

Study Effect of Breed on Milk Production Traits and their Regression on Weight in Local and Cypriot Goats

¹ Doha Salah Jameel  ² Abdallah Hameed Salim 

Department of Animal Production - College of Agriculture and Marshlands, University of Thi – Qar, Thi – Qar, Iraq.

¹E-mail: .post.2022@utq.edu.iq

²E-mail: Abdallah@utq.edu.iq

Abstract

The study was conducted on a group of goats in the Ruminant Research Station of the Agricultural Research Department. It aimed to study the effect of breed on milk production and its components, which include (daily milk production, milk protein percentage, milk fat percentage, milk lactose percentage and non-fat solids percentage) in both local and Cypriot goats, and to study correlation and regression coefficient between studied traits, for effect of goat breed (local and Cypriot) on milk production traits and its components. The results indicated that there were no significant differences between two breeds with respect to trait (total milk production, number of milking days, peak production, fat percentage and protein percentage). Also noted that local goats superiority Cypriot goats in trait of total milk production, number of milking days, peak production and protein percentage. As for trait of fat, and noted that Cypriot goats superiority local goats. The results indicated that there were highly significant differences ($P \leq 0.01$) with respect to the lactose trait, with local goats superiority Cypriot goats. There were also significant differences ($P \leq 0.05$) between two breeds for non-fat solids trait with superiority of local goats over Cypriot goats, most of correlations between studied traits were significant and medium to highly correlated and regression coefficient of these traits on birth weights, weaning and current weights were not significant at all levels of significance studied.

Keywords: Breed - Local and Cypriot goats - Milk components

Introduction

Goats are considered one of animals that have been exploited with high efficiency in many countries of the world due to their distinctive genetic ability that qualifies them to be a source of meat, in addition to their distinctive milk production with good specifications (Alberto et al., 2018). Goat milk is an important source of protein, fat, sugar, minerals and vitamins and high nutritional value that exceeds nutritional benefit of milk of other dairy farm animals (Haenlein, 1996) due to its medical aspect in treating many incurable diseases that humans suffer from due to its containing some important biological compounds such as lactoferrin and lysozyme (Raynal-Ljutovac et al., 2008) and its containing small fat granules and also high concentrations of calcium salts that are beneficial for children (Haenlein, 2002). The number of goats in Iraq reached 1,282,856 heads (FAO, 2019). It is one of the most adaptable animals to harsh environmental conditions and can maintain its productivity despite scarcity of feed and poor pastures compared to sheep and cows (Ibtisham et al., 2017). Therefore, improving productivity of these animals is important, especially by using breeds that have a large scope for genetic improvement, as it works to fill part of deficit resulting from scarcity of meat and milk and their high prices (Al-Hamdani, 2000). The Ministry of Agriculture, represented by the General Authority for Agricultural Research, worked to import Cypriot goats with aim of developing a plan to improve local goats by crossing them with Cypriot goats due to their high milk productivity and high twinning rate, and also for purpose of spreading the distinctive genetic compositions among local animals to increase their milk and offspring productivity.

Materials and methods

The study was conducted at the Ruminant Research Station of Agricultural Research Department / Ministry of Agriculture for period from 11/1/2023 to 3/1/2024. The study included 30 local goats and 30 Cypriot goats, aged between (4-2) years. Milk production and analysis of milk samples included milking the animals once a day, where newborns were isolated from mothers in the evening and milked in the morning. After that, newborns were released to mothers. Milk samples were taken from each animal weekly and analyzed to determine the proportions of components in the milk using device (Juli Z7- Scop Electric), which works by sensors located inside a tube, where sends signals to the device. Measurements of milk components and traits included the following (protein percentage in milk, sugar percentage in milk, fat percentage in milk, percentage of non-fat solids). The total milk production was also calculated using the following equation:

Total milk production (kg) = Daily milk production x Number of milking days

The test data were statistically analyzed using the ready-made statistical program SAS (2012) (Statistical Analysis System), and applied completely randomized design (CRD) to study effect of breed on the studied traits in goat samples. Duncan's multiple range test (Duncan, 1955) was used to compare significant differences between the means of the traits.

