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Original Research

# Evaluation of Some Productive Characteristics of Jordanian Awassi

**Khaled Al-Najjar[1]*, Ahmad Q. Al-Momani[1], Azzam N. Al Yacoub[2] and Reda Elsaid[3]**

[1]Jerash University, Faculty of Agriculture, Animal Production and Protection Department, JORDAN
[2]Umm Al-Qura University, Faculty of Agriculture, Department of Biology, Makkah, SAUDI ARABIA
[3]University of Sadat City, Environmental Studies and Research Institute (ESRI), Department of Sustainable Development, Menofyia, EGYPT

*Corresponding Author: khnajj2011@yahoo.com

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## Abstract

*This study was carried out on Awassi ewes at Al-Fjaj station, Jordan. The objectives were investigated environmental factors affecting litter-birth weight (LBW), litter-weaning weight (LWW), milk yield (MY), daily-milk yield (DMY) [kg], and milking season (MkSn) [day] and estimated its values. LBW was highly significantly affected lambing year (YL), parity (PR), birth type (BT), litter-sex (LS), and (YL×BT). LWW was highly significantly affected by (YL), (LS), (YL×BT), (PR×BT), and Ewe weight at lambing (ELW). The effect of YL and LS were highly significant on MY and MkSn and significant on DMY. Production line of ewe (LE) and (PR) had significant on MkSn and MY, respectively. (LE×PR) and (PR×BT) had a significant on DMY. The value of corrected correlations varied from low to moderate and highly significant effect except (MY) with (LBW) and (LWW). Awassi sheep have dual productivity due to the low correlations between milk traits and weights in Jordan.*

**Keywords:** Ewes, Litter weights, Milk, Jordanian Awassi

## Introduction

Awassi is a fat-tailed sheep, it is the most common breed in the East of the Mediterranean, and its population is around 3 million in Jordan (FAO, 2018). Unimproved Awassi sheep have adapted to arid conditions with low rain, which is distinguished by vitality, strength, and average production of milk and meat (Epstein, 1985). In the last few years, interest in small ruminants has increased to exploit the potential of local breeds (Selvaggi *et al.*, 2014). Litter-weight weaned postpartum per ewe lambing is often believed to measure ewe productivity (Bromley *et al.*, 2001). Lamb's bodyweight of Awassi is affected by some environmental factors, which might improve by applying better management procedures (Al-Momani *et al.*, 2020). In Jordan, litter weights at birth and weaning were not systematically estimated on Awassi sheep, although these traits are important because affecting the profitability of sheep farms. Therefore, this study aimed to estimate litter-birth weight (LBW), litter-weaning weight (LWW), milk yield (MY), daily-milk yield (DMY), and milking season (MkSn) traits and investigated some environmental factors on the Awassi sheep under Jordanian field conditions.

## Materials and Methods

This study was conducted at Al-Fjaj sheep station that belongs to the Ministry of Agriculture, is located 210 km south of Amman city. A total data of 2433 records of Jordanian Awassi sheep were collected. The sheep were managed under a semi-intensive system. They were allowed to graze in the morning and afternoon. Pasture represents a part of nutrition, which is poorly during the dry season, and shortly after the rainy season. Plan of feeding during the last two months of gestation, each ewe fed 0.5 kg of alfalfa hay and 1.5 kg of concentrate until lambing ewe. Concentrate was composed of barley (67.5%), wheat bran (18%), soybean meal (12%), limestone (1.4%), salt (1%), trace minerals (0.1%), and (8-10) million IU of Vitamin (A) a ton. The sheep have free access to water and salty stone licks.

Mating season begins in July and the lambing is in December. The ewes tested by a teaser ram with an apron for estrus and then assigned around 30 ewes for each stud ram according to efficiency reproductive with avoiding kinship. Ewes were inseminated naturally or after synchronized hormonal estrus approximately 90 days postpartum. Each ewe was housed separately for lambing and, they allowed caring for its lambs for a few days until strong to join dams at pasture.

