behavioral observations a video camera was hanged on the ceiling of the chamber with a video recording from 7:00 a.m. till 5:00 p.m. A focal sampling method was utilized in this study according to Martin and Frs (1986). The behavioral observations were carried out from the 3rd week of age till weaning at 8th week of age. The behavioral data were analyzed by using MSTAT (1984) system with the following model:

$$Y_{ijk} = \mu + A_i + (AB)_{ij} + e_{ijk}$$

Where: Y_{ijk} = An individual observation. μ = Overall mean A_i = Effect due to the i th type of birth i.e. $i=1$ for Single birth and 2 for twin birth. $(AB)_{ij}$ = Effect due to interaction between type of birth and the age till weaning and e_{ijk} = Random effect.

The productive performance of lambs was evaluated through biweekly weighing of the lambs from 2 weeks of age till 10th week of age and the weight gain were then calculated and analyzed by MSTAT (1984).

RESULTS

Ingestive behavior: (Table 1)

The data presented in table (1) showed that frequency of suckling was significantly higher ($P < 0.01$) in twins lambs (2.82 ± 0.25)

than single lambs (1.89+0.10), moreover, the suckling bouts were significantly longer ($P < 0.01$) in Twins born lambs (1.53+0.29 min/h) than single lambs (0.77+0.07). Moreover, the suckling frequency and bouts were increased from 3rd till the 4th week after parturition where the frequency of nursing was high in both twins and single lambs ((5.70+1.01 and 3.12+0.27, respectively) with longer bouts (3.91+1.48 and 0.93+0.13 min/h) then showed gradual decline till the weaning. On the other hand, the feeding frequency and feeding time were higher in single lambs (9.19+0.27 and 19.20+0.65) than twin lambs (8.57+0.35 and 18.51+0.87) respectively. However, a reverse trend was observed for feeding frequency which reached its peak during the 8th week after parturition (10.94+0.65) in both single (10.90+0.86) and in twin born lambs. Moreover, the feeding bouts were longer in the twin than single born lambs (31.49+2.06 vs. 29.43+1.85 min/h) respectively.

The drinking time and frequency were higher in single than twin lambs (0.12+0.02 and 0.07+0.02 vs. 0.10+0.02 and 0.06+0.02, respectively). However, the drinking was more frequent with longer bouts during the third weeks after parturition especially in single born lambs (0.30+0.08 and 0.17+0.05, respectively), whereas, in twin lambs it was frequent (0.25+0.10) with longer bouts (0.22+0.08) during the 5th week then showed gradual decline in both drinking frequency and bout with progress in age.

Resting and Movement activities: (Table 2)

Lambs born in twins spent longer time of lying (Table 2) especially during 3rd, 4th and 6th weeks after parturition, moreover the frequency of lying showed the same trend. Although, the mean values of frequency and time of lying were not significantly differ between the single and twin born lambs, these values were declined with age till weaning. The standing time and frequency as well as walking frequency reached the peak values during the 4th week after parturition in both twins and single born lambs. While, the running frequency reached its peak during the 4th week after parturition in the single born lambs (9.60+0.90) and during the 5th week in twin born lambs (8.78+1.17), these values were declined gradually till weaning with no significant difference could be observed between single and twin born animals. Generally, the difference between the single and twin born lambs in movement activities was not clear and could not be judged.

Body care activities: (Table 3)

The developmental changes in the body care activities of lambs showed that scratching activities were gradually increased till the 4th

week after parturition in both single and twin born lambs with higher frequency for twin born lambs ($9.08+1.02$ vs. $8.84+0.74$), then declined gradually to the lowest level during the 8th week after parturition ($3.65+0.55$ and $2.99+0.35$, respectively). Moreover, the mean values of scratching activities were higher in single born lambs than twin born lambs ($5.39+0.25$ vs. $5.13+0.30$). The rubbing activities were shown to reach its peak during the 7th week after parturition in single born lambs ($0.90+0.18$) and during the 4th week in twin born lambs ($0.63+0.20$). On the other hand, the stretching activity showed its peak value during the 4th week after parturition for both single and twin born lambs ($1.38+0.14$ and $1.45+0.23$).