Results and discussion

Table (1) shows that there are no significant differences between two breeds with regard to the total milk production trait, despite the arithmetic superiority of local goats over Cypriot goats, as the total production rate of local goats reached (244.84) liters, while in Cypriot goats the total milk production rate reached (208.900) liters. The results of this study were contrary to what Al-Azzawi et al. (2018) reached, who concluded that there were significant differences in total milk production between the local Iraqi and Damascus goat breeds, as production of local goats reached (201.71) liters, while in Damascus goats the percentage was lower (160.41) liters, and it also does not agree with what Al-Azzawi (2015) reached, that there is significant difference between local goats and Cypriot goats in Iraq, as total milk production in Cypriot goats was higher than in local goats, the production percentage of Cypriot goats reached (221.31) liters, while in local goats it reached (149.84) liters, while ratio of (local x Cypriot) ratio reached (171.51) liters. Also, there is contradiction between what Kamal El-Din et al. (2020) showed in a comparative study conducted between Saudi Aradi goat and the Damascus goat, where he concluded that the total milk production of the Aradi goat is less than Damascus goat, and the percentage reached (199.518, 216.793) liters for the two breeds, respectively. Azzaka et al. (2007) mentioned the presence of significant differences in total milk production, thus differing with the results of the current study between local Libyan goat breed and Cypriot goat, as production of local goat reached (64.10) kg, that is less than Cypriot goat (83.24) kg.

Table (1) Effect of goat breed (local and Cypriot) on milk production traits and components

| Trait / Breed | No. | local goat | Cypriot goat | S. |
|---|-----|----------------|----------------|----|
| Total milk production (liter) | 31 | 34.274± 244.84 | 17.252±208.900 | NS |
| Number of milking days (day) | 31 | 10.137±213.354 | 7.277±191.903 | NS |
| Peak production (liter) | 31 | 1.533±38.064 | 1.680±34.645 | NS |
| Fats% | 31 | 0.231±2.917 | 0.173±3.046 | NS |
| Protein% | 31 | 0.033±3.083 | 0.040±2.937 | NS |
| Lactose% | 31 | A 0.0426±4.503 | B 0.054±4.330 | ** |
| Non-fatty solids% | 31 | A 0.072±8.251 | B 0.079±7.999 | * |
| NS (P≤0.01) :** (P≤0.05) :* The means with different letters within one column are significantly different | | | | |

Also note from the table that there are no significant differences in the number of milking days in both breeds, despite simple arithmetic superiority of local goats in this trait, as percentage reached (213.354) days, while in Cypriot goats it reached (191.903) days. The results of current study do not agree with what Al-Azzawi et al., (2015), reached, as reached existence of significant differences in length of milk season or (number of milking days), as local goats outperformed Cypriot goats and number of milking days in it reached (188.46) days, while in Cypriot number of milking days was less (172.51) days, and in (local x Cypriot) cross, the result was less than local and higher than Cypriot and reached (177.67) days. Results of current study were contrary to what was reached by GÜLER et al. (2007), as results showed presence of highly significant differences between breeds (Damascus goats and German goats Peon x hybrid hair goats B1) (hybrids), as hybrids were superior in milking period, reaching (257.6) days, While in Damascus goats it was less and reached (244.5) days.

From Table 4-6, also note that there are no significant differences between local and Cypriot goat breeds for peak production trait, although highest amount of milk produced during the milking period was from local goats, which amounted to (38.064) liters, while percentage was lower in Cypriot goats, which amounted to (34.645) liters.

Results indicated that there were no significant differences between local and Cypriot goat breeds in percentage of milk fat, despite the slight superiority of Cypriot goat, which was 3.046% in Cypriot, and 2.917% in local. The results of current study agree with what Al-Azzawi and others (2015) reached, that there were no significant differences between three genetic groups (local, Cypriot and their hybrid). It also agrees with the results of study of Azaka et al. (2007) that there were no significant differences between local Libyan goat breed and Cypriot goat in the percentage of fat, although the percentage of fat in Cypriot goat breed was higher than in Libyan goat (3.51, 2.28)%, respectively. The results also came in agreement with what Çak et al. (2021) reached, that there were no significant differences between hair goat breed and goat mix (Saanen x hair goat) first generation, as percentage of fat in hair goat reached (3.98)% higher than in mix (3.80)%.

It differs from what Kamal El-den et al. (2020) reached regarding presence of highly significant differences ($P \leq 0.01$) in the percentage of fat between two breeds, which was higher in Damascus goats compared to Aradi goats (4.252 and 3.901%), and it was contrary to what Khalil and Al-Azzawi (2018) reached, who indicated presence of significant differences in percentage of fat, as a higher percentage of fat was recorded in local goats compared to Damascus goats (3.54, 3.16)%, respectively, and results contradict what GÜLER et al. (2007) reached regarding presence of significant differences in percentage of fat between Damascus and hybrid breeds, and percentage was higher in hybrids than in Damascus and reached (4.55, 4.02).

