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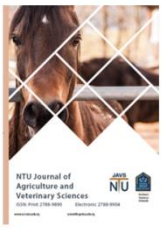

The Effect of Ewe's Age and The First Birth On Sex Lamb, Type of Birth , Litter Size And the Lamb's Weight at Birth and some Genetic Parameters

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A B S T R A C T

This study was conducted at the Agricultural Research Station/Rotary for the period (2009-2014). Data was collected from 1375 individual records of Awassi ewes and 1518 births to determine the effect of maternal age, first parity type, and sex on parity type, sex, and birth weight for older ewes. Dams of female lambs were selected to calculate the heritability and genetic correlation between birth weight and weaning weight. Results showed highly significant differences ($P < 0.01$) between ewe ages in parity type, with single and twin births at 1.5 years of age exceeding other ages by 51.58% and 12.25%, respectively, and decreasing with advancing age. Single births significantly exceeded ($P < 0.01$) twin births at all ages. For lamb sex, the proportion of male and female births at 1.5 years of age was significantly higher ($P < 0.01$) at 33.33% and 30.50%, respectively, and decreased to 0.60% and 0.66% with advancing age. The proportion of female births increased after 3.5 years of age at the expense of male births. Results showed a high heritability for birth weight of ewes born in 2009 and born in other years, and a decrease in heritability for the same ewes and the same period for weaning weight. Genetic correlations were very high, while this situation was reversed for ewes born in 2010 and 2011, as well as for weaning weight.

Introduction

There has been a rapid development in sheep industry. Efficiency of sheep livestock production depends on litter size (number of lambs per ewe) per year [17, 18]. Increase in lamb production (individual and twin) result of increased fertility due to increased secretion of glandular glands of gonadotropin gland [3]. The economic and biological efficiencies of livestock farms can be improved by increasing their reproductive capacity. Reproduction is a complex process that includes puberty, ovulation, estrus, fertilization, embryo implantation, pregnancy, parturition, lactation, and maternal skills[19]. Improving ewe productivity is important for increasing sheep profitability [20]. The profitability of sheep production depends to a great extant on lamb birth weight [21], which directly affects weaning weight [6]. Previous studies have shown different results for effect of ewes' age on lamb birth weight, some of which mentioned that there is no significant effect of ewes' age on lambs' birth weight [6], While [3, 8] found that age of mother affects the weight at birth. Lambs with less than 3.5 kg weight resulted from mothers aged five years, while younger ewes gave smaller, less weight lambs than older ewe lambs [9]. The weight of males and single births was higher than that of females and twin births for all ages under study [6].

Birth Type: The studies did not resolve the effect of mother's age on birth type. [22] found type of birth in first season is related to birth type in next season. In other words, an ewe that has born a twin in the first season can give birth individually in the following seasons. However, some studies have suggested that older ewes in herd can give twins more than younger ewes, with no significant difference

The sex of lambs is an important factor affecting the economics of animal production. Herd bias is an important management tool that helps breeders maximise economic profits by producing desirable numbers of males and females [1]. When environment is favorable, ewes tend to produce a larger proportion of females and vice versa [2], while male sex ratio of the herd tends to ewes that gave birth to single births for ewes aged 5-6 years [3], a significant and positive correlation was found between age of herd and the percentage of males which were biased to proportion of males and then returned to femininity again [3,4], The same researcher said that individual births tend to produce males while trilateral twins tend to produce females, On the other hand, the maternal age of goats did not have a significant effect on sex of the fetus [1].

Litter Size: The biological explanation of phenomenon of multiple births in animals, such as sheep, is extent to which ovaries are affected by hormones genital level. The level of genital secretion varies according to the age of the animal [5]. The number of lambs / ewe decreases with the age of the sheep [6,7]. In contrast, 1.5-year-old ewes gave multiple births and less fertility than older ewes [8]. Birth type and lambs' gender had a significant effect ($P < 0.01$) on weight at birth and weaning [9; 10].

Sheep birth weight heritability estimates ranged from 0.08 to 0.21 in different studies [11, 12]. In addition, [13,14,15], the heritability estimates for weaning weight varied from 0.14 to 0.31. With values ranging from 0.10 to 0.98, genetic correlations between birth weight and weaning weight were found to be positive, moderate, and strong. This suggests that breeding programs that select higher birth weights may also select higher weaning weights.