The head shaking activity showed gradual increased with the progress in lamb age to reach its peak value during the 8th week after parturition in both single and twin born lambs ($10.84+0.64$ and $10.80+0.74$, respectively). Generally, it was slightly higher in single than twin born lambs except during the 6th week where the reverse condition was observed ($7.82+0.57$ vs. $7.19+0.45$).

Exploratory behaviors: (Table 4)

The exploratory behavior showed gradual decline with age of lambs specially after the 4th weeks of age where the highest frequencies of litter, wall and other explorations were observed during the 4th week after parturition in single born ($8.16+0.69$, $8.50+0.74$ and $18.34+1.35$, respectively) and twin born lambs ($7.80+0.92$, $6.35+0.88$ and $15.28+1.87$, respectively). Thereafter, these activities showed gradual decline to reach the lowest frequencies during the 8th week after parturition in single ($3.38+0.33$, $3.04+0.33$ and $5.62+0.46$, respectively) and twin born lambs ($3.82+0.43$, $2.63+0.36$ and $5.90+0.70$, respectively). Whereas, the trough exploration showed progressive decrease with age from the 3rd till the 8th week after parturition in both single born ($3.75+0.64$ to $0.93+0.22$) and twin born lambs ($3.23+0.79$ to $0.88+0.17$).

Social activities: (Table 4)

The development in the social activities or playing activities showed increase in the butting and jumping frequencies from 3th to the 4th week after parturition in single born ($1.47+0.30$ and $0.78+0.21$, respectively) and twin born lambs ($1.20+0.44$ and $0.53+0.19$, respectively). These activities were declined gradually with age till the 7th week of age then it began to increase again. Moreover, the single born lamb showed higher butting frequency than twin born lambs ($0.67+0.08$ vs. $0.60+0.11$, respectively). Moreover, jumping frequency

showed the same trend ($0.32+0.05$ and $0.18+0.04$, respectively).

Productive performance: (Table 5)

The body weights of the single born lambs were heavier than twin born lambs during the 2nd week ($10.00+0.69$ vs. $9.31+1.07$ kg); 4th week ($13.44+0.85$ vs. $12.10+1.23$ kg); 6th week ($14.78+0.88$ vs. $13.46+1.32$ kg); 8th week ($17.22+1.07$ vs. $15.87+1.45$ kg) and 10th week after parturition ($21.72+1.41$ vs. $19.73+1.87$ kg). Moreover, the single born lambs gained more weight than twin born lambs during the age period of 2-4 weeks ($3.44+0.22$ vs. $2.79+0.32$ kg), then the twin born lambs gained better during the age period of 4-6 weeks ($1.36+0.15$ vs. $1.34+0.12$) and during the age period of 6-8 weeks ($2.41+0.25$ vs. $2.34+0.23$ kg). However the overall body weight gain was higher in the single born lambs than twin born lambs ($11.72+0.83$ vs. $10.43+1.07$ kg).

DISCUSSION

Ingestive behavior:

Production of twins or triples is not indicator to the ability of mother to spare a good maternal environment for them. Moreover, the competition for nursing between lambs could affect both time of nursing and amount of milk suckled by each lamb during the pre-weaning period. This could affect development of the digestive system of the litter and so the ingestive behavior, performance, and survival percentage.

The mothering ability of the ewe to care her lambs depends upon variation in the physiological efficiency of the ewe, especially those related to milk production which is affected by birth type, parity and the ability of the ewe to nurse the newly born lambs. In this study a highly significant effect to the birth type on suckling frequency, suckling time, feeding frequency, feeding time, drinking frequency and drinking time by the lambs is mostly attributed to the ability of dam to mothering her lambs. Moreover, the chance of suckling was greater for the single than twin lambs and the development of their digestive tract during pre-weaning period. The lighter lambs stood earlier and attempted to suck for less time (17.7 and 2.4 min v. 32.4 and 10.5 min, $P<0.05$) than heavier ones (Kuchel and Lindsay 1999).