As for protein trait, there were no significant differences between two breeds, but protein percentage in local goat breed was higher than that of Cypriot goat, reaching (3.038, 2.937)%, respectively. The results of the study agree with what Khalil and Al-Azzawi (2018) concluded, as they concluded that there were no significant differences in protein percentage between local and Shami goat breeds, despite superiority of the local goat by (3.57) over Shami goat (3.42)%. The results of current study also agree with what Al-Azzawi and others (2015) concluded, as he indicated that there were no significant differences between three genetic groups, as protein percentage in Cypriot goat was higher, followed by mixed goat breed (Cypriot x local), and finally local, and percentage reached (3.00, 2.99, 2.96)%. It also agrees with what Azzaka and others (2007) concluded, that there were no significant differences between local Libyan goat breeds and Cypriot goat for protein percentage trait, and protein percentage in Cypriot goat reached (3.22)% and less than that in local goat (3.20)%.

The results of study contradict what Kamal El-den and others (2020) reached, as they reached conclusion that there were highly significant differences between Aradi and Damascus breeds, and protein percentage in Damascus goats was higher than in Aradi goats (3.600, 3.259)%.

As for lactose (milk sugar), the results indicated presence of highly significant differences ($P \leq 0.01$) between two breeds, as results show superiority of local goats by (4.503)%, higher than Cypriot goats (4.330)%, and this result is consistent with what was reached by AL-Qasimi et al., (2020), as he reached presence of significant differences between the Awassi and Arabi sheep breeds with regard to milk sugar, as Awassi outperformed by (5.51)% higher than Arabi (4.89)%, but this result differed from Al-Azzawi et al., (2015) in the absence of significant differences between breeds with regard to lactose, as he found a non-significant superiority of crossbred goats over both local and Cypriot goats with the following



percentages (4.49, 4.43, 4.41)%, which also contradicts what was reached by Çak et al., (2021) There are no significant differences between hair goat breed and goat mix (Saanen x hair goat), the percentage of lactose sugar in hair goats is higher than in mix goats and in the following percentages (5.24, 5.08)%.

Statistical analysis showed in this study that there were significant differences between local and Cypriot goat breeds regarding non-fat solids characteristic in goat milk, as percentage of non-fat solids in local goat was higher (8.251)% than in Cypriot goat (7.999)%. These results differ from what Çak et al. (2021) reached, which showed that there were no significant differences between hair goat breed and first generation (Saanen x hair goat) goat, as the hair goat was superior by (9.54)% higher than racket goat (9.24)%.

The environmental factors surrounding the animal are considered among most important factors that may affect the components of milk in general and thus affect their variation or lack thereof (Zaid and Ahmed, 1994). Most of changes that occur in composition of goat milk may be due to the nutritional factor (Wilkinson and Stark, 1987). Therefore, lack of significance between most of studied traits between two breeds may be due to equality of two breeds in their influence by the surrounding environmental conditions, such as weather conditions, nutrition, and others.

Table (2) shows multiple regression values of studied traits on birth, weaning and current weight. The results indicate that the values of regression coefficient ranged between positive and negative for all studied traits in both local and Cypriot breeds together, where the regression value of trait of total milk production on birth weight was 0.156 kg/kg, at weaning -0.80 kg/kg and at current weight -0.81 kg/kg, and all of them were insignificant as in the rest of other traits, whose values ranged between negative and positive as shown in the table below.

Table (2) show regression coefficient of studied traits on birth , weaning weights and current weight

| Trait | Regression coefficient on birth weight | Regression coefficient on weaning weight | Regression coefficient on current weight |
|----------------------------|--|--|--|
| Total milk production | 0.156 ^{NS} | - 0.806 ^{NS} | - 0.814 ^{NS} |
| Peak production | 3.303 ^{NS} | - 0.326 ^{NS} | - 0.054 ^{NS} |
| Number of milking days | 0.300 ^{NS} | -2.729 ^{NS} | -0.618 ^{NS} |
| Milk fat percentage | -0.438 ^{NS} | 0.055 ^{NS} | -0.010 ^{NS} |
| Milk protein percentage | -0.060 ^{NS} | 0.010 ^{NS} | -0.005 ^{NS} |
| Lactose percentage in milk | -0.090 ^{NS} | 0.003 ^{NS} | -0.005 ^{NS} |
| Non-fat solids percentage | -0.109 ^{NS} | 0.009 ^{NS} | -0.011 ^{NS} |
| NS | | | |

It was expected that if the values were significant, the means of the dependent traits (milk production traits and its components) would be predicted to increase or decrease for the followed traits (three weights above), each according to its mean.

