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Relationship between Birth Weight and Body Growth of Awassi Lambs during Early Weaning

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Abstract

A study was conducted to find the relationship between body weight of male and female Awassi lambs at birth with their body development at early weaning period. Sixty lambs were used and divided into two groups (I, II). Each group was consisted of 30 lambs and divided into two subgroups (15 male and 15 female). Groups formed according to body weight at birth as follows: Group I, lambs with less than 3kg of weight; and Group II, lambs with more or equal than 3 kg of weight. Lambs were kept with their mothers and suckling ad libitum throughout the experimental period and were weighed at birth day (1 day old), at 30 days, and at 60 days. Differences between groups of lambs at 60 days of age were significant ($p<0.05$). Correlations ranged from low to moderate among the respective traits and ranged between positive from 0.505 to 0.762 and negative from -0.181 to -0.513. Highest correlation in this study found between age (1-60) in male lambs (0.762) and in female lambs (0.659) of group II. The correlation coefficient effect at 60 days of age was higher in males than females lambs ($p<0.05$) where the correlation coefficient was 66% for male and 50% for female lambs. Therefore, lambs with heavier birth weights, showed the best production results in the development of body weight during the period of 60 days of early weaning process, which indicated that selection of lambs with greater birth weight may contribute to increasing Awassi lamb body development and growth.

Keywords: Awassi sheep, Body growth, Correlation, Early weaning.

1. Introduction

Animal Production occupies a large area in agriculture production in Jordan since its accounts for 55% of the value of agricultural production. Moreover, sheep production has a huge importance in animal production as the number of sheep reached 2311105 head consisting about 132885 head of lambs from total number of sheep (DOS, 2014).

Awassi sheep breed capable to adapt to different climate conditions. Its production is based on a semi-intensive system distinguished by low offspring production but by high milk and meat production (Pollot and Gootwine, 2004). This breed is native to the Mediterranean area and it's the most important breed in Jordan (Abdullah and Tabbaa, 2011; Dikmen et al., 2007). Dual purpose ewes, such as Awassi breed ewes, produces a high amount of milk that may exceed the requirement of normal lamb development and growth (Bocquier et al., 1999; Pollot and Gootwine, 2004; Reiad et al., 2010). Higher daily milk production occurs mostly during the first month of lactation (Akçapinar, 2000), when this milk is being used in a traditional rearing system for lambs to suckle. Therefore, it will be hard on producers to get benefit of such milk. As a result, a sheep producer has to wait until weaning, which reduces the income from the sheep herd because of lower milk production (Gargouri et al., 1993; McKusick et. al., 2001).

Weaning defined as the withdrawals of milk from lambs suckle their dams, while early weaning is the withdrawal of the milk supply before the time when weaning would normally occur. Early weaning may be achieved successfully by the speed of lamb's rumen development (Wardrop, 1960). It was also reported that rumen function develops very fast after birth until about 8 weeks of age, lambs consumes solid feed can digest it efficiently as adults (Al-Laham, 2007). The objective of early weaning for lambs is to increase the efficiency of milk production by dams and fattening lambs most rapidly by offering solid feed. It appears on theoretical grounds that lambs can be successfully weaned at any time after about 8 weeks of age. This theoretical prediction has been experimentally verified by Ward et al., (2008) who found that lambs weaned at 8 weeks of age had the same growth rate as un-weaned controls.

Many studies showed how lamb's body growth and development affected by genetic and non-genetic factors. Unfortunately, little attention addressed to the connection between body weight of lambs at birth and their early weaning weight. To effectively define the selected criteria, it is important to know the following: How lamb's weight at birth affects body growth and weight during the weaning process. Therefore, the aim of this study was to explore the relationship between body weight of male and female Awassi lambs at birth with their body development at early weaning (period of 60 days).

2. Material and Methods

2.1 Experimental Study:

The experiment was conducted in a population of Awassi sheep, including 60 lambs. Lambs were born during the period of late January and early February of 2015. Lambs were divided into two groups (I, II). Each group observed was consisted of 30 lambs were divided into two subgroups (15 male and 15 female). Groups formed according to body weight of lambs at birth as follows: Group I are lambs with less than 3kg of weight; and Group II are lambs with more or equal than 3 kg of weight.

