Research Article

Influence of some Genetic and Non-Genetic Factors on Total Milk Yield and Lactation Period in Iraqi Awassi Sheep

Firas Rashad Al-Samarai[1], Yehya Khalid Abdulrahman[2], Fatten Ahmad Mohammed[3], Falah Hamad Al-Zaidi[4], Nasr Nouri Al-Anbari[5]

[1, 2]Department of Veterinary Public Health, College of Veterinary Medicine, University of Baghdad, Iraq; [3, 4]Department of Animal Resources, Directorate of Baghdad Agriculture, Ministry of Agriculture, Iraq; [5]Department of Animal Resources, College of Agriculture, University of Baghdad, Iraq.

Abstract | This study was conducted to evaluate productivity of Awassi sheep raised at the Research Station of Sheep and Goats (Abo Gharib) in the west of Baghdad, Iraq. A total of 369 milk records of the Awassi ewes collected during year of 2008 were used to investigate the effect of some genetic and non-genetic factors (group of dam, parity, month of birth, type of birth and sex) on total milk yield (TMY), and lactation period (LP). Data were analysed by using GLM in SAS program. Restricted Maximum Likelihood Estimation method (REML) was used to estimate heritability (h^2) for milk yield an lactation period. Best Linear Unbiased Predication (BLUP) values were estimated for rams. Results revealed that total milk yield (TMY) and lactation period (LP) were 103.57±3.63kg and 107.44±1.47 days respectively. LP affected significantly (P< 0.01) by parity, group of dam (local and Turkish), month of birth and type of birth (single and twin), while the sex of birth was not significant. TMY was affected significantly (P< 0.01) by the same factors except the parity and sex of birth, which were not significant. Estimates of heritability for TMY and LP were 0.40 and 0.30 respectively. BLUP values of rams for total milk yield were between -33.61and 31.00 kg. These results point to a high genetic potential of Awassi sheep. Hence, it is imperative to apply selection programs to improve the productive performance of Awassi sheep in Iraq.

Keywords | Awassi sheep, Milk yield, Heritability, BLUP

Editor | Kuldeep Dhama, Indian Veterinary Research Institute, Uttar Pradesh, India.
Received | November 03, 2014; **Revised** | December 01, 2014; **Accepted** | December 03, 2014; **Published** | December 06, 2014
***Correspondence** | Firas Rashad Al-Samarai, University of Baghdad, Iraq; **Email:** firas_rashad@yahoo.com
Citation | Al-Samarai FR, Abdulrahman YK, Mohammed FA, Al-Zaidi FH, Al-Anbari NN (2014). Influence of some genetic and non-genetic factors on total milk yield and lactation period in Iraqi Awassi sheep. Adv. Anim. Vet. Sci. 2(12): 662-667.
DOI | http://dx.doi.org/10.14737/journal.aavs/2014/2.12.662.667
ISSN (Online) | 2307-8316; **ISSN (Print)** | 2309-3331

INTRODUCTION

Awassi breed is utilized for production of meat, milk, and wool. It is the main breed in Iraq and most of the Middle Eastern countries (Epstein, 1985; Zarkawi et al., 1999; Tabbaa et al., 2001; Hailat, 2005). Awassi sheep survive under harsh environmental conditions. It is adapted to scarcity of feed and high environmental temperatures (Said et al., 1999). The Awassi breed is traditionally kept for the production of milk and meat and plays a socioeconomic role in Iraq.

The average total milk yield (TMY) of Iraqi Awassi sheep was ranged between 73.16 to 131.92 kg and the average lactation period (LP) was ranged between

85.80 to 142.00 days (Eliya and Juma 1970; Karam et al., 1971; Alkass et al., 2009; Al-Samarai and Al-Anbari 2009; Abd Al-Noor, 2011). The potential genetic ability of Awassi sheep for increasing milk production have been supported according to the genetic improvement programs that have been applied in Israel. Intensive selection within the Awassi breed has increased milk production in Israel from 297 kg in 1940's to over 500 kg in the 1990's (Epstein, 1985; Galal et al., 2008). Thus, the objective of this study was to determine the level of influence of some factors on milk yield and lactation period, as well as to estimate the heritability of these traits as heritability is an important genetic parameter that must be taken into consideration when designing breeding programs for animal populations and the study also aimed to estimate Best Linear Unbiased prediction (BLUP) of sires for TMY.