The results from Table (3) indicated the values of simple correlation coefficients between the milk production traits and its components in both local and Cypriot breeds, as it was shown that there was a high and highly significant correlation between each of total milk production and the number of milking days (0.65) and a medium significant correlation between total milk production and percentage of lactose in milk (0.32).

Table (3) show simple correlation between studied traits

| Trait | Total milk production | Peak production | Number of milking days | Milk fat percentage | Milk protein percentage | Lactose percentage in milk | SNF% |
|-----------------------------|-----------------------|----------------------|------------------------|---------------------|-------------------------|----------------------------|---------------------|
| Total milk production | - | -0.068 ^{NS} | 0.652 ^{**} | 0.269 [*] | 0.190 ^{NS} | 0.321 ^{**} | 0.205 ^{NS} |
| Peak production | -0.068 ^{NS} | - | -0.043 ^{NS} | 0.135 ^{NS} | 0.106 ^{NS} | 0.153 ^{NS} | 0.157 ^{NS} |
| Number of milking days | 0.652 ^{**} | -0.043 ^{NS} | - | 0.260 [*] | 0.043 ^{NS} | 0.287 [*] | 0.221 ^{NS} |
| Milk fat percentage | 0.269 [*] | 0.135 ^{NS} | 0.260 [*] | - | 0.338 ^{**} | 0.413 ^{**} | 0.447 ^{**} |
| Milk protein percentage | 0.190 ^{NS} | 0.106 ^{NS} | 0.043 ^{NS} | 0.338 ^{**} | - | 0.778 ^{**} | 0.765 ^{**} |
| Lactose percentage in milk | 0.321 ^{**} | 0.153 ^{NS} | 0.287 [*] | 0.413 ^{**} | 0.778 ^{**} | - | 0.890 ^{**} |
| SNF% | 0.205 ^{NS} | 0.157 ^{NS} | 0.221 ^{NS} | 0.447 ^{**} | 0.765 ^{**} | 0.890 ^{**} | - |
| NS (P≤0.01) :** (P≤0.05) :* | | | | | | | |

Also noted that there was no significance between all correlations of the peak production trait and other studied traits, while the level of significance ranged between significant and non-significant in the correlation of each percentage of protein and percentage of non-fat solids with rest of other traits, and each percentage of milk fat and percentage of lactose in milk gave a significant correlation with all traits except for their correlation with peak production trait, which was not significant. These results agreed in some ways and differed in others with what Al-Dabbagh (2019) reached in his study on Awassi and Hamdani sheep in Iraq and Al-Samarrai (2012) in her study on Iraqi Awassi sheep.

Association between different traits can be explained by phenomenon of multiple gene effect, which is result of effect of one gene or a group of genes on one or more traits at same time. Or we can attribute association between different traits to short crossing distance between genes that affect more than one trait, which increases correlation coefficient between these traits (Jalal and Karam, 1986).

References:

- Al-Azzawi, Zaid Mohammed Mahdi, Saeed, Saad Ibrahim, Neda, Saad Mohammed, (2015). Factors affecting total milk production and length of the milk season in Cypriot and local goats and their hybrids. *Karbala Journal of Agricultural Sciences* (Volume Two - Issue Four).
- Al-Azzawi, Saleh Hassan Jassim, Khalil, Zainab Sami, (2018). Estimation of genetic parameters and some non-genetic factors for milk production and its components in local goats. *Department of Animal Production - College of Agriculture - University of Diyala, Diyala Journal of Agricultural Sciences DJAS*, 01(2): 35-22 21.
- Al-Barzanji, Yousef Mohammed Saleh, Zainal, Fahd Koura, (2023). Genetic evaluation of milk production in local goats, *Department of Animal Resources, College of Agricultural Engineering Sciences, Salahuddin University - Erbil, Iraqi Journal of Agricultural Sciences*: 54 (6): 1548-1556.
- Alberto, F. J., Boyer, F., Orozco-terWengel, P., Streeter, I., Servin, B., de Villemereuil, P., Benjelloun, B., Librado, P., Biscarini, F., Colli, L., Barbato, M., Zamani, W., Alberti, A., Engelen, S., Stella, A., Joost, S., Ajmone-Marsan, P., Negrini, R., Orlando, L., Rezaei, H. R., Naderi, S., Clarke, L., Flicek, P., Wincker, P., Coissac, E., Kijas, J., Tosser-Klopp, G., Chikhi, A., Bruford, M. W., Taberlet, P., & Pompanon, F. (2018). Convergent genomic signatures of domestication in sheep and goats. *Nature Communications*, 9, 813.