Materials and Method

Study was conducted from 2009 to 2014 at the Agricultural Research Station in Al-Dawar, Anbar government, Iraq. Table (1) illustrates herd's movement during this time. Information was gathered from station's records utilizing information on 1375 ewes, 20 fertile rams, and 1518 births. Information included the date of birth, the birth type (single or twin), sex, and quantity of lambs born during that time. to ascertain impact of mother's age and her first birth on the lambs' weight, sex, and birth type. Data for ewes born in at least three consecutive years were examined [16].

Table 1. The movement of improved ewes herd during the study period.

	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014
Number of ewes	211	373	523	237	248
Total births	230	427	558	265	260
twin %	16.08	25.29	12.54	20.75	8.85
Single%	83.91	74.71	87.46	79.25	91.15
Male %	71.74	37.78	46.77	49.05	47.31
Female %	28.26	52.22	52.23	50.95	52.69
Fertility %	91.74	87.35	93.73	89.43	95.39
Litter Size	1.09	1.07	1.08	1.95	0.34

Statistical Analysis:

The data of this experiment were statistically analyzed by using Chi square (X^2) to determine effect of ewe's age on births%, twins%, Sexing and litter size, randomized complete design (CRD) was used with three factors (ewe's age × birth type × lambs sex)

to determine the effects of factors and interactions on the lambs birth weight, Averages were compared using Duncan multiple range test [25], The effect of first birth and sex on the following births and their sex was also calculated using regression analysis, using the statistical program [26].

$$h^2 = 2\left[\frac{\sigma_{XY}}{\sigma_X^2 \sigma_{XY}^2}\right]$$

$$rG_{XY} = \frac{\sqrt{(\sum(X1Y2)(X2Y1)}}{\sqrt{(X1X2)(Y1Y2)}}$$ [23]

Results and Discussions

Results in Table (2) showed a high significant differences ($P \leq 0.01$) between ages on birth type, 1.5 years old surpass than rest ages in individual births 51.58%, while percentage for ages 2.5, 3.5, 4.5 and 5.5 (16.10, 9.68, 3.10 and 0.72)%, Individual births were significantly higher ($P \leq 0.01$) comparing with twin births for all years, In addition, twin births were affected by age, highest percentage obtained at 1.5 years, which was significantly higher ($P \leq 0.01$) than rest of ages (12.25, 3.16, 2.44, 0.86 and 0.20)% for (1.5, 2.5, 3.5, 4.5, and 5.5) respectively, these results were agree with [6], that twin birth decrease with aged, while disagreeing with [24]. The decline in the proportion of single and twin births may be due to fact that age-old ewes negatively affect pregnancy and childbirth rates as they decline with age, due to increased reproductive disorders, reduced ovulation and presence of emancipated eggs in older ewes [27]. From same table, it is possible to note that male and female births% has been significantly higher affected ($P \leq 0.01$) with ewe aged, percentage of male births (33.33, 9.57, 5.93, 1.65 and 0.26% For 1.5, 2.5, 3.5, 4.5 and 5.5 years age, male births % were surpassed females births% only in 1.5 and 2.5 years. These percentages differed as ewes aging, after that ratio Biased for females births%, the percentage of female births (30.50, 24.92, 9.16, 2.31 and 0.66)%.

In a parent-offspring regression model, heritability and genetic correlation are examined, with a focus on female offspring who did not bear male offspring.

Litter size was also declined with ewes aging value of litter size is 1.32, 1.26, 1.25, 1.21 and 1.17 for ages 1.5, 2, 5, 3.5, 4.5 and 5.5 years. This result was agreed with [6,7] and did not agree with [8]. This decline in litter size may be due to decrease in number of twin births in the herd with ewes aging, or direct effect of ewe's age and weight on the number of Oocytes, their growth and maturity in ovaries of young ewes with ages (9-14) months [28].

Table 2. Age effect of improved ewes at reproductive.

		1.5	2.5	3.5	4.5	5.5	X^2
Total births		969	291	184	60	14	
Birth type	Single%	51.58	16.01	9.68	3.10	0.72	332**
	Twin%	12.25	2.16	2.44	0.86	0.20	
Lamb gender	Male%	33.33	9.75	5.93	1.65	0.22	198**
	Female%	30.50	9.42	6.19	2.31	0.66	
Litter size		1.32	1.26	1.25	1.21	1.17	0.01

The comparison within a character is vertical and horizontal.

