Livestock Studies, 2024; 64 (1): 24-31
http://doi.org/10.46897/livestockstudies.1509804

RESEARCH ARTICLE

LIVESTOCK STUDIES

Investigation of Some Environmental Factors on Reproductive Characteristics, Milk Traits and Kleiber Ratios of Kilis Goats Reared in the Fertile Crescent of Türkiye

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Article History
Received: 30.05.2024
Accepted: 25.06.2024
First Online: 03.07.2024

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Keywords
Environmental factors
Developmental characteristics
Milk yield
Keiber ratio

Abstract

This study was carried out to determine the effect of environmental factors on some yield traits in Kilis goats. For this purpose, 6000 heads of Kilis goats each year, and a total of 30000 goats and kids born from them for 5 years, were the subject of the research. Milk control in goats was calculated by the ICAR-AT method. At the end of the study, Average birth weight was 3.56 kg, weaning weight was 15.06 kg and daily live weight gain was 191.64 g in kids. KR value found to be 23.6±0.03 in kids. Lactation milk yield in mothers was determined as 367.64 kg. As a result, it was determined that environmental factors were effective on the reproductive parameters and milk yield characteristics of Kilis goats and the developmental characteristics of kids. The crucial determination of these factors in the breeding of this breed will increase the accuracy of selection. In addition, the success will also be increased by starting the transition from the traditional breeding approach to the genomic breeding method and by combining these two strategies.

Introduction

Agriculture plays a very important role in preventing poverty, ending hunger, ensuring food security, and making the whole world a happy and liveable place. At the same time, it is all the positive events that we can count on behalf of agriculture, science, engineering, health, technology, social life, culture, environment, and humanity. Agricultural production has created a wonderful product variety because of centuries-old traditions, the accumulation of experience in this field and the synthesis of the richness of the geography with the climate in Türkiye. Hosting different cultures in agricultural production, Türkiye has always made a name for itself among the countries of the world with its existing plant and animal genetic resources. In this geography, goat breeding has always kept its importance and raised as a hobby as well as a source of livelihood. For breeding, several studies have been conducted and are still being conducted (Gül *et al.,* 2016; Keskin *et al.,* 2016, 2017; Özdemir & Keskin, 2018; Kurtay, 2019; Gül *et al.,* 2022; Behrem *et al.,* 2022; Gül *et al.,* 2023). These studies span certain time frames, and most of them are brief. However, animal improvement is a long-term process, and it must be ongoing.

Reproductive characteristics and milk yields are always considered to be the most important factor in increasing productivity in some environmental conditions. The level of yield performance in farm animals depends on genetic and environmental factors. At the beginning of environmental factors are birth type, maternal age, herd management, year, season, and sex. Success in selection and breeding will rise with the identification of these parameters and the elimination of their negative impacts.

Growth characteristics such as birth weight, weaning weight and average daily weight gain are the most important indicator phenotypes for sustainable and economical production in goat breeding and for the farmer to make a more accurate selection decision. In addition, a major part of the income in goat breeding comes from selected animals. For this reason, the selection of animals with high daily weight gain and better feed conversion efficiency should be the main components of a successful goat enterprise. Measuring

the feed efficiency of animals in extensive farming is very difficult and impractical. For this purpose, different selection strategies have been developed according to the growth characteristics and feed conversion rates of animals (Ghafouri-Kesbi, 2011; Illa *et al.,* 2018; Gül *et al.,* 2023).

Kleiber ratio (KR) is a developed and widely used metric to calculate the feed conversion of animals and is calculated by dividing the average daily gain weight by the metabolic weight ($ADG/WW^{0.75}$) and the growth rate divided by the body weight (Kleiber, 1947). The Kleiber ratio, which is an indicator of feed conversion efficiency, can be used in the selection program to increase the biological efficiency of the herd.

The Kilis goat breed has been a very good adaptation to harsh environmental conditions and is widely raised in almost every region of Türkiye. Kilis goat breed is known for high reproductive characteristics and milk yield and is mostly raised in Gaziantep, Kilis, Şanlıurfa and Hatay provinces located on the fertile crescent of Türkiye (Keskin *et al.,* 2004; Gül, 2008; Gül *et al.,*2022; Keskin *et al.,* 2022).

A breeding program was started in 2011 by the General Directorate of Agricultural Research and Policies to improve milk and reproductive traits in Kilis goats under breeder conditions. In this context, some yield characteristics are investigated in goats.

In this study, within the scope of the breeding project carried out in Gaziantep between 2018-2022, the effects of different environmental factors on the reproductive and milk yield of Kilis goats and the developmental characteristics of kids were investigated, and the results were presented.

Among these environmental factors, seasonal differences between years affect the productivity of the whole flock, while birth type, maternal age, sex, and birth weight affect individual performance. Therefore, estimating the magnitude of all such parameters is critical to developing efficient and successful breeding plans.

In this study, the impact of various environmental conditions on the reproductive and milk yield of Kilis goats as well as the developmental traits of kids were examined, and the results were reported as part of the breeding project conducted in 2018-2022.

Materials and Methods

Animal Material and Management

Gaziantep is located at the junction of the Mediterranean Region and South-eastern Anatolia Region and between 36° 28' and 38° 01' east longitudes and 36° 38' and 37° 32' north latitudes. The climate is transitional between Mediterranean and Continental climates, and the Mediterranean climate predominates. Summers are hot and dry. Winters are very cold and rainy. The average precipitation is 550 millimetres. The temperature ranges between -17°C and 48.8°C. The data used in this study were obtained from goats (50 flocks) included in the improvement of Kilis goats under breeder conditions project within the scope of the National Public Small Ruminant Improvement Project in Gaziantep province. The animal material of the project consists of 6000 heads of females and 300 heads of male goats each year. The data of 30.000 goats and their offspring were analysed in this study. In the research region, there are a total of 55 different herds. The herds have a minimum size of 100 animals and a maximum of 250.

Mating in goats was carried out between August and September as free mating. The bucks were separated from the flocks at least 45 days before the mating. The number of goats mated per buck in a mating season varied from 20 to 25. Goats were exposed to bucks from the beginning