- Al-Dabbagh, Sameem Fakhri, (2019). Study of the relationship between milk production and some of its components with the growth of lambs in two breeds of Iraqi sheep. Department of Animal Production, College of Agriculture and Forestry, University of Mosul, Mosul, Iraq, Iraqi Journal of Veterinary Sciences, Volume 33, Issue 2 (95-87).
- Al-Hamdani, Wahbi Abdul Qader Salman, (2000). Study of the effect of some environmental and physiological factors on the production and composition of milk in genetic groups of goats, PhD thesis, College of Agriculture - University of Baghdad.
- Al-Qasimi, R. H., Abbas, S. M., & Al-Khauzai, A. L. D. (2020). Effect of breed and some non-genetic factors on milk production and some proportions of its chemical components in two breeds of local sheep. Al-Qadisiyah Journal for Agricultural Sciences, 10(1), 227-231. ISSN: 2618-1479.
- Al-Samarrai, Wafaa Ismail, (2012). Predicting some growth traits through milk production and length of the production season in Awassi sheep. Al-Anbar Journal of Veterinary Sciences (2012); 5 (2) (1-6).
- Azzaka, Ibrahim, Ahtash, Abdul Karim, Majeed, Ayyad, Abu Saq, Fathi, Bayala, Abdullah. (2007). "Improving the performance of Libyan goats (local) by crossbreeding them with Cypriot goats (Shami) - 3: Milk production and some milk components of first generation females". Journal of Sabha University, Volume 6, Issue 1.
- Çak, B., Yılmaz, O., Ocak, E., & Demirel, A. F. (2021). A study on the milk composition of hair goat and saanen x hair goat crossbreed (f1) under semi-intensive conditions. Journal of Agricultural Sciences (Tarım Bilimleri Dergisi) , 27(1), 51-60. e-ISSN: 2148-9297.
- Duncan, D. B. (1955). Multiple range and multiple f tests. Biometrics 11:1.
- FAO .(2019), FAO Statistical Database . www.Faostat.fao.org.
- Güler, Z., Keskin, M., Masatçioğlu, T., Gül, S., & Biçer, O. (2007). Effects of breed and lactation period on some characteristics and free fatty acid composition of raw milk from damascus goats and german fawn x hair goat b_1 crossbreeds. Turkish Journal of Veterinary & Animal Sciences, 31(5), Article 10.
- Haenlein, G. (1996). Status and prospects of the dairy goat industry in the state. Journal of Animal Science, 74, 1181–1186.
- Haenlein, G. (2002). Composition of goat milk and factors affecting it. Small Ruminant Research, 15, 127–132.
- Ibtisham, F., Li, Z., Mei, X., Lilong, A., Muhammad, B. R., Aamir, N., Yi, Z., Guanghui, L., & Ying, M. X. (2017). Genomic selection and its application in animal breeding. Thai Journal of Veterinary Medicine, 47(3), 301–310
- Jalal, Salah and Hassan, Karam, (1986). Animal Husbandry. Fifth Edition, Dar Al-Maaref, Cairo.
- Kamal El-Den, M. A., Mohammed, K. M., & Dahmouh, A. Y. (2020). Genetic evaluation of milk yield and milk composition of Saudi Aradi and Damascus goats. Archives of Agriculture Sciences Journal, 3(2), 118-126. Available online at www.agricuta.edu.eg.
- Raynal-Ljutovac, K., Lagriffoul, G., Paccard, P., Guillet, I., & Chilliard, Y. (2008). Composition of goat and sheep milk products. Small Ruminant Research, 79, 57–72.
- SAS.(2012). Statistical analysis system, user’s guide . statistical . version 9.1 th ed. SAS. Inst.Inc. Cary. N.C. USA .
- Wilkinson, J. M., & Stark, B. A. (1987). Commercial goat production (1st ed.). London, UK: BSP Professional Books.
- Zaid, A.A. and Ahmed, M.Kh.A., (1994). Dairy cows, principles, applications, problems and solutions. Publications of Omar Al-Mukhtar University, Al-Bayda, Libya.