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Breed Effect and Genetic Characterization of the THRSP Gene in Local and Shami Goats

Huda Rahman Fager, Abdullah Hameed Salim

[1-2]Department of Animal Production, Faculty of Agriculture and Marshlands, University of Thi-Qar, Thi-Qar,Iraq.

E-mail: Huda.post.2022@utq.edu.iq

E-mail :Abdallah@utq.edu.iq

Abstract

This study was conducted at the Ruminant Research Station affiliated with the Agricultural Research Directorate. The study aimed to investigate the effect of goat breed on body dimension traits (chest circumference, body length, height at the withers, and height at the rump), growth traits (birth weight, weaning weight, average daily gain from birth to weaning, and current weight), and the genetic variation among the studied traits as well as the genetic characterization of the local and Shami goat breeds.The results showed that the studied growth traits were not significantly affected by breed, with no notable differences among the three genotypes (CC, GC, GG) of the targeted gene segment THRSP in the local goats. Similarly, in the Shami goats, no significant differences were observed among the three genotypes for any of the growth traits.Furthermore, the results indicated that there were no significant effects of the three genotypes (CC, GC, GG) resulting from the 322.G>C mutation on body dimension traits in either of the two breeds (local and Shami). It was also observed that the genotype GG had a higher frequency than the other two genotypes (CC and GC) in both local and Shami goats.Regarding the biodiversity indicators for the studied gene THRSP, both local and Shami breeds showed a lower effective allele number compared to the actual allele number. The Shannon-Weiner index showed weak or low values in both breeds. The homogeneity index (E) in both breeds indicated a near-complete homogeneity among genotypes, approaching a value of 1. However, the genetic differentiation index reflected a degree of genetic variation between the two breeds (local and Shami), while the gene flow rate was high, indicating strong gene exchange between the two breeds.

Key words: breeds, THRSP gene, Genetic Characterization, goats.

I. Introduction

Livestock holds great importance in the Iraqi national economy, as it plays a crucial role in achieving food security. Scientific attention to livestock and efforts to develop and improve it contribute significantly to increasing food production. Animal production occupies a prominent position within the agricultural economy due to its vital role in production growth and economic development (Al-Tarabany et al., 2015).Among livestock species, goats are considered more efficient and economically superior compared to other animals. They are dual-purpose animals, raised for both milk and meat production (Al-Jubouri, 2012). Recent studies have confirmed that goats are ideal animals for harsh climates, as they are better able to tolerate varying temperatures and drought conditions, in addition to their strong resistance to diseases (Serradilla et al., 2018).Studying the genetic characteristics of local breeds is essential for conserving their genetic diversity(Thbit, et all.2021). Moreover, the performance traits of animals are

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important as they directly influence the economics of livestock production (Shojaei et al., 2007).This study aimed to investigate the effect of breed on the studied traits in both local and Shami goats, and to examine biodiversity indicators and genetic variation in the THRSP gene across the two studied breeds.

II. Materials and Methods

This study was conducted during the period from October 1, 2023, to April 1, 2024. The study included 62 female goats that had given birth — 31 local goats and 31 Shami goats aged between 2 to 5 years. The research was carried out at the Ruminant Research Station affiliated with the Agricultural Research Directorate / Ministry of Agriculture. The laboratory section involved conducting molecular genetic tests to determine the genotypes of the mutations within the studied segment of the THSRP gene. Three milliliters of blood were drawn from each goat's jugular vein into an evacuated collection tube containing an EDTA K3 anticoagulant, and were transferred in a refrigerated container to the laboratory and preserved in the freezer. Then, the genetic material (DNA) was extracted for molecular testing of the targeted segment of the THRSP gene. DNA was extracted from blood samples of the local and Shami goat breeds using the extraction kit prepared by Geneaid and according to the extraction kit instructions. Molecular examination of the gene was performed using electrophoresis at an electrical voltage of 70 volts and 85 milliamps for half an hour after the migration process was completed. The agarose gel was examined using a UV Gel Documentation device, and migration images were taken using a camera installed and designated for this purpose. THRSP gene-specific primers were prepared for molecular screening, identification of mutations in the THRSP gene, and phenotypic analysis of the studied traits. Forward Primer: 5'-AGTCTGCGGGACTCCATATG-3'
Reverse Primer: 5'-AAAATGGGACAGGCCATGT-3'
(Source: Ghasemi et al., 2022)

Growth traits and body dimensions were measured using station records and a regular tape measure. The data were statistically analyzed using the Statistical Analysis System (SAS, 2018). Duncan's Multiple Range Test (Duncan, 1955) was employed to compare the significant differences between the means.