The lambs and their dams were weighted immediately after lambing and biweekly of lambs until they weaned at a bodyweight of around 14 Kg. The lambs underwent a conditional suckling program by gradually separating them from their ewes until weaning. Afterward, lambs were allowed to suckling their ewes for 15 days of age. After that, lambs were let to suckling for an hour twice a day, morning and evening, from 16 to 30 days of age. Then, lambs were allowed to suckling the ewes after milking them from the age of more than a month until weaning. After weaning, lambs were fed concentrates, hay, and silage to ensure the best growth until adulthood. Daily-milk yield was recorded by weighing the collected produced milk a day for each ewe. Ewes were milked twice daily after the days of colostrum until milk yield had decreased to around 200 gram a day or when dried off.

Data were analyzed using SAS (2012) to determine environmental factors that affect the examined traits, according to the following fixed model:

$$\mathbf{Y_{ijklmn}=\mu+YL_i+LE_j+PR_k+BT_l+LS_m+(LE\times PR)_{jk}+(YL\times BT)_{il}+(LE\times BT)_{jl}+(PR\times BT)_{kl}+BX_{ijklmn}+e_{ijklmn}}$$

Where $Y_{ijklmn}$=studied traits of the ijklmn$^{th}$ records. μ=overall mean, $YL_i$=effect of the i$^{th}$ year of lambing. $LE_j$=effect of the j$^{th}$ production line of a ewe. $PR_k$=effect of the k$^{th}$ parity. $BT_l$=effect of the l$^{th}$ birth type (single and twin+). $LS_m$=effect of the m$^{th}$ litter-sex (single male, single female, twin male, twin female, and triplet). $(LE\times PR)_{jk}$=the interaction between production line of a ewe with parity, $(YL\times BT)_{il}+(LE\times BT)_{jl}+(PR\times BT)_{kl}$=the interaction of year of lambing, production line of ewe, and parity with birth type, respectively. B=linear partial regression coefficient of studied traits on the ewe lambing weight (ELW). $X_{ijklmn}$=deviation of the n$^{th}$ ewe lambing weight (kg) from the μ of ELW. $e_{ijklmn}$=the random error term. Duncan's multiple range test was used (Duncan, 1955). Partial correlation coefficients from the error sums of squares and cross products (SSCP) matrix from the above model were used by SAS (2012) among all studied traits.

## Results and Discussion

The lambing years (YL) had a highly significant effect (Table 1). Haile *et al.* (2017) reported the same result of LBW, LWW, MY, and MkSn, while Oravcova *et al.* (2018) agreed with the DMY result. Generally, differences over YL of the LBW, LWW, MY, DMY, and MkSn illustrate the role of environmental and management factors. Table 1 shows the effect of factors related to ewes [ewe line, (EL) parity, (PR), and ewe lambing weight (ELW). The difference between each milk and meat line was a non-significant effect of EL except for MkSn affected by EL. In Syria, Kassem et al. (2010) did not confirm this result on MkSn but MY shows effectiveness of phenotypic selection for MkSn in Jordanian Awassi and MY in Syrian Awassi. There are no similar results to comparison in the reference studies of LBW and LWW on sheep.

**Table 1:** Variance analysis of milk yield (MY), daily-milk yield (DMY), litter-birth weight (LBW), litter-weaning weight (LWW)/[kg] and milking season (MkSn)/[day].

| S.O.V. | D.F. | Means of Squares | | | | |
|---|---|---|---|---|---|---|
| | | MY | DMY | MkSn | LBW | LWW |
| YL | 8 | 6645.2** | 0.7972** | 8159.5** | 10.03** | 178.83** |
| LE | 1 | 372.8 | 0.0138 | 1266.6* | 0.03 | 3.5 |
| PR | 3 | 1212.8* | 0.0745 | 482.9 | 2.78** | 10.12 |
| BT | 1 | 639.8 | 0.0537 | 4.3 | 5.82** | 4.7 |
| LS | 4 | 4704.1** | 0.0805* | 2894.4** | 22.80** | 197.52** |
| LE×PR | 3 | 188.6 | 0.0921* | 485.1 | 0.76 | 13.74 |
| YL×BT | 8 | 1526.8** | 0.1242** | 539.1 | 11.24** | 114.72** |
| LE×BT | 1 | 10.4 | 0.0055 | 530.4 | 0.2 | 0.99 |
| PR×BT | 3 | 625.4 | 0.1347* | 21.8 | 0.92 | 52.10** |
| ELW | 1 | 42 | 0.0635 | 29.6 | 0.05 | 480.82** |
| Residual | 2399 | 451.3 | 0.0368 | 312.9 | 0.6 | 9.38 |