The suckling was more frequent with longer bouts in twin lambs, which may be attributed to the competition between lambs to take their share of milk. However, the reverse trend was observed for feeding and drinking since the development of the digestive tracts in single

lambs occurs more rapidly. Litter size had a retarding influence on the behavior of multiple-born lambs that could not be accounted for birth weight (Dwyer, 2003)

Resting and movement activities:

The time spent lying down decreased and the time of standing, frequency of standing, walking and running increased gradually as the age of lambs increased either in single or twin born lambs. This could be attributed to the development of muscular tone and increasing the demand of the animal for searching for feed and exploration of their environment. On contrary, Lickliter (1987) found that mean time spent walking, running and standing sustained stable throughout the first 15 weeks following birth. Whereas, Coe, *et al.*, (1992) observed that the amount of time spent lying decreased from 90 to 75% (between 1st and 25th week). However, the behavioral profiles of welfare parameters in commercial veal calf facilities revealed that calves spent approximately 25 and 75% of the time in standing and lying respectively and the calves performed 17 and 19 lying and standing transitions per day (Stull, 1992). On the other hand, Hinch, *et al.*, (1982) stated that running incidence found to be declined with age with highest and lowest frequencies at 10 and 18 months of age, respectively.

Body care behavior:

The developmental changes in the body care activities of lambs revealed that scratching activities showed gradual increase till the 4th week after parturition in both single and twin born lambs with the highest frequency was for twin born lambs. However, it was declined gradually to lowest level during the 8th week after parturition. Moreover, the mean scratching activities were higher in single born than twin born lambs. The rubbing activities reached its peak during 7th week after parturition in single born lambs and during the 4th week after parturition in twin born lambs then declined gradually with age. In contrast the stretching activity showed gradual decline from 3rd week till the 8th week after parturition. Similarly, Hinch, *et al.* (1982) found that grooming or licking the head, neck or shoulders of an inactive animal significantly increased as the age of bulls and steers increased (from 10 to 14 months). Whereas, rubbing of neck, shoulder, rump on fixed objects showed a reverse trend the highest and lowest frequencies were achieved at 10th and 14th month, respectively. While, Albright, *et al.* (1991) found that the time spent grooming, investigating and idling activities decreased with age from 13.3 to 3.1% between 5th and 17th week in stall reared calves and from 12.5 to 2.3% for group penned

calves. However, Sato, *et al.* (1991) found that percentages of licking to different body parts were 27, 24, 15, 12, 11, 4, 3, 3 and 1 for neck; head; back; shoulders; rump; belly; hind legs; forelegs and tail, respectively. Social licking with solicitation was mainly oriented to the neck and the areas which the receivers could not themselves reached in self-licking. Furthermore, licking of these areas was accounted for 78% of the total time.

Exploratory behaviors:

The exploratory behavior showed gradual decline with age of lambs where the highest frequencies of litter, wall and other exploration were during the 4th week while, the lowest frequencies were during the 8th week after parturition in single born and twin lambs. However, the trough exploration showed gradual decline with age from the 3rd till the 8th week after parturition in both single born and twin born lambs. The changes in the exploratory behaviors with age could be attributed to the motivation of the lambs as they build the basic information about their new environment, where they can find the food, the dangerous areas and so on. So that at the beginning the exploratory behavior occurs with highest frequencies then the animals built an information base about their surroundings, consequently these exploratory behaviors take place. Moreover, Deprivation from dam suckling resulted in less time ($P < .001$) spent in investigative behavior, shorter duration of movement and a longer latency time, higher number of bleats as well as higher plasma cortisol levels and reduced growth (Napolitano *et al.*, 2003).

Social behavior:

The development in the social activities or playing activities showed gradual increase in butting and jumping frequencies till the 4th week after parturition in single and twin born lambs then these activities were declined gradually with age till the 7th week of age then it began to increase again. The play behavior of lambs (butting and pushing) seemed to be sporting. Moreover, the mounting behavior for their mothers or companions might be developed into subsequent sexual behavior (Tanka *et al.*, 1992). Moreover the single born lamb had the higher butting and jumping frequencies than twin born lambs since the twin lambs were engaged longer time in competition for suckling than single born lambs.