III. Results and Discussion

Table 1 shows that there were no significant differences between the two goat breeds (local and Shami) in terms of growth traits and body dimensions. These findings are consistent with those of Al-Khazraji et al. (2016), who also reported no significant differences between local and Shami goats. However, they contradict the results of Al-Fikiki et al. (2015), who found significant differences in birth weight, with Shami kids outperforming local kids (3.15 kg vs. 2.86 kg, respectively). Similarly, the results differ from those of Al-Azzawi et al. (2011), who observed highly significant differences, where local kids (3.79 kg) outperformed Shami kids (3.36 kg). The same table also indicates no significant differences between the two breeds in weaning weight, despite a slight numerical superiority of Shami goats over local ones (15.048 kg vs. 13.983 kg). This result contradicts the findings of Al-Khazraji et al. (2016), who reported a significant breed effect on weaning weight, with Shami kids (15.23 kg) outperforming local kids (14.26 kg). It also differs from the findings of Abdulrahman et al. (2006), who reported that Shami goats had higher weaning weights at 15 weeks (14.109 kg) compared to local goats (12.04 kg). This discrepancy may be due to genetic variation in weaning weight, birth weight differences, and the quantity of milk available during lactation. Similarly, the table shows no significant differences between the two breeds in average daily weight gain, despite a slight superiority of Shami goats over local goats (12.696 g vs. 11.474 g). This finding is consistent with Al-Fikiki et al. (2015), who reported no significant differences between the two breeds in daily weight gain.

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Table 1: Effect of breed on growth and body dimensions traits

Growth traits(kg)					
Trait\breed	**No**	**Birth weight**	**Weaning weight**	**Gain**	**Current weight**
Local goat	31	0.117 ±2.509	0.514±13.983	0.506 ±11.474	1.328 ± 42.096
Shami goat	31	0.107 ±2.351	0.569 ±15.048	0.554±12.696	1.884 ±45.774
Significant	62	NS	NS	NS	NS
Body dimensions					
Trait\breed	**No**	**chest width**	**body length**	**Front height**	**rear height**
Local goat	31	0.966± 83.580	0.846 ± 83.258	0.647 ± 76.612	0.741±78.516
Shami goat	31	1.299± 84.870	1.191 ±82.806	0.798 ± 76.806	0.819 ± 78.903
Significant	62	NS	NS	NS	NS
NS: Non-significant					

Additionally, no significant differences were observed in the current weight of the goats, although Shami goats recorded a higher average weight (45.774 kg) compared to local goats (42.096 kg). In terms of body dimensions, the table shows no significant differences between the two breeds in chest width, despite a slightly higher numerical value for the Shami goats (84.870 cm vs. 83.580 cm). This result contradicts Al-Khazraji et al. (2016), who reported significant differences between the two breeds for this trait.

Regarding body length, no significant differences were found between the breeds, with averages of 83.258 cm for local goats and 82.806 cm for Shami goats. Similarly, front height did not differ significantly between the breeds (76.612 cm vs. 76.806 cm for local and Shami goats, respectively). This result contradicts Jimmy et al. (2010), who found significant breed differences in body length and front height, with Mubende and Teso breeds outperforming the Lugware breed. However, the findings are consistent with those of Al-Azzawi et al. (2015), who found no significant breed effect, despite a numerical superiority of Shami goats in both body length and front height.The same trend was observed in rear height, with no significant differences between the breeds. The averages were 78.516 cm for local goats and 78.903 cm for Shami goats.The lack of significant breed effects on growth traits and body dimensions in both local and Shami goats may be due to the similarity of the two breeds in their ability to grow under the same environmental conditions, which minimizes genetic differences. Additionally, crossbreeding and interbreeding between the two breeds over several generations may have obscured the influence of the original breed. It is evident from Table (2) that the observed and expected numbers of local goats carrying the homozygous dominant genotype GG of the THRSP gene were 18 and 16 individuals, respectively. This genotype had a higher frequency compared to the other genotypes GC and CC. The calculated Chi-square (χ^2) value was 6.68, which is greater than the tabulated value of 3.84, indicating statistically significant differences among the frequencies of the three genotypes. This suggests a lack of equilibrium within the studied population, due to the discrepancy between the observed and expected genotype frequencies, calculated from allele frequencies.

