The effect of both the type of birth on total milk production, lamb body weight at birth and weaning, and weight gain rates between different ages of lambs in Awassi ewes

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Abstract:

This study was conducted on 60 ewes of the local Awassi breed with their 67 lambs at the Al-Fayhaa sheep breeding station, part of the Jibla project, located 55 km south of Baghdad. Laboratory analyses were performed at the Central Laboratory of Tikrit University to analyze the components of milk, including solids, fats, and lactose, and their relationship to the productive performance of the studied local Awassi ewes, as well as to determine the relationship between milk components and lamb growth. The results of the experiment showed that there were significant differences in the two types of birth among the ewes in the experiment that gave birth to a single lamb and twins in the percentage of total milk production, 2120.57 ±30.78 and 1978.57 ±26.40 respectively, and no significant differences in the two types of birth among the ewes in the experiment that gave birth to a single lamb and twins in each of the average weight at one month of age (kg), the average weaning weight at 4 months of age (kg), and the average birth weight of the lambs (kg). with it concluded th that there were significant differences in both single lambing and twins in the weight gain from weaning to 6 months (kg), and the results were 13.04 ± 0.26 and 11.36 ± 0.81 respectively.

Introduction:

Sheep are among the most important sources of livestock wealth and are widespread. Sources indicate that there are approximately 2.2 billion head of sheep and goats as sources of this wealth. There are approximately 106 sheep breeds distributed across different countries worldwide, varying in production [7].Iraqi sheep are considered the most important source of livestock wealth in Iraq and many other countries. They are part of the Asian sheep breed with a harmonious structure, numbering 6,604,185 head in 2016 (FAO). They rely primarily on natural pastures for their feed. The Awassi sheep breed is distinguished by its high capacity, good resistance, and adaptation to the harsh environmental conditions of the region. This has resulted in variations in production efficiency and reproductive characteristics in line with changes in the environmental conditions in which they live [9]. Growth characteristics are among the basic indicators in evaluating the productive efficiency of lambs, as they are directly linked to the economic return in sheep farming systems, whether in meat production or in improving future performance. For reserve females. Birth weight, weaning weight, and weight gain rates between these stages are used as quantitative measures reflecting the impact of the terrestrial and environmental factors on growth [6]; [11] Birth type (single or twin) is one of the most important factors affecting lamb growth, as single lambs often have a higher birth weight compared to twins, which is later reflected in

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their superior growth rates during the early stages of life[10]. Conversely, this indicates an interactive effect between the type of birth and the surrounding environment[1]. The type of birth also affects milk production in mothers. Recent studies have shown that uterine volume and the number of fetuses can influence birth weight, while continued superior growth after birth depends on the level of milk production and its efficiency in consumption by lambs [13];[14]. Therefore, studying the effect of the type of birth on body weight, as well as analyzing its relationship to total milk production, is an important step in understanding growth dynamics in lambs and identifying optimal strategies for improving productive performance within breeding and genetic improvement programs, especially in local breeds that vary in their responses to environmental factors.

Materials and Methods :

1. Management and Farming:

The station adopted a semi-open housing system, with open spaces comprising approximately 60% of the barn area and covered areas representing about 40%. This ensures adequate ventilation and protection for the animals. The barns were equipped with troughs and feeders ranging from 20 to 35 meters in length to meet the flock's nutritional and water needs. Separate pens were provided for ewes during lambing to ensure suitable care during this critical period. The flock was managed according to a structured program that included balanced feeding plans, preparation for the breeding season, and the management of pregnancy and lambing stages. The station's veterinary program also implemented approved health and preventative measures.

2. Nutrition:

The quantities and types of feed provided to the animals varied depending on the season and the availability of forage resources. Group grazing was the primary source of nutrition for the flock, with supplementary feed provided as needed. These supplements include green fodder such as alfalfa, concentrated feeds such as hay, and roughage such as straw, especially when natural pastures are scarce. Concentrated feed is provided at a rate of approximately 500 grams per head per day, with the possibility of increasing this amount during the breeding season according to the ewes' nutritional needs. Mineral salts are also provided continuously. Lambs are left with their mothers after birth and rely primarily on breastfeeding. They begin consuming limited amounts of green fodder starting at two weeks of age. After weaning, lambs are fed a concentrated feed equivalent to about 3% of their body weight until they are one year old, with roughage provided freely. The weaning age is determined to be between 4 and 6 months, based on the lambs' health and weight.