Productive performance:

Growth rates, expressed by average daily gain of lambs over a certain period of life, are characters of great significance in animal breeding. A final weight whether it is a weaning or yearling weight, is

dependent firstly on the initial weight and secondly on the daily gain. Therefore, improving this character yields a marker improvement in the other economic traits. For this reason, many workers were interested to study the effect of various genetic and environmental factors affect growth rate. In our study the body weights of the singletons lambs were heavier than twin born lambs during the 2nd, 4th, 6th, 8th and 10th week after parturition. This could be attributed to the prepartum increase in fetal plasma cortisol in singletons than twins which responsible for maturing a number of systems in preparation for birth and the immediate postnatal period. Thus, it could be argued that relative immaturity in twins may explain their increased susceptibility to stress Gardner *et al* (2004). Moreover, the single born lambs gained more weight than twin born lambs during the period of 2-4 weeks, then the twin born lambs gained better during the periods 4-6 and 6-8 weeks, although however, the total body weight gain was higher in single than twin born lambs. This could be attributed to the ability of dam to suckle one lamb better than twin or triple lambs, which in turn helps in development of their digestive system and their productive performance. Moreover, Napolitano, *et al* (2003) suggested that frustration arising from maternal feeding deprivation results in altered endocrine and behavioral responses and reduced growth from emotional disturbances of lambs.

REFERENCES

- Albright, J.L.; Stouffer, D.K. and Kenyon, N.J. (1991):* Behavior of veal calves in individual stalls and group pens. Wageningen, Netherlands, Pudoc.(1) 44-48.
- Coe, B.L.; Albright, J.L.; Ladd, J.K.; Ladd, B.T. and Reisert, C. (1992):* Resting postural differences between tethered and untethered Holstein heifer and bull calves. J. Anim. Sci., 70:163 (Suppl. 1).
- Dwyer, CM. (2003):* Behavioural development in the neonatal lamb: effect of maternal and birth-related factors. Theriogenology; 59: 1027-1050.
- Gardner, DS.; Jamall, E.; Fletcher, AJ.; Fowden, AL. and Giussani, DA. (2004):* Adrenocortical responsiveness is blunted in twin relative to singleton ovine fetuses. J Physiol.15; 557:1021-1032.
- Hinch, G.N.; Lynch, J.J. and Thwaites, C.J. (1982):* Patterns and frequency of social interactions in young grazing bulls and steers. Appl. Anim. Ethol., 9:15-30.

- Kuchel, RC. and Lindsay, DR. (1999):* Maternal behavior and the survival of lambs in superfine wool sheep. *Reprod Fertil Dev.*; 11:391-394.
- Lickliter, R.E. (1987):* Activity patterns and companion preferences of domestic goat kids. *Appl. Anim. Behav. Sci.*, 19: 137-145.
- Martin, P. and Frs, P.B. (1986):* Measuring behaviour an introductory guide. pp. 48-49 Cambridge university press. Cambridge, London.
- Mstat, (1984):* Microcomputer statistical program. Experimental design, data management and Analysis. Michigan statistical university, crop and soil sciences. Agricultural Economics institute of international agriculture.
- Napolitano, F.; Annicchiarico, G.; Caroprese, M.; De Rosa, G.; Taibi, L. and Sevi, A. (2003):* Lambs prevented from suckling their mothers display behavioral, immune and endocrine disturbances. *Physiol Behav.*; 78(1): 81-89.
- Sato, S.; Sako, S. and Maeda, A. (1991):* Social licking patterns in cattle (*Bos taurus*): influence of environmental and social factors. *Appl. Anim. Behav. Sci.*, 32:3-12.
- Stull, C.L. (1992):* Welfare parameters in commercial veal calf facilities: Behavioral profiles. *J. Anim. Sci.*, 70:163 (Suppl. 1).
- Tanaka, T.; Odagiri, K.; Shiose, E.; Yoshimoto, T. and Minura, K. (1992):* Developmental changes of playing behavior in lambs. *World Review of Animal Production*, 27: 28.

Table 1: Effect of birth type and age on the ingestive behavior of lambs.