All lambs had the same housing conditions, nutrition and care at the research station of the Faculty of Agriculture at Jerash University. Lambs were kept with their mothers and suckling ad libitum throughout the experimental period until their weaning day. In addition to milk, lambs throughout the period of experiment received alfalfa hay and concentrate mixture containing the following: 17% crude protein (CP; DM basis) and to meet the requirements for lambs (NRC, 2007). The basal concentrate diet was composed of soybean meal (15%), wheat hay (20%), Barley (62.5%), limestone (1%), and salt (1.5%). The chemical composition of the basal diet contained 89.8, 91.9, 17, 31.8, 14.4, 5.2% for the dry matter (DM), organic matter (OM), crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), and ether extract (EE), respectively. The experimental diet was offered ad libitum intake as a total mixed ration. The water was offered with free access throughout the experiment. Lambs were weighed at birth day (1 day old), at 30 days, and at 60 days.

2.2 Statistical Analysis

SPSS (2013) package program was used to analyze the data by using the following procedures: the Dependent t-test (called the Paired-Samples T-test) and Pearson's correlations.

3. Results

For the whole period of testing female lambs in group I (less than 3 kg) had realized a total gain of 12.34 kg, or 0.205 kg/d. For the whole period of testing male lambs in group I had realized a total gain of 13.45 kg, or 0.224 kg/d. For the whole period of testing female lambs in group II (More than or equal 3 kg) had realized a total gain of 18.59 kg, or 0.309 kg/d. For the whole period of testing male lambs in group II had realized a total gain of 20.18 kg, or 0.336 kg/d.

Development of female lambs in the postnatal period was slightly weaker than the trend of male lambs. Female lambs of group I, from birth to weaning had a total gain of 12.34 kg, group II of lambs from birth to weaning had total gain of 18.59 kg, which is 6.25 kg higher than in the group I. Male lambs of group I, from birth to weaning had a total gain of 13.45 kg, group II of lambs from birth to weaning had total gain of 20.18 kg , which is 6.64 kg higher than in the group I.

Table 1. Descriptive statistics of lamb's group's body weight from birth to early weaning.

Group	Gender	Age	Mean	Std. Deviation
I	Female	1	2.46	0.29
		30	7.40	0.89
		60	14.80	1.78
	Male	1	2.69	0.29
		30	8.07	0.89
		60	16.14	1.78
II	Female	1	3.76	0.46
		30	10.27	0.91
		60	22.26	2.68
	Male	1	3.97	0.46
		30	10.70	1.26
		60	24.15	2.70

From Table 2, we can notice that the difference in body weight of female lambs between group I and II was 1.29. On the other hand, we can notice that the difference in body weight of male lambs between group I and II was

1.28, all these differences in body weight of lambs at birth were statistically significant ($p<0.01$). At 30 days of age, the body weight of the female lambs was 4.17 kg, but in male lambs the body weight of the male lambs was 3.56 kg in the first and the second group. All these differences in body weight of lambs at birth were statistically highly significant ($p<0.01$).At the end of the early weaning (60 days), average body weight was 7.46 kg in I and II group. The body weight of male lambs was 8.01 kg in I and II group. Differences between groups of lambs at this age were statistically very significant ($p<0.01$).

Table 2. Paired samples test of lambs groups body weight from birth to early weaning.

Gender	Pair of groups	Age	Paired Differences					t	Sig.
			Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
						Lower	Upper		
Female	I-II	1	-1.29	0.32	0.08	1.47	1.11	15.383	0.000
	I-II	30	-4.17	1.93	0.49	5.24	3.09	8.356	0.000
	I-II	60	-7.46	2.35	0.60	8.76	6.15	12.247	0.000
Male	I-II	1	-1.28	0.42	0.10	1.51	1.05	11.801	0.000
	I-II	30	-3.56	2.02	0.52	4.68	2.44	6.819	0.000
	I-II	60	-8.01	2.03	0.52	9.13	6.88	15.272	0.000

Table 3 shows the correlations between the body weights of lambs in the postnatal period. It is evident that all the correlations ranged from low to moderate among the respective traits and ranged between positive from 0.505 to 0.762 and negative from -0.181 to -0.513. Highest correlation in this study found between age (1-60) in male lambs (0.762) and in female lambs (0.659) of group II. Most weak correlations were found between the age (1-30) in female lambs (-0.181) and male lambs (-0.292) of group II. From birth until sixty days of age, a significant values ($P<0.05$) were determined between weight of the male and female lambs in group II where the correlation for male lambs was greater than female lambs. Generally, it can be seen that there is moderate correlation between body weights of lambs at birth and weaning weight of lambs. However, lambs born with greater weight have a higher weaning weight.