*YL: Lambing year, LE: Production line of ewe, PR: Parity, BT: Birth type, LS: Litter sex, ELW: Ewe weight at lambing. **:P<0.01, *:P<0.05, no-sign: non-significant.*

LBW was significantly affected by PR this finding agrees with Haile *et al.* (2017) findings which might be due to improvement in the physical condition of ewes as parity progresses. PR had a non-significant effect on LWW; Haile *et al.* (2017) reported the opposite result, who found that PR significantly affected MY but not DMY and MkSn; Haile *et al.* (2017) agreed for MY and MkSn, while Oravcova *et al.* (2018) for DMY. LBW was not significantly affected by ELW; MY and MkSn were not affected by ELW, which was approved by Al-Najjar *et al.* (2011); LWW was highly significantly affected by ELW, a similar result determined by Al-Najjar *et al.* (2011). Table 1 shows the effect of birth-related factors [birth type (BT) and litter-sex (LS)]. The changes between single and twinning estimates were non-significant affected except the LBW. Al-Najjar *et al.* (2011) reported a highly significant effect of BT on LBW, while Jawasreh and Khasawneh (2007) found a non-significant of BT on MY and DMY.

The LS estimate was highly significantly affected by LS and DMY was a significant effect. LBW rises linearly with increased litter-size (Freetly and Leymaster, 2004). Besides, Haile *et al.* (2017) asserted that sex of lambs had a significant effect on LBW; Lambs born into a shared male twin had a lower weight than those born to a female joint twin, and lambs born into a female joint twin grew faster from birth to 60 days old (Bufening, 1972); this might return to Sexual conflict in twins (Korsten *et al.*, 2009). LS had a highly significant effect on the LWW, agreed with Haile *et al.* (2017), which might be due to the sex hormones on growth of lambs. When considering sex by litter-size, it was found to have a highly significant effect on MY, this result agrees with Alkass *et al.* (2009) finding. Oravcova *et al.* (2006) reported that litter-size significantly affected DMY. Alkass *et al.* (2009) reported a highly significant LS affected MkSn; Al-Samarai and Al-Anbari (2009) confirmed the significant effect for litter-size and without for the lamb sex on MkSn.

Table 1 illustrates the effect of interactions on studied traits. Interaction of (LE×PR) had a non-significant except DMY, explained the homogeneity between LE effects within parities except DMY, which was heterogeneous on Jordanian Awassi. Kassem *et al.* (2010) reported that (LE×PR) significantly affected MY and the non-significant MkSn in Syrian Awassi. The interactions of (YL×BT, El×BT, PR×BT) had a highly significant effect except for MkSn, a non-significant for the studied traits and significant for LWW, DMY, respectively.

The least-squares means and standard errors of the studied traits are shown in Table 2. Casas *et al.* (2004), and Haile *et al.* (2017) found higher LBW estimates which were 7.42 and 6.40 kg, respectively, however, birth weight is determined by growth in late pregnancy. Vatankhah and Talebi (2008), and Haile *et al.* (2017) decided higher values for LWW which were 30.15 and 26.10 kg, respectively and this may be due to the rearing of different lambs. Alkass and Akreyi (2016), and Haile *et al.* (2017) reported that higher values of milk yield were 126.05 and 91.20 kg, respectively, while Ozyurek (2020) published a lower value was 47.99 kg. Jawasreh and Khasawneh (2007) and Oravcova *et al.* (2018) identified that DMY was 0.796 and (0.499-0.510) kg, respectively, while Thomas *et al.* (2014) confirmed that a higher value was (1.36-1.59) kg. Haile *et al.* (2017) determined a lower value that was 100.39 days of MkSn, while Kaygisiz and Birol (2017) and Ozyurek (2020) identified higher values, which was 173.8 and 130.05 days, respectively. Differences in LBW and LWW, MY, DMY, and MkSn estimates might be due to the genotype of Awassi, breeds, and/ or care conditions for sheep flocks in different countries.