Item	Suckling		Feeding		Drinking		
	Freq.	Time	Freq.	Time	Freq.	Time	
Birth type							
Single	1.89±0.10 ^b	0.77±0.07 ^b	9.19±0.27	19.20±0.65	0.12±0.02	0.07±0.02	
Twins	2.82±0.25 ^a	1.53±0.29 ^a	8.57±0.35	18.51±0.87	0.10±0.02	0.06±0.02	
Birth*weeks							
3 rd wk	Single	3.01±0.37 ^c	2.11±0.33 ^b	6.58±0.60 ^{de}	8.71±0.81 ^f	0.30±0.08 ^a	0.17±0.05 ^{ab}
	Twins	4.20±0.65 ^b	2.77±0.61 ^b	6.05±0.69 ^e	8.37±1.09 ^f	0.23±0.08 ^{ab}	0.09±0.05 ^{bc}
4 th wk	Single	3.12±0.27 ^c	0.93±0.13 ^c	10.18±0.70 ^{ab}	15.09±1.13 ^g	0.15±0.05 ^{abc}	0.05±0.02 ^{bc}
	Twins	5.70±1.01 ^a	3.91±1.48 ^a	8.78±0.97 ^{bc}	11.15±1.32 ^f	0.03±0.03 ^{cd}	0.04±0.04 ^a
5 th wk	Single	1.32±0.17 ^{de}	0.38±0.07 ^c	9.85±0.93 ^{abc}	18.85±1.77 ^{de}	0.19±0.07 ^{abc}	0.12±0.07 ^{abc}
	Twins	2.38±0.45 ^{cd}	0.95±0.28 ^c	8.90±0.86 ^{bc}	17.70±1.85 ^{de}	0.25±0.10 ^{ab}	0.22±0.08 ^a
6 th wk	Single	1.37±0.16 ^{de}	0.43±0.10 ^c	8.49±0.64 ^{bc}	19.62±1.70 ^{de}	0.10±0.05 ^{bcd}	0.08±0.05 ^{bc}
	Twins	1.72±0.30 ^{de}	0.57±0.12 ^c	7.87±0.89 ^{cd}	18.40±2.08 ^{de}	0.03±0.03 ^{cd}	0.01±0.01 ^f
7 th wk	Single	1.63±0.14 ^{de}	0.46±0.05 ^c	9.06±0.58 ^{abc}	23.32±1.28 ^{bc}	0.00±0.00 ^f	0.00±0.00 ^f
	Twins	1.90±0.44 ^{de}	0.65±0.19 ^c	8.93±0.73 ^{bc}	23.93±1.97 ^b	0.03±0.03 ^d	0.00±0.00 ^f
8 th wk	Single	0.90±0.11 ^e	0.31±0.08 ^c	10.94±0.65 ^a	29.43±1.85 ^a	0.00±0.00 ^f	0.00±0.00 ^f
	Twins	1.00±0.13 ^e	0.32±0.06 ^c	10.90±0.86 ^a	31.49±2.06 ^a	0.05±0.03 ^{cd}	0.01±0.00 ^f
S.O.V.							
Mean square errors							
Birth type	128.5**	86.87**	58.28	70.31	0.08	0.01	
Birth*wks	92.82**	58.76**	131.24**	3110.1**	0.68**	0.3**	
Exp. error	6.83	7.67	20.88	106.4	0.15	0.09	

Table 2: Effect of birth type and age on the resting and movement activities of lambs.