MATERIAL AND METHODS

This study was conducted at the Research Station of Sheep and Goats, Abu Gharib, Ministry of Agriculture, Iraq.

A total of 369 records of productive performance of 369 Awassi ewes daughters of 66 sires were analyzed for one year (2008). The flock was kept in semi-shaded houses, grazed mainly on natural pastures and some green forage legumes and cereals during March-May. During June-November, the flock grazed on crop residues post harvesting with access to grazing a triplex shrubs, in addition to some supplements (250-500 gm/head) of feed concentrates according to their physiological status. In winter, the flock was fed 0.5-1.0 kg concentrate of mixed grain in addition to 0.5-1.0 kg of hay and straw.

Milk yield was measured weekly (Twice-daily). On the milk recording day, lambs were isolated from their dams, and dam's udders were evacuated handily from the surplus milk post lambs suckling, and milk produced was weighed and recorded. This method was routinely repeated till lambs were weaned. The flock included Local Awassi in addition Turkish Awassi which was exported from Turkey to improve the performance of local Awassi by mating.

Statistical Analysis

Data were analysed using General Linear Model (GLM) in SAS program (2010) to investigate the effect of some fixed factors on: total milk yield and lactation period in Awassi sheep according to the following linear model:

$$Y_{ijklm} = \mu + P_i + X_j + W_k + G_l + e_{ijklm}$$

Where Y_{ijklm} is the studied trait, μ is the overall means, P_i the fixed effect of i^{th} parity (i = 1 – 2), X_j the fixed effect of j^{th} birth month (j = January, February and March), W_k the k^{th} effect of birth type (k = 1= single, 2 = twins), G_l the fixed effect of sex of lamb and e_{ijklm} is the residual effect.

Mixed model was used to estimate variance components using Restricted Maximum Likelihood Estimation (REML) method as following model:

$$Y_{ijklmn} = \mu + P_i + X_j + W_k + G_l + S_m + e_{ijklmn}$$

Where Y_{ijklm}, μ, P_i, X_j, W_k, G_l and e_{ijklmn} are the same in the first model, whereas S_m is the random effect of sires. The same model was also used to estimate Best Linear Unbiased Prediction (BLUP) of sires for TMY using Proc mixed procedure in SAS program (2010). Least square means were compared using Duncan test.

RESULTS AND DISCUSSION

Table 1 showed that the overall means of TMY and LP were 103.57±3.63 kg and 107.44±1.47 days respectively. The estimate of the TMY in this study was within range of 73.16 – 131.92 kg reported by several workers (Eliya and Juma 1970; Karam et al., 1971; Alkass et al., 2009; Al-Samarai and Al-Anbari 2009; Abd Al-Noor, 2011) for the same breed in Iraq. Results revealed that the effect of parity on the TMY was not significant (Table 2), whereas the effect of the group of dam was significant ($P < 0.01$). Least square means of the TMY in local and Turkish Awassi were 45.30 and 129.07 kg respectively (Table 1). This result is consistent with the finding of Iñiguez and Hilali, (2009) who stated that the Turkish Awassi sheep surpassed the Syrian Awassi sheep (101.3 vs 77.8 kg) in TMY. Least square mean of TMY of ewes in January (106.31 kg) was differed significantly ($p < 0.01$) as compared with February (77.76 kg) and March (77.48 kg). Similar results were reported by Alkass et al. (2009) and Kassem et al. (2010). This result could