3: Breeding Season

The breeding season at the station begins in mid-May and continues until the beginning of July, covering two estrous cycles. The natural insemination system involves introducing a ram to a group of ewes, isolating them to ensure insemination. The inseminated ewes are then moved to separate pens until they complete their two estrous cycles. Insemination data is documented, including the date, the ram's identification number, and the ewe's weight at the time of insemination. After the season ends, cleaning rams are used to ensure all ewes have been inseminated. As lambing approaches, the ewes are moved to individual pens designated for this stage. The lamb is

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weighed and tagged within 24 hours of birth and given colostrum for its immunological and nutritional importance. It then continues to nurse until weaning. During the nursing period, the lambs are separated from their mothers in the evening for morning milking and then reunited. Ewes with twin births are provided with separate pens to ensure proper care and management. 4: Health and Preventive Aspects

The station implements periodic health programs to maintain herd health and limit disease spread. These programs include:

1. Implementing a periodic vaccination program for adult animals according to approved veterinary guidelines.

2. Conducting annual vaccinations to prevent peste des petits ruminants (PPR).

3. Vaccinating the herd against sheep pox and foot-and-mouth disease according to the established preventive schedule.

4. Regularly dipping animals to control external parasites.

5. Treating cases of mastitis when they occur using appropriate veterinary treatments.

6. Administering deworming medication (such as Fendex) to control liver and intestinal worms during March and April, with a repeat dose 21 days after the first treatment to ensure effective control.

5: Milk Measurements

Milk production in ewes was estimated every two weeks throughout the trial period. Milking was carried out manually at 9:00 AM after the lambs had been isolated the previous evening (from 8:00 PM until 9:00 AM the following day). Semi-monthly milking was recorded using a 2000 ml graduated cylinder with 20 ml increments. To calculate daily milking, the amount of milked each morning was multiplied by 2. Milk production in the field was measured using graduated cylinders in milliliters, and this measurement was taken once a month for each ewe until the end of the lactation period. Total milk production was calculated by multiplying the average daily production by the length of the lactation period, based on the International Council for Animal Recording [4] formula:

$$Tmy = (Ty - T0)\, My + \sum(Tr - Tr - y)(Mr + Mr - y)\, 2$$

6: Milk Sampling

Milk samples were collected every 30 days for 90 days for component analysis. Samples were taken in the morning after the milk had been weighed and thoroughly mixed. The milk was then placed in sterile 100 ml plastic containers with tightly sealed lids and transported to the laboratory for testing.

7: Milk component analysis

Milk samples were analyzed using a German-made Milk Analyzer (Milk Analyzer Julie Z7) to measure the percentages of fat, protein, lactose, and non-fat solids.

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Julie Z7 milk component testing device (Figure 1)

8. Body Weight:

Weight is measured at birth, at weaning, and at six months of age. The final weight gain is calculated by dividing the weight gain by the number of days in that period. Body weight is used to calculate the relative growth rate from birth to weaning, and from weaning to six months. It is calculated as the difference in the natural logarithm of the initial and final weights divided by the number of days between those weights [5]. The following equation illustrates this: RGR = Log_e(Weight2) - Log_e(Weight1) / Days between two weightings.

9: The rate of weight gain is calculated according to the following equation: Weight gain = Weight at weaning - Weight at birth. Daily rate of weight gain = Weight gain / Number of days.

Results and Discussion

Table (1) shows significant differences in the two types of lambing among the ewes in the experiment: single lambings and twin lambings. The percentage of total milk production was 2120.57 ± 30.78 and 1978.57 ± 26.40, respectively. The superiority in total milk production in single lambings can be explained by the fact that single lambings require less effort from the ewes compared to raising twins, which reduces the biological stress on the dam and increases the... Energy is concentrated in milk production [15]. Twins may also increase energy consumption during pregnancy and lactation, which may reduce the ewes' ability to produce larger quantities of milk, especially in cases where adequate nutrition or balanced feed management is not available [8]. No significant differences were found between the two types of lambing in the experimental ewes that gave birth to single lambs and twins in terms of protein, fat, lactose, and non-fat solids percentages. However, in single lambs,

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the protein, fat, lactose, and non-fat solids percentages were found to be 4.88 ± 0.11, 5.58 ± 0.14, 5.15 ± 0.14, and 10.73 ± 0.11, respectively. The number of ewes in this single lambing group was 53. For twins, the protein, fat, and non-fat solids percentages were... The lactose and non-fat solids content was 4.65 ± 0.19, 6.03 ± 0.38, 4.97 ± 0.17, and 10.77 ± 0.41, respectively, in the group of ewes that gave birth to twins (7). This is because milk quality (its components) may be more genetically stable than milk production, which is directly affected by gestational age and lactation requirements. Recent studies have shown that the type of birth can affect milk quantity without significantly altering its composition, as the main components tend to remain relatively stable across different conditions due to internal mammary regulation[2];[3].