Item	Lying		Standing		Walking Freq.	Running Freq.	
	Freq.	Time	Freq.	Time			
Birth type							
Single	2.81±0.11	24.48±0.79	12.05±0.29	15.30±0.39	27.93±0.67	7.37±0.32	
Twins	2.87±0.15	24.02±1.09	12.43±0.42	15.86±0.56	27.60±0.90	6.90±0.41	
Birth*weeks							
3 rd wk	Single	3.76±0.22 ^b	33.96±1.55 ^a	10.31±0.70 ^d	14.01±0.96 ^{de}	24.94±1.74 ^{cd}	5.57±0.58 ^{cd}
	Twins	4.60±0.43 ^a	34.08±1.87 ^a	10.80±0.90 ^d	14.27±1.32 ^{bcd}	23.55±2.16 ^d	4.15±0.76 ^d
4 th wk	Single	3.28±0.23 ^{bc}	26.11±1.68 ^{bc}	14.21±0.89 ^{ab}	18.07±0.94 ^a	33.93±1.83 ^a	9.60±0.90 ^a
	Twins	3.70±0.49 ^b	27.44±2.57 ^c	15.63±1.50 ^a	17.47±1.53 ^{ab}	32.00±2.84 ^{ab}	7.73±1.17 ^{ab}
5 th wk	Single	2.91±0.30 ^{bcd}	24.97±2.41 ^{bc}	12.68±0.95 ^{bcd}	15.59±1.25 ^{ab}	30.69±2.21 ^{ab}	8.22±0.98 ^{ab}
	Twins	2.75±0.28 ^{cd}	24.08±2.70 ^{bc}	13.23±0.90 ^{bc}	17.19±1.43 ^{abc}	30.98±2.30 ^{ab}	8.78±1.17 ^a
6 th wk	Single	3.04±0.42 ^{bcd}	26.70±2.16 ^b	11.29±0.68 ^{cd}	12.87±0.89 ^e	23.59±1.47 ^d	7.15±0.70 ^{abc}
	Twins	2.41±0.27 ^{cd}	26.89±2.93 ^b	10.74±0.89 ^d	14.17±1.35 ^{bcd}	23.79±1.86 ^d	7.67±1.18 ^{abc}
7 th wk	Single	2.57±0.20 ^{cd}	22.27±1.60 ^{bc}	11.71±0.59 ^{cd}	13.91±0.88 ^{abc}	25.62±1.28 ^{cd}	6.01±0.74 ^{bcd}
	Twins	2.15±0.20 ^{de}	20.71±2.30 ^c	11.73±0.80 ^{cd}	14.71±1.10 ^{de}	25.45±1.68 ^{cd}	5.80±0.74 ^{bcd}
8 th wk	Single	1.29±0.16 ^f	13.02±1.79 ^d	12.06±0.61 ^{bcd}	17.3±0.99 ^{bcd}	28.79±1.44 ^{bc}	7.62±0.94 ^{abc}
	Twins	1.58±0.27 ^{ef}	11.01±2.22 ^d	12.43±0.82 ^{bcd}	17.28±1.48 ^{bcd}	29.75±1.82 ^{ab}	7.28±0.71 ^{abc}
S.O.V.							
Mean square errors							
Birth type	0.43	28.91	20.71	43.61	20.87	32.92	
Birth*weeks	48.48**	2797.81**	128.03**	198.27**	816.9**	129.05**	
Exp. error	4.33	169.99	26.59	57.57	138.28	33.43	

Table 3: Effect of birth type and age on the body care activities of lambs.

ITEM		Scratching	Rubbing	Stretching	Head shaking
Birth type					
Single		5.39±0.25	0.59±0.06	1.20±0.24	7.49±0.23
Twins		5.13±0.30	0.41±0.06	0.90±0.08	7.64±0.33
Birth*weeks					
3 rd wk	Single	7.12±0.69 ^b	0.27±0.10	2.43±1.39	4.61±0.56 ^{df}
	Twins	5.95±0.78 ^{bc}	0.05±0.03	1.13±0.21	4.38±0.68 ^f
4 th wk	Single	8.84±0.74 ^a	0.71±0.17	1.38±0.14	6.91±0.40 ^d
	Twins	9.08±1.02 ^a	0.63±0.20	1.45±0.23	6.98±0.55 ^d
5 th wk	Single	6.37±0.85 ^{bc}	0.56±0.22	0.93±0.24	6.44±0.62 ^d
	Twins	5.18±0.60 ^{cd}	0.48±0.19	0.80±0.21	6.10±0.64 ^{de}
6 th wk	Single	3.53±0.41 ^{de}	0.49±0.14	0.99±0.23	7.19±0.54 ^{cd}
	Twins	3.67±0.51 ^{de}	0.56±0.18	0.82±0.19	7.82±0.57 ^{cd}
7 th wk	Single	3.53±0.36 ^{de}	0.90±0.18	1.09±0.20	8.88±0.47 ^{bc}
	Twins	3.23±0.44 ^e	0.50±0.16	0.75±0.15	9.80±1.09 ^{ab}
8 th wk	Single	2.99±0.35 ^e	0.63±0.16	0.43±0.10	10.84±0.64 ^a
	Twins	3.65±0.55 ^{de}	0.28±0.12	0.48±0.12	10.80±0.74 ^a
S.O.V.		Mean square errors			
Birth type		11.3	4.71	13.79	3.82
Birth*weeks		290.47**	2.42	17.65	267.91**
Exp. error		19.94	1.4	15.2	18.59

Table 4: Effect of birth type and age on the exploratory and social activities of lambs.