Table 1: Least square means of TMY and LP of Awassi sheep

Factor	No. of obs.	TMY	LP
Parity		N.S	**
1	175	86.49±4.99[a]	88.63±2.57[b]
2	97	88.04±6.60[a]	100.58±4.07[a]
3	56	87.02±9.66[a]	85.78±6.89[b]
Group of dam		**	**
Local Awassi	112	45.30±8.43[b]	80.45±3.29[b]
Turkish Awassi	257	129.07±10.08[a]	102.88±3.93[a]
Month of birth		**	**
January	141	106.31±8.40[a]	109.59±3.28[a]
February	190	77.76±6.64[b]	91.85±2.98[b]
March	38	77.48±14.54[b]	73.54±6.78[c]
Type of birth		**	**
Single	240	79.72±8.49[b]	82.59±3.31[b]
Twin	129	94.65±9.57[a]	100.74±3.73[a]
Sex		N.S	N.S
Male	186	84.60±8.95[a]	89.71±3.49[a]
Female	183	89.77±9.00[a]	93.62±3.51[a]
Overall mean	369	103.57±3.63	107.44±1.47

**Means with the different letters in same column differed significantly (P< 0.01); N.S=Non-significant

Table 2: Analysis of variance of factors affecting TMY in Awassi sheep

Source of variation	df	Mean square	F	P
Parity	2	23.2257	0.01	0.9930
Group of dam	1	390977.6517	117.66	<0.0001
Month of birth	2	34045.4847	10.25	<0.0001
Type of birth	1	17969.0633	5.41	<0.0206
Sex	1	2445.1813	0.74	0.3916
Error	361	3322.813		

Table 3: Analysis of variance of factors affecting LP in Awassi sheep

Source of variation	df	Mean square	F	P
Parity	2	2014.00671	3.98	0.0195
Group of dam	1	28016.18905	55.35	<0.0001
Month of birth	2	16337.70309	32.27	<0.0001
Type of birth	1	26553.55363	52.46	<0.0001
Sex	1	1398.52797	2.76	0.0973
Error	361	506.2077		

be attributed to changes in the environmental conditions, particularly in ambient temperature together with the availability of feeds during different lambing months (Alkass et al., 2009). The effect of type of birth on TMY was significant (P< 0.05). TMY of ewes suckling twins (94.65 kg) was higher than that of ewes suckling singles (79.72 kg). Such increase was obviously due to increased stimulation of the udder. Similar results have been found by Macciotta (1999), Sakul et al. (1999), Alkass et al. (2009) and Kassem et al. (2010). On the other hand, the effect of sex of birth on TMY was not significant. Our results confirmed finding of Al-Samarai and Al-Anbari (2009).

Table 4: Heritability of TMY and LP in Awassi sheep

Trait	Sire variance	Error variance	h^2
TMY	516.26	4330.20	0.42
LP	53.83	651.54	0.30

Table 5: BLUP values of sires for TMY and LP

Rank of Sire	No. of Sire	BLUP value
1	11976	-33.6155
2	11958	-31.8667
3	11966	-22.9156
4	11941	-19.2332
5	11902	-17.2458
.	-	-
.	-	-
62	11999	14.4530
63	11921	14.5797
64	11985	17.9483
65	11924	21.7712
66	11939	31.0058