Table (1) Effect of birth type on total milk production (kg) and its main components in sheep (Means ± Standard Error)

Characteristics	Type of birth		Type of birth
	Single birth (53)	Twins birth (7)	
Total Milk Production (kg)	A 30.78± 2120.57	B 26.40± 1978.57	*
Protein Percentage (%)	0.11 ± 4.88	0.19 ± 4.65	N.S
Fat Percentage (%)	0.14 ± 5.58	0.38 ± 6.03	N.S
Lactose Percentage (%)	0.14 ± 5.15	0.17 ± 4.97	N.S
Non-Fat Solids Percentage (%)	0.11 ± 10.73	0.41 ± 10.77	N.S

*Different letters within the same row indicate significant differences ($p \leq 0.05$) between genetic structures. N.S indicates no significant differences ($p>0.05$).

Table (2) shows that there were no significant differences between the two types of birth in the experimental ewes that gave birth to single lambs and twins in terms of average weight at one month of age (kg), average weaning weight at four months of age (kg), and average birth weight (kg). The results for single lambing were 11.56 ± 0.17, 19.34 ± 0.22, and 42.99 ± 0.47, respectively. For twins, the results for average weight at one month of age (kg), average weaning weight at four months of age (kg), and average

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birth weight (kg) were 11.71 ± 0.31, 18.50 ± 0.68, and 42.29 ± 1.02, respectively. The reason for the lack of a significant difference is attributed to the twins' ability to compensate for growth from birth to weaning (Silva). [12]. As for both the average birth weight (kg) and the average weight at 6 months of age (kg), there were significant differences for both single births and twins. The reason for this difference may be biological for twins due to competition between them inside the womb for the food coming from the mother, which causes a decrease in the weight of newborns when compared to single births [12]. The results for the average birth weight (kg) were 4.21 ± 0.06 for single births and 3.46 ± 0.12 for twin births. The average birth weight at 6 months of age (kg) was 32.38 ± 0.34 for single births and 29.86 ± 0.86 for twin births. The reason for these differences lies in the prenatal period, which determines the number of cells present in the developing muscle of the fetus. Twin births have fewer cells than single births, which widens the significant differences between births [14].

Table (2) Effect of birth type on body weights of lambs at birth, at 1 month of age, at weaning, and at 6 months of age (kg) and ewe birth weight (kg) (means ± standard error)

Characteristics	Type of birth		Type of birth
	Single birth (53)	Twins birth (7)	
Average birth weight (kg)	0.06 ± 4.21 A	0.12 ± 3.46 B	*
Average weight at 1 month of age (kg)	0.17 ± 11.56	0.31 ± 11.71	N.S
Average weaning weight at 4 months of age (kg)	0.22 ± 19.34	0.68 ± 18.50	N.S
Average weight at 6 months of age (kg)	0.34 ± 32.38 a	0.86 ± 29.86 b	*
Average ewe birth weight (kg)	0.47 ± 42.99	1.02 ± 42.29	N.S

*Different letters within the same row indicate significant differences ($p \leq 0.05$) between genetic makeups. N.S indicates no significant differences ($p > 0.05$).

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Based on the results obtained in Table No. (3) regarding single births and twin births, no significant differences were observed in weight gain from birth to one month (kg), weight gain from birth to weaning (kg), and weight gain from birth to 6 months (kg) for the ewes in this experiment. The weight gain from birth to one month (kg), weight gain from birth to weaning (kg), and weight gain from birth to 6 months (kg) for the 53 single birth ewes in the total flock was 7.34 ± 0.18, 15.13 ± 0.21, and 28.16 ± 0.32, respectively. As for the 7 twin births among the ewes in the flock, the weight gain from birth to one month (kg), weight gain from birth to weaning (kg), and weight gain from birth to 6 months was also not significant. The weight gain in lambs (kg) was 8.25 ± 0.31, 15.04 ± 0.31, and 26.39 ± 0.78, respectively. In addition to the aforementioned results, we found significant differences in weight gain from weaning to 6 months (kg) between singleton and twin births. The results were 13.04 ± 0.26 and 11.36 ± 0.81, respectively. This is because singleton births generally result in a higher weight for a single lamb compared to twin births. This affects the long-term growth trajectory of lambs due to either the feed conversion ratio for each lamb or an unknown genetic factor [14].

Table (3) Effect of Birth Type on Weight Gain Rates Among Different Ages of Lambs (kg) (Means ± Standard Error)

Characteristics	Type of birth		Type of birth
	Single birth (53)	Twins birth (7)	
Weight gain from birth to 1 month (kg)	0.18 ± 7.34	0.31 ± 8.25	N.S
Weight gain from birth to weaning (kg)	0.21 ± 15.13	0.31 ± 15.04	N.S
Weight gain from birth to 6 months (kg)	0.32 ± 28.16	0.78 ± 26.39	N.S
Weight gain from weaning to 6 months (kg)	0.26 ± 13.04 A	0.81 ± 11.36 B	*

*Different letters within the same row indicate significant differences ($p \leq 0.05$) between genetic makeups. N.S indicates no significant differences ($p>0.05$).

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