ITEM	Exploratory activities				Social activities		
	Litter	Wall	Other	Trough	Butting	Jumping	
Birth type							
Single		5.01±0.25	4.80±0.22	9.41±0.39	2.16±0.15	0.67±0.08	0.32±0.05
Twins		4.84±0.27	4.19±0.30	8.38±0.50	2.07±0.19	0.60±0.11	0.18±0.04
Birth*weeks							
3 rd wk	Single	5.61±0.46 ^b	6.15±0.57 ^b	9.37±0.75 ^c	3.75±0.64 ^a	0.18±0.07 ^e	0.18±0.07 ^{ab}
	Twins	4.65±0.62 ^{bc}	4.78±0.72 ^{bc}	7.83±1.25 ^{cd}	3.23±0.79 ^{ab}	0.48±0.16 ^e	0.03±0.03 ^b
4 th wk	Single	8.16±0.69 ^a	8.50±0.74 ^a	18.34±1.35 ^a	3.21±0.28 ^{ab}	1.47±0.30 ^a	0.78±0.21 ^a
	Twins	7.80±0.92 ^a	6.35±0.88 ^b	15.28±1.87 ^b	3.20±0.42 ^{ab}	1.20±0.44 ^{ab}	0.53±0.19 ^{ab}
5 th wk	Single	4.85±0.63 ^{bc}	4.65±0.58 ^{bcd}	8.74±1.09 ^{cd}	2.26±0.33 ^{bc}	0.85±0.25 ^{ab}	0.35±0.15 ^{ab}
	Twins	5.23±0.65 ^{bc}	4.78±0.61 ^{bc}	7.93±0.96 ^{cd}	2.43±0.42 ^{bc}	0.43±0.18 ^e	0.25±0.11 ^{ab}
6 th wk	Single	3.53±0.40 ^d	3.34±0.42 ^{de}	8.12±0.70 ^{cd}	1.88±0.27 ^{cd}	0.35±0.13 ^e	0.26±0.10 ^{ab}
	Twins	3.82±0.49 ^{bc}	3.72±1.03 ^{cd}	6.92±0.80 ^{cd}	1.69±0.37 ^{cd}	0.41±0.16 ^e	0.13±0.07 ^b
7 th wk	Single	4.54±0.88 ^{bc}	3.15±0.37 ^{de}	6.25±0.52 ^{bc}	0.99±0.16 ^d	0.40±0.13 ^e	0.04±0.03 ^b
	Twins	3.65±0.46 ^d	2.88±0.38 ^{de}	6.40±0.64 ^{bc}	1.00±0.25 ^d	0.23±0.11 ^e	0.00±0.00 ^b
8 th wk	Single	3.38±0.33 ^d	3.04±0.33 ^{de}	5.62±0.46 ^c	0.93±0.22 ^d	0.74±0.20 ^{bc}	0.31±0.10 ^{ab}
	Twins	3.88±0.43 ^d	2.63±0.36 ^e	5.90±0.70 ^{bc}	0.88±0.17 ^d	0.85±0.37 ^{ab}	0.13±0.06 ^b
S.O.V.		Mean square errors					
Birth type		5.07	58.59	162.79	1.57	0.71	3.22 ^a
Birth*weeks		154.08**	198.61**	963.73**	66.4**	10.03**	2.86**
Exp. error		18.97	17.6	46.26	7.62	2.44	0.73

Means within the same column carry different superscripts are significantly differ.

Table 5: Effect of birth type and age on the body weights and weight gain of lambs.

Item	Single	Twins	T-value
Body weight			
2 Weeks	10.00±0.69	9.31±1.07	0.579
4 Weeks	13.44±0.85	12.10±1.23	0.952
6 Weeks	14.78±0.88	13.46±1.32	0.889
8 Weeks	17.22±1.07	15.87±1.45	0.793
10 Weeks	21.72±1.41	19.73±1.87	0.894
Weight gain			
G2-4	3.44±0.22	2.79±0.32	1.788
G4-6	1.34±0.12	1.36±0.15	0.077
G6-8	2.34±0.23	2.41±0.25	0.076
G8-10	4.5±0.41	3.87±0.51	1.027
Total gain	11.72±0.83	10.43±1.07	1.011