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Table 2: THRSP gene genetic patterns of local goats, their observed and expected numbers, and the Chi-square value.

Genotypes	Observed No.	Expected No.	Chi-square	P. value
GG	18	16	0.25	P≤0.05
GC	8	13	1.93	
CC	5	2	4.50	
Total	31	31	6.68*	

Table 3: THRSP gene genetic patterns of Shami goats, their observed and expected numbers, and the Chi-square value.

Genotypes	Observed No.	Expected No.	Chi-square	P. value
GG	18	14	1.14	P≤0.05
GC	6	14	4.57	
CC	7	3	5.33	
Total	31	31	11.04*	

Similarly, as shown in Table (3) for the Shami goats, the results were comparable to those of the local breed, with the GG genotype also being the most prevalent, with 18 individuals, exceeding the numbers of GC and CC genotypes (as shown in Tables 4–10). A significant difference was also found among the three genotypes, as indicated by a Chi-square value of 11.04, which exceeds the critical value of 3.84. This also points to a lack of equilibrium in this group, caused by the mismatch between the observed and expected genotype distributions.Table (4) presents the calculated genetic diversity indicators for the studied THRSP gene within both the local and Shami goat populations. The observed heterozygosity (the proportion of individuals possessing two different alleles at a single genetic locus) in the local goats was 0.26, while the expected heterozygosity was higher, at 0.412. This discrepancy suggests the possible presence of inbreeding, internal breeding, or natural selection within the studied population.

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Table 4: Expected and observed zygotic heterozygosity and index of individual invariance within the group

Breed	Sample size	Observed heterozygosity	Expected heterozygosity	FIS
Local	31	0.26	0.412	0.369
Shami	31	0.19	0.439	0.567

Table 5: Biodiversity Indicators (Actual and Effective Number of Alleles, Shannon Index, and Fixation Index)

Breed	Sample size	Allele actual no. (Na)	Allele Effective No. (Ne)	Shannon-Weiner index)H'(
Local	31	2	1.70	0.869
Shami	31	2	1.78	0.910

Table 6: Indicators of Genetic Homogeneity, Genetic Differentiation, and Gene Flow Between the Two Genetic Populations.

breed	Sample size	homogeneity index (E)	Genetic Differentiation (GST)	Gene flow (Nm)
Local	31	0.824	0.0014	173.58
Shami	31	0.878		

Similarly, in the Shami goats, the results mirrored those of the local breed, with the expected heterozygosity (0.439) surpassing the observed value (0.19), likely due to the same underlying causes mentioned above.From the same Table (4), it is observed that the inbreeding coefficient (FIS) values for both the local and Shami goat populations were 0.369 and 0.567, respectively. Since these values are greater than zero, this indicates a deficit in heterozygosity, which is likely due to inbreeding or internal breeding practices within the herd.The results of Table (5) regarding biodiversity indicators showed that the actual number of alleles for the THRSP gene in both breeds was equal to 2 at the studied genetic locus. However, the effective number of alleles in the two breeds was 1.70 and 1.78 for the local and Shami breeds, respectively. This reduction compared to the actual number is due to unequal gene frequencies or due to genetic drift in small populations, which leads to a faster loss of genetic diversity than expected based on the actual number