**Table 2:** Least-square Means±Standard errors of milk yield (MY), daily-milk yield (DMY), litter-birth weight (LBW), litter-weaning weight (LWW)/[kg] and milking season (MkSn)/[day].

| **S.O.V.** | | **Obs.** | **MY** | **DMY** | **MkSn** | **LBW** | **LWW** |
|---|---|---|---|---|---|---|---|
| μ | | 2433 | 79.9±0.46 | 0.675±0.003 | 120.27±0.45 | 5.80±0.02 | 21.12±0.07 |
| YL | 1st | 316 | 80.4±2.6$^{cd}$ | 0.024±0.538$^{d}$ | 131.88±2.20$^{b}$ | 6.38±0.10$^{ed}$ | 22.60±0.38$^{ed}$ |
| | 2nd | 247 | 66.1 ±2.3$^{e}$ | 0.020±0.656$^{c}$ | 107.03±1.89$^{d}$ | 6.21±0.08$^{bc}$ | 22.16±0.33$^{cd}$ |
| | 3rd | 286 | 90.2±2.2$^{a}$ | 0.020±0.806$^{a}$ | 122.80±1.80$^{c}$ | 6.37±0.08b | 24.93±0.31$^{a}$ |
| | 4th | 278 | 91.7±3.4$^{a}$ | 0.030±0.815$^{b}$ | 135.05±2.79$^{a}$ | 7.06±0.12$^{cde}$ | 23.72±0.48$^{bc}$ |
| | 5th | 191 | 80.7±2.5$^{bc}$ | 0.022±0.802$^{a}$ | 120.80±2.07$^{c}$ | 6.62±0.09$^{a}$ | 22.73±0.36$^{bc}$ |
| | 6th | 279 | 95.6±3.8$^{bc}$ | 0.034±0.689$^{c}$ | 138.50±3.15$^{a}$ | 6.44±0.14$^{e}$ | 21.96±0.55$^{e}$ |
| | 7th | 257 | 91.6±2.4$^{ab}$ | 0.022±0.787$^{ab}$ | 135.86±2.04$^{a}$ | 5.77±0.09$^{bcde}$ | 23.70±0.35$^{b}$ |
| | 8th | 316 | 79.7±2.2$^{d}$ | 0.020±0.643$^{c}$ | 126.64±1.84$^{c}$ | 6.64±0.08$^{bcd}$ | 20.54±0.32$^{d}$ |
| | 9th | 263 | 89.8±3.0$^{c}$ | 0.688±0.027$^{c}$ | 129.03±2.53$^{c}$ | 6.08±0.11$^{f}$ | 23.73±0.44$^{b}$ |
| LE | Milk line | 2057 | 85.9±1.9$^{a}$ | 0.719±0.017$^{a}$ | 129.09±1.55$^{a}$ | 6.39±0.05$^{a}$ | 22.81±0.21$^{a}$ |
| | Meat line | 376 | 84.2±1.4$^{a}$ | 0.709±0.013$^{a}$ | 125.93±1.20$^{b}$ | 6.40±0.07$^{a}$ | 22.98±0.27$^{a}$ |
| PR | 1st | 1346 | 79.6±2.2$^{b}$ | 0.683±0.020$^{a}$ | 125.72±1.83$^{a}$ | 6.39±0.05$^{b}$ | 22.47±0.32$^{a}$ |
| | 2nd | 270 | 86.7±2.7$^{a}$ | 0.738±0.024$^{b}$ | 127.19±2.23$^{a}$ | 6.40±0.07$^{a}$ | 22.87±0.39$^{a}$ |
| | 3rd | 248 | 88.0±2.3$^{a}$ | 0.701±0.021$^{a}$ | 130.45±1.92$^{a}$ | 6.39±0.05$^{b}$ | 23.08±0.33$^{a}$ |
| | 4th | 569 | 86.1±1.7$^{a}$ | 0.733±0.015$^{a}$ | 126.68±1.41$^{a}$ | 6.40±0.07$^{a}$ | 23.16±0.24$^{a}$ |
| BT | single | 2171 | 80.0±5.2$^{a}$ | 0.667±0.047$^{a}$ | 127.09±4.32$^{a}$ | 5.91±0.19$^{b}$ | 22.46±0.75$^{a}$ |
| | twin+ | 262 | 90.2±3.8$^{a}$ | 0.761±0.034$^{a}$ | 127.93±3.13$^{a}$ | 6.89±0.14$^{a}$ | 23.34±0.54$^{a}$ |
| LS | Single-m | 1440 | 85.4±4.3$^{b}$ | 0.746±0.039$^{b}$ | 123.62±3.62$^{b}$ | 5.44±0.16$^{c}$ | 21.65±0.63$^{b}$ |
| | Single-f | 731 | 91.8±4.3$^{a}$ | 0.762±0.039$^{b}$ | 128.45±3.61$^{ab}$ | 5.08±0.14$^{d}$ | 20.44±0.62$^{c}$ |
| | Twin-m | 77 | 83.8±5.0$^{ab}$ | 0.677±0.045$^{ab}$ | 131.23±4.17$^{a}$ | 6.90±0.18$^{b}$ | 23.71±0.72$^{a}$ |
| | Twin-f | 85 | 82.9±4.8$^{ab}$ | 0.726±0.043$^{a}$ | 126.50±3.99$^{ab}$ | 7.26±0.17$^{a}$ | 23.85±0.69$^{a}$ |
| | Triplet | 100 | 81.54.9$^{bc}$ | 0.659±0.044$^{b}$ | 127.75±4.06$^{b}$ | 7.29±0.18$^{a}$ | 24.83±0.70$^{a}$ |