In present study, the overall mean of LP of Awassi was 107.44 days (Table 1), which was within the range of 85.80 to 142.00 days reported by previous studies (Eliya and Juma, 1970; Karam et al., 1971; Alkass et al., 2009; Al-Samarai and Al-Anbari 2009; Abd Al-Noor, 2011) for the same breed in Iraq. LP was affected significantly (P< 0.05) by parity (**T**able 3). The LP of second parity (100.58 days) was higher than first (88.63 days) and third parity (85.78 days). Similar result was found by Jawasreh et al. (2013) who reported that means of LP in first forth parity were 88.28, 113.68, 105.86 and 87.93 days respectively and LP of the second parity differed significantly (P< 0.05) as compared with other means. Group of dam had significant (P <0.01) effect on LP. Turkish Awassi had longer LP (102.88 days) as compared with local Awassi (80.45 days). This result confirmed previous results reported by Iñiguez and Hilali (2009) and Kassem et al. (2010). Our finding could be reflects the differences in genetic potential between local and Turkish sheep, in other words it seems that persistency of Turkish Awassi was higher than local Awassi, however this explanation need more studies to be determine. The effect of month of birth was significant (P< 0.01). Highest estimate of LP was found in January with reduction in estimation along with advancing sequence of months. This finding is consistent with Abdul-Rahman and Abbo (2013). In the finding of present study, the effect of type of birth was significant (P< 0.01). The mean of LP of ewes with twins was more longer (100.74 days) as compared with ewes with single (82.59 days). These differences could be attributed to that twins are more stimulate of the udder than single. Al-Samarai and Al-Abari (2009) found that LP of ewes with twins (90.87 days) differed significantly (P< 0.01) as compared with single (80.81 days). On the other side, the effect of sex was not significant. Estimates of heritability are shown in table 4. Heritability of TMY was 0.42. This estimate was lower than estimate of 0.47, 0.56 and 0.60 reported by Al-Samarai and Al-Anbari (2009), Mavrogenis (1996) and Hossamo et al. (1985) for the same breed. Whereas the estimate of present study was higher than 0.103 (Pollott and Gootwine, 2001), 0.25 (Pollott et al., 1998) and 0.26 (Jawasreh and Khasawneh, 2007). The variation in estimates of heritability could be attributed to several factors: such as, method of estimating variance component, size of flock, breed of sheep but generally the estimate of heritability of TMY tend to be low for flocks under selection. Gootwine, (2011) stated that "In response to selection for high milk production in the Awassi, the genetic variation for milk production ability is expected to decrease in the selected lines. It is thus not surprising that heritability estimates for milk yield in the Improved Awassi dairy strain are low as compared to those in non-selected Local Awassi populations". The estimate of heritability of LP was moderate (0.30) which was consistent with 0.33 recorded by Al-Sa-

marai and Al-Anbari (2009). The values of BLUP of sires for TMY are shown in table 5. It is obvious that there was a considerable wide difference between values of BLUP. The low and high values were –33.61 and 31.00 kg respectively. These results in addition to high estimate of heritability increase the opportunity to get acceptable response in TMY by selection.

In conclusion: A large portion of the increased performance and productivity of modern livestock can be attributed to genetic improvement through selection. Thus, for Local Awassi populations with low milk production, and high heritability, mass selection based on actual milk records will continue to be the main breeding strategy to improve Awassi performance in Iraq. As the Local Awassi, is a triple-purpose breed (meat, milk, and carpet–wool production) with priority intention for meat in Iraq, so it is of interest, that a positive association was found between ewe weight and milk production and such association was confirmed by Gootwine (2011), who reported that the development of the high milk producer Improved Awassi line from the Local Awassi was associated with an increase in ewes' body weight.