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of alleles (Na) (Weinreich, 2023).As for the Shannon-Weiner index in this study (which measures the diversity of genetic structures in terms of number and relative distribution of individuals), it reached 0.869 in the local goat and 0.910 in the Cypriot goat. These values indicate low or weak diversity, suggesting that one or two genotypes are relatively dominant in the studied populations (Begon et al., 1996).From Table (6), which presents indicators of genetic homogeneity, genetic differentiation, and gene flow, it is shown that the homogeneity index (E) was 0.824 for local goats and 0.878 for Shami goats. These values, being close to 1, indicate a high level of homogeneity among the genotypes within both populations. This suggests that the three genotypes are relatively evenly distributed, with most genotypes represented by similar numbers of individuals, implying that the population is relatively stable (Begon et al., 1996).Our results for the genetic differentiation index (Table (6)), which expresses the extent of genetic variation between the two studied groups (local and Shami), showed that its value reached 0.0014, indicating that only this very small percentage of genetic diversity explains the differences between the two studied groups or strains. The value of gene flow (Nm) reached 173.58, which is a very high gene flow indicating its strength between the two studied groups.

IV. References

Abdulrahman, F. Y., Wasoufi, M. K., & Jasim, A. K. (2006). Study of some productive traits of local, Shami, and crossbred goats. Mesopotamia Journal of Agriculture, 34(2), 30–36.

Al-Azzawi, S. H. J. (2011). Effect of crossbreeding between local and imported Shami goats on some productive traits under intensive rearing conditions (Doctoral dissertation, College of Agriculture – University of Mosul, Iraq).

Al-Fakeeki, A. A. R. M. (2015). Evaluation of growth and reproductive traits in Cypriot and local goats and their crossbreeds and the relationship of breeding values with some genetic markers (Doctoral dissertation, College of Agriculture – University of Baghdad, Iraq).

Al-Tarabany, F., Hamdi, Y., Sedqi, U., & Unis, A. (2015). Effect of adding rosemary (Rosmarinus officinalis) and licorice (Glycyrrhiza glabra).

Begon, M., Harper, J. L., & Townsend, C. R. (1996). Ecology: Individuals, populations, and communities (3rd ed.). Blackwell Science Ltd.

Crow, J. F. (2010). Wright and Fisher on inbreeding and random drift. Genetics, 184 (3), 609–611. https://doi.org/10.1534/genetics.109.110023

Hussein, R. M., & Al-Jubouri, K. O. S. (2012). Variation in some biochemical values associated with anemia cases in local goats. Proceedings of the Eleventh Scientific Conference – College of Veterinary Medicine, 77–85.

Jimmy, S., Mutetikka, D., Kugonza, R. D., & Mpaiwe, D. (2010). Variability in body morphometric measurements and their application in predicting live body weight of Mubende and Small East African goat breed in Uganda. Middle-East Journal of Scientific Research, 5 (2), 98–105.

SAS (2018). Statistical analysis system, user's guide. Statistical. Version 9. ed. 4th SAS. Inst. Inc. Cary. N.C. USA.

Serradilla, J. M., Carabaño, M. J., Ramón, M., Molina, A., Diaz, C., & Menéndez-Buxà, A. (2018). Characterisation of goats' response to heat stress: Tools to improve heat tolerance. Goat Science, 15, 329–347.

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https://jam.utq.edu.iq/index.php/main *https://doi.org/10.54174/utjagr.v13i1.323*

Shojaei, M., Abadi, M. M., Fozi, M. A., Dayani, O., Khezri, A., & Field, T. G. (2007). Beef production and management decisions (5th ed.). Prentice Hall.

Thbit,I.A.A., Abdulkareem,A.A. and Salim, A.H.(2021).Effect of CAPN3 gene genotypes on productive traits and carcass traits of broiler. University of Thi-Qar Journal of Agriculture Research,10(1),13-24.

Wasan, J. M. A., Al-Azzawi, Z. M. M., Abdullah, A. N., & Taha, A. A. (2016). Some factors affecting growth traits and body dimensions at weaning in Shami and local goats. Al-Anbar Journal of Veterinary Sciences, 9(1).

Weinreich, D. M. (2023). The foundations of population genetics. Cambridge, MA: The MIT Press.