*YL: LambingYear (2000-2008), LE: Production line of ewe, PR: Parity, BT: Birth type, LS: Litter-sex, m: male, f: female. Means in the same column not followed by the same letter differ significantly at the 5% level. Regression coefficient on ewe at lambing weigh were -0.020±0.06, -0.0008±0.0006, -0.017±0.054, 0.0007±0.0024, and -0.067±0.009 for MY, DMY, MkSn, LBW, and LWW, respectively.*

Table 3 presents corrected correlations (CC) that were low to moderate. CC values were significant between all studied traits except MY and LBW, MY and LWW, and DMY and LWW. The significant positive CC values were between LWW and LBW, DMY and LBW, DMY and MY, MkSn, and MY. The significant negative CC values were between MkSn and all studied traits except MY.

**Table 3:** Partial correlation coefficients from the error SSCP matrix Prob.>|r| of milk yield (MY), daily-milk yield (DMY), litter-birth weight (LBW), litter-weaning weight (LWW) [kg] and milking season (MkSn) [day].

| **traits** | **LWW** | **MY** | **DMY** | **MkSn** |
|---|---|---|---|---|
| LBW | 0.083** | 0.002 | 0.056** | -0.090** |
| LWW | | -0.033 | 0.026 | -0.052** |
| MY | | | 0.564** | 0.403** |
| DMY | | | | -0.129** |

*SSCP: Sums of squares and cross products matrix, **: high significant, no-sign: non-significant, D.F.=2399.*

## Conclusion

The study concluded that Awassi sheep are considered to have dual production due to the low correlation between milk traits and weights. Also, improving the feeding of ewes during pregnancy and caring for new lambs increases the rates of all traits studied.

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## Conflict of Interests

There is no conflict of interest.

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