REFERENCES

- Abd Al-Noor MM (2011). A study of some factors affecting the milk production and lactation length of local and Turkish Awassi sheep. Diyala Agri. Sci. J. 3(1):21-29. (In Arabic).
- Abdul-Rahman FY, Abbo NY (2013). Non-genetic factors affecting milk yield, some constitute and lactation period of Awassi ewes. J. Tikrit Uni. Agri. Sci. 13(2):61-69.
- Alkass JE, AL-Azzawi WAR, AL-Tayy HM (2009). Milk production in Awassi sheep and their crosses with Assaf under accelerated lambing system. J. Zankoy Sulaimani. 12(1): (Part A) 7-12.
- Al-Samarai FR, Al-Anbari N (2009). Genetic evaluation of rams for total milk yield in Iraqi Awassi sheep. ARPN J. Agri. Biol. Sci. 4(3): 54-57.
- Eliya J, Juma KH (1970). Birth weight, weaning weight and milk production in Awassi sheep. Trop. Agri. Trin. 47(4): 321-324.
- Epstein H (1985). The Awassi sheep with special reference to the improved dairy type. Food and Agriculture Organization of the United Nations, Rome.
- Galal S, Gürsoy O, Shaat I (2008). Awassi sheep as a genetic resource and efforts for their genetic improvement-A review. Small Rumin. Res. 79(2-3): 99-108.
- Gootwine E (2011). Breeding Awassi and Assaf sheep for diverse management conditions. Trop Anim. Health Prod. 43(4):1289-1296.
- Gootwine E, Zenu A, Bor A, Yossafi S, Rosov A Pollott GE (2001). Genetic and economic analysis of introgression of the B allele of the FecB (Booroola) gene into the Awassi and Assaf dairy breeds. Livest. Prod. Sci. 71(1): 49-58.
- Hailat N (2005). Small ruminant breeds of Jordan. In: Iñiguez, L. (Ed.), Characterization of small ruminant breeds in West Asia and North Africa. Vol. 1: West Asia, ICARDA, Aleppo, Syria. Pp. 30-61.
- Hossamo HE, Owen JB, Farid MFA (1985). The genetic improvement of Syrian Awassi sheep with special reference to milk production. J. Agri. Sci. 105(2): 327-337.
- Iñiguez L, Hilali M (2009). Evaluation of Awassi genotypes for improved milk production in Syria. Livest. Sci. 120(3): 232-239.
- Jawasreh K, Alqaisi O, Awawdeh F, Al-Majali A, Eljarah A (2013). A Comparative performance study between Afec-Awassi crossbred, improved Awassi and local Awassi sheep reared intensively in Jordan. Jordan J. Agri. Sci. 9(2): 184-192.
- Jawasreh KIZ, Khasawneh AZ (2007). Studies of some economic characteristic on Awassi lambs in Jordan. Egyptian J. Sheep and Goats Sci. 2(2): 76-85.
- Karam HA, Juma KH, Al-Shabibi M, Eliya J, Abu-Almaali HN (1971). Milk production in Awassi and Hungarian Merino sheep in Iraq. J. Agric. Sci. 76(3): 507-511.
- Kassem R, Al-Azzawi W, Al-Najjar K, Masri Y, Salhab S, Abdo Z, El-Herek I, Omed H, Saatci M (2010). Factors influencing the milk production of Awassi sheep in a flock with the selected lines at the Agricultural Scientific Research Centre in Salamieh,Syria. Kafkas Uni. Vet. Fak. Derg. 16(3): 425-430.
- Macciotta NPP, Cappio-Borlino A, Pulina G (1999). Analysis of environmental effects on test-day milk yields of Sarda dairy ewes. J. Dairy Sci. 82(10): 2212-2217.
- Mavrogenis AP (1996). Estimates of environmental and genetic parameters influencing milk and growth traits of Awassi sheep in Cyprus. Small Rumin. Res. 20 Small Ruminant Research: 141-146.
- Pollott GE, Gootwine E (2001). A genetic analysis of complete lactation milk production in improved Awassi sheep. Livest. Prod. Sci. 71(1): 37-47.
- Pollott GE, Gürsoy O, Kirk K (1998). Genetic of meat and milk production in Turkish Awassi sheep. In: Proceedings of the 6th World Congress on Genetics Applied to Livestock Production (Armidale,

Australia). Pp. 177-182.
- Said R, Kridli T, Muwalla MM (1999). Estimation of milk yield in suckled Awassi sheep under traditional feeding conditions. J. Appl. Anim. Res. 16(3): 162-168.
- Sakul H, Boylan WH, Shrestha JNB (1999). Animal model evaluation of dairy traits in US sheep breeds, their crosses and three synthetic populations. Small Rumin. Res. 34(1):1-9.
- SAS Institute (2010). The SAS System for Windows, Release 9.1. SAS Inst. Inc., Cary, NC.
- Tabbaa MJ, Al-Azzawi WA, Campbell D (2001). Variation in fleece characteristics of Awassi sheep at different ages. Small Rumin. Res. 37(1-2): 131-135.
- Zarkawi M, Al-Merestani MR, Wardeh MF (1999). Induction of synchronized estrous and early pregnancy diagnosis in Syrian Awassi ewes, outside the breeding season. Small Rumin. Res. 33(1): 99-102.