The effect of the correlation coefficient from (1-60) age was higher in males than females lambs ($p<0.05$) where the correlation coefficient was 66% for male lambs, while it was 50% for female lambs. When comparing the effect of body weight between the groups I and II. The correlation coefficient was greater ($p<0.05$) for male lambs in group II than I (76%). Moreover, the correlation coefficient was greater ($p<0.05$) for female lambs in group II than I (66%).

Table 3. Correlation (Pearson's) between body weights of lambs in groups I and II.

Age		Group I		Group II	
		Male	Female	Male	Female
1-30	Correlation	-0.325	-0.513*	-0.292	-0.181
	Sig	0.237	0.050	0.291	0.519
1-60	Correlation	0.662**	0.505*	0.762**	0.659**
	Sig	0.007	0.050	0.001	0.008

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

4. Discussion

A study was performed to find the relationship between birth weight of Awassi male and female lambs and their body weight and growth at early weaning; a period of 60 days. Based on the results in Table 1and 2, we can conclude that the lambs of group II whose body weight at birth was the nearest to the average mean of Awassi lambs found in literature showed the best production results in the development of body weight up to weaning. Biological potential for growth in the II group of lambs increased in the second month of body development.

We can view in table 1 that at the age of 60 days, maximum body weight was in the second group of lambs. Male

lambs had heavier weight than female lambs in the same group. Many studies found that there is a relationship between birth weight and body development (Muir et al., 2000; Morris et al., 2003; Hanford et al., 2003). Moreover, female and male lambs had heavier body weight in group II at 60 days than group I at the same period. When comparing the results of this study with other studies, it was found that lambs weaned at 90 days gave similar body weight as lambs that weaned at 60 days in this study (Ward et al., 2008; Petrovic et al .,2013 ; Petrovic et al , 2014). A study performed by London and Weniger (1995) was found to support this study; the authors suggested that heavier body weight at 60 day was affected by higher birth weight of lambs and higher postpartum weight of their dams.

Similar results were found by Schichowski et al. (2008) who reported that lambs weaned at 8 weeks of age had greater ($p < 0.05$) average daily gain compared with lambs weaned at 16 weeks of age. On the other hand, a study performed by Holcombe et al. (1994) indicated that early (30 days) and natural (60 days) weaned groups showed similar final live body weight after weaning, despite of the higher ($p< 0.05$) intake of the early weaned group lambs. Those results showed that early weaned lambs seem to have the suitable daily requirements of nutrients from suckling and feeding solids with their dams relative to their age and live body weight. Increasing solid feed consumption by early weaning stimulates rumen development and better growth responses for lambs as reported by Karim et al., (2001). Moreover, early transition to solid feeds is an important component to successful newborn rearing programs. Increasing solid feed with milk consumption may enhance the production of volatile fatty acids which activate the rumen development and increases lambs feed efficiency.

The highest values of correlation coefficients of the body weight for female lambs of group II at 60 days of age shown in table 3. The greater weight may be explained by the study of Petrovic et al., (2013) who indicated that the higher body weight of lambs at birth gives greater possible strength for growth in early months of age, in contrast to lambs with less weight and thus less power of growth.

The difference between male and female body weights were shown in table 3 and found to be greater for males ($p<0.05$) than for females. The influence of lamb sex and dam breed ($p<0.01$) on birth weight was also significant and greater for male than female lambs by the study performed by Abdullah and Tabbaa (2011). The researchers found that male lambs had higher values than females Awassi lambs and than that for lambs from Chios breed. The effect of sex, birth type and year of lambing was extended into the weaning weight by a study performed by Khan et al., (1991) who reported that the differences in birth weight due to birth type, and sex of lambs were significant and found that male lambs were also heavier than female lambs.

Overall, lambs weaned at early age (a period of 60 days) reached the targeted average weight that most producers want. Early weaning increase producer's benefit from milk produced by lamb dams and introduces both male and female lambs to their next stage of production earlier.

5. Conclusion

As a conclusion for this study, lambs with birth weights which is closest to the average weight of lambs in other literature, showed the best production results in the development of body weight during the period of 60 days of early weaning process. Heavier lambs of both sexes had greater weaning weight, but biological potential for growth is particularly increased in the second month of development. The correlations among the respective traits were low to moderate ranging from positive to negative values. Due to the influence of different environmental factors on the development of the body in the postnatal period and to increase the benefit from dam's milk after weaning; the selection of lambs at birth should be directed towards intermediate birth weight, because reduced birth weight may have a smaller contribution to successful sheep production.

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