Lamb birth weights: Statistical analysis in Table (3) revealed that age of ewes had no discernible impact on male weight or female lambs, although there were mathematical differences, Generally speaking, birth weights have decreased in first 1.5 and 2.5 years, then increased again in 3.5 year mark, and then decreased in final 2 years.. These findings concurred with [8] regarding variation in birth weights according to maternal age, with no discernible impact and with [6] that age did not affect weight at birth, individual male births also surpassed male twin births and female individual births, individual female births were superior to female twin births with no significantly effect, these results were agree with [6, 9 ,10].

Males tend to weigh more than females, possibly because of Y chromosome and early androgenic effect that causes males to grow more quickly than females in uterus during the embryonic stage [29 ,30], or that male genetic ability to grow and develop faster than females, leading to increase total weight at birth, which is reflected on rest of subsequent weights.

Table 3. Age effect of improved ewes at lambs birth weights (Mean ± S.E)

		1.5	2.5	3.5	4.5	5.5
Male births	Single%	4.13 ± 0.12 a	3.76 ± 0.07 a	3.91 ± 0.09 a	3,27 ± 0.09 a	3,83 ± 0.16 a
	Twin%	3,48 ± 0.06 a	3.14 ± 0.11 a	3.34 ± 0.13 a	3.60 ± 0.18 a	3.50 ± 0.00 a
Female births	Single%	3.82 ± 0.04 a	3,50 ± 0.6 a	3.71 ± 0.11 a	3,26 ± 0.08 a	3.75 ± 0.31 a
	Twin%	3.32 ± 0.07 a	3,09 ± 0.10 a	3.41 ± 0.11 a	3.00 ± 0.15 a	3,00 ± 0.00 a

similar letter on the averages refers to that there are no significant differences between averages, according to Duncan test.

Table (4) indicates that type and sex of subsequent births were not significantly influenced by type and gender of first birth., it did not provide evidence to help predict type of births following, but we can see in a movement of herd the type of births took a fluctuation way for some cases during study years, ewes who born twins in a year born individual in the next year then twins in the following year.

These results were agree with [31] in fluctuation of birth weights depending on the ewes age without significant.

Table 4. Equations for gender prediction and type birth depending on the sex of the first birth and its type.

	Predicting gender of birth lamb	
Predicting the lamb gender at 2.5 years old.	= 1.46 + (0.10 × lamb sex at 1.5 year old of ewe)	**n. s.**
Predicting the lamb gender at 3.5 years old.	= 1.26 + (0.16 × lamb sex at 1.5 year old of ewe)	**n. s.**
Predicting the lamb gender at 4.5 years old.	= 1.19 + (0.70 × lamb sex at 1.5 year old of ewe)	**n. s.**
	Predicting Type of birth	
Predicting the birth type at 2.5 years old.	= 1.64 - (0.03 × birth type at 1.5 year old of ewe)	**n. s.**
Predicting the birth type at 3.5 years old.	= 1.60 - (0.11 × birth type at 1.5 year old of ewe)	**n. s.**
Predicting the birth type at 4.5 years old.	= 1.19 - (0.02 × birth type at 1.5 year old of ewe)	**n. s.**

Table (5) showed birth weight of ewes lambing in 2009 and the birth weight of their daughters from 2010 to 2014 had heritability ranging from 0.047 to 1.01, while values for weight at weaning varied from 0.732 to 0.443. The same ewes' genetic correlations for two traits over same time period varied from 0.990 to 0.0997.

Females lambed in 2013 for ewes born in 2010. The genetic correlation was 0.994, h^2 for birth weight was 0.020, and h^2 for weaning weight was 0.736.

A portion of female lambs born in 2011 lambed in 2012, while others did so in 2013 and 2014. For birth weight in these years, the h^2 were 1.001, 0.751, and 0.667. For weaning weight over same time period, h^2 were 0.194, 0.646, and 0.856. The genetic correlation were 0.987, 0.991, and 0.988.

Likewise, ewes born in 2011 would not female lamb until 2013. The genetic correlation was 0.892, the h^2 was 0.306 for birth weight, and 0.785 for weaning weight.

Table 5. Heritability of birth and weaning weight for mothers and daughter through the study years

Date of mothers born	Date of daughter born	Heritability		rG
		Birth weight	Weaning weight	
2009	2011	0.047	0.732	0.997
	2012	0.462	0.684	0.996
	2013	0.516	0.441	0.990
	2014	1.010	0.443	0.999
2010	2013	0.020	0.736	0.994
2011	2012	1.001	0.194	0.987
	2013	0.751	0.646	0.991
	2014	0.667	0.856	0.988
2012	2013	0.306	0.758	0.892

As ewes aged, h^2 values for birth and weaning weight showed an inverse relationship, according to results above. These findings are consistent with those of [32, 33, 34, 35], who proposed that environmental factors could be reason behind these results, such as year of lambing, have a large influence on lamb birth and weaning weights. Furthermore, the age of ewes affects lambs birth weight; younger ewes give birth to lighter offspring. Moreover, live weight and age of young ewes at breeding influence their production and weaning rates, with heavier young ewes achieving higher production and weaning rates. Taken together, these results point to a dynamic interaction between genetic and environmental factors that affect lamb birth weights and weaning weights as ewes age.

References

1. Gharahveysi , S. ; Hamidi, P. ; Abdollahpour, R. and Abbasi, A. (2018). Factors Affecting the Secondary Sex Ratio of the Iranian Raeini Goats. Egypt. J. Vet. Sci. 49 (1): 35 – 41.
2. Martin, J. G. A. and Bianchet , M. F. (2015). Sex ratio bias and reproductive strategies: What sex to produce when? Ecology, 92(2): 441–449.
3. Kent, J. P. (1995). Birth sex ratios in sheep over nine lambing seasons: years 7-9 and the effects of ageing. Behav. Ecol. Sociobiol. 36:101-104.
4. Polák, J. ; Mareš, V.; Konrád, R. and Frynta, D. (2015). Offspring sex ratio in domestic goats: Trivers-Willard out of natural selection. Czech. J. Anim. Sci., 60 (5): 208–215.
5. Sharafeldin , M. A. (1960). Factors Affecting Litter Size In Texel Sheep. Mededelingen Van De Landbouwhogeschool Te Wageningen, Nederland, 60(3):1-61 .
6. Baneh , H. and S. H., Hafezian (2009). Effects of environmental factors on growth traits in Ghezel sheep, Afr. J, Biotech, , 8 (12) : 2903-2907.
7. Mullaney , P. D. and Brown, GH (969). The influence of age on reproductive performance on sheep in Australia, Australian J. Agri. Res. 20(5) : 953 – 963, (abstract).
8. Akta¸S. A. H. ; S., Dursun ; Do˘ganl, S. ; Z., Kiyma ; U., Demirci and I, Halıcı (2015). Effects of ewe live weight and age on reproductive performance, lamb growth, and survival in Central Anatolian Merino sheep. Arch. Anim. Breed. 58, 451–459.
9. AL-Khuzai , A..A. ; AL-khuzai , H .M. ; Al-Asadi , A. N. and Hassan .H.AL-Abbasi (2009).Effect of Twin Sex and Birth Year on Total Weight and Livability in Awassi Sheep for Different Ages . Kufa Journal For Agricultural Sciences, 1(1): 75-85.
10. -Khalaf , A. I. ; Said, S. I. and Edriss, S. M. (2010). Role of some genetic and environmental factors in growth traits of turkish awassi, local and crossbred lambs. The Iraqi Journal of Agricultural Sciences 41 (3):12-22.
11. Abebe, A. S., Alemayehu, K., Gizaw, S., & Johansson, A. M. (2022). Genetic and phenotypic parameters for growth and lamb survival traits of Farta and their crosses with Washera sheep in northwest Ethiopia: Inputs to design of breeding programs. Cogent Food & Agriculture, 8(1), 2082043.
12. Tesema, Z., Deribe, B., Lakew, M., Getachew, T., Tilahun, M., Belayneh, N., ... & Bishaw, M. (2022). Genetic and non-genetic parameter estimates for growth traits and Kleiber ratios
13. Balasundaram, B., Thiruvenkadan, A. K., Murali, N., Muralidharan, J., Cauveri, D., & Peters, S. O. (2023). Genetic parameters of growth traits and quantitative genetic metrics for selection and conservation of Mecheri sheep of Tamil Nadu. *Animals*, *13*(3), 454.
14. McHugh, N., Pabiou, T., McDermott, K., & Berry, D. P. (2023). Genetic (co) variance components for slaughter traits in a multi-breed sheep population. *animal*, *17*(8), 100883.
15. Jafari, S., & Razzagzadeh, S. (2016). Genetic analysis and the estimates of genetic and phenotypic correlation of growth rates, Kleiber ratios, and fat-tail dimensions with birth to yearling live body weight traits in Makuie sheep. *Tropical Animal Health and Production*, *48*(3), 667-672.
16. Westhusysen, J. M. V. (1973). The Relationship of Birth Status and Early Reproductive Performance With Lifetime Reproductive Performance In Merino Ewes. S. Afr. J. Anim. Sci., 3 (29) : 29-31.
17. Schoeman , S. J. (1990). Production parameters for Dohne Merino sheep under an accelerated, intensive lambing system. S. Afr. Tydskr,Veek. 20 (4) : 174-179.
18. Dariusz, P. (2009). Using classification trees in statistical analysis of discrete sheep reproduction traits. J. Cent. Euro. Agri. , 10 (3) : 303 – 310.
19. Gaskins, C. T. ; Snowder , G. D. ; Westman, M. K. and Evans, M. (2005). Influence of body weight, age, and weight gain on fertility and prolificacy in four breeds of ewe lambs. J. Anim. Sci., 83:1680-1689.
20. Lee , J. W.; D. F. Waldron and L. D. Van Vleck (2000). Parameter estimates for number of lambs born at different ages and for 18-month body weight of Rambouillet sheep. J. Anim. Sci., 78:2086–2090.
21. Tosh, J. J. and R. A., Kemp (1994). Estimation of Variance Components for Lamb Weights in Three Sheep Populations. J. Anim. Sci., 72:1184-1190.
22. Schoeman , S. J. (1990). Production parameters for Dohne Merino sheep under an accelerated, intensive lambing system. S. Afr. Tydskr,Veek. 20 (4) : 174-179.

23. Khalil, M. H. (2007). Foundations of Animal Genetics and Breeding. Al-Qassim University, Kingdom of Saudi Arabia.

24. Westhusysen, J. M. V. (1973). The Relationship of Birth Status and Early Reproductive Performance With Lifetime Reproductive Performance In Merino Ewes. S. Afr. J. Anim. Sci., 3 (29) : 29-31.

25. Al- Rawi , K. M. and Khalaf-Allah , A. M. (2000). Design and Analysis of Agricultural Experimental, Mosul University.

26. SAS 9 (2002). Statistical Analysis System. SAS institute Inc. Cary, NC, U.S.A.

27. Fukui, Y. ; Kohno, H.; Okabe, K.; Katsuki, S. ; Yoshizawa, M.; Togari , T. and Watanabe, H. (2010). Factors affecting the fertility of ewes after intrauterine insemination with frozen-thawed semen during the non-breeding season. J. Reprod. and Dev., 56(4): 460-466.

28. Al-Shajairi, A. Kh. (2017).Effect of weight, age, and number of eggs in the concentration of some hormones in The follicular fluid. Journal of Babylon University, Pure and Applied Sciences, 4 (25): 1438 - 1451.

29. Fraser, A . and Stamp, J. Y. (1987). Sheep husbandry and Disease, New York: Sheridan house INC.

30. Haqq, C. M. ; King, C.Y. ; Ukiyama, E. ; Falsafi, S. and Weiss, M. (1994). Molecular basis of mammalian sexual determination :activation of mullerian inhibiting substance gene expression by SRY,Sci.,266:1494-1500.

31. Sava, C. A.; C., Pascal ; N., Zaxaria ; R., Zaxaria and T., Atanasin (2011- B). Mother's age lambing type as influential factors on body growth and development of youth sheep. Lucrări Ştiinţifice Seria Zootehnie. 55, 131-135

32. Kramarenko, A. S., Kramarenko, S. S., Lugovoy, S. I., & Yulevich, O. I. (2020). Analysis of the influence of genetic and non-genetic factors on the birth weight and weaning weight of lambs. *Scientific Messenger of LNU of Veterinary Medicine and Biotechnologies. Series: Agricultural sciences*, *22*(93), 14-21.

33. Thompson, A. N., Bowen, E., Keiller, J., Pegler, D., Kearney, G., & Rosales-Nieto, C. A. (2021). The number of offspring weaned from ewe lambs is affected differently by liveweight and age at breeding. *Animals*, *11*(9), 2733.

34. Cloete, S. W. P., Olivier, J. J., Van Wyk, J. B., Erasmus, G. J., & Schoeman, S. J. (2003). Genetic parameters and trends for birth weight, birth coat score and weaning weight in Merino lines divergently selected for ewe multiple rearing ability. *South African Journal of Animal Science*, *33*(4), 248-256.

35. Loureiro, M. F. P. (2014). Effect of ewe age on offspring development and performance, Ph. D. thesis , Massey Univ. , Palmerston North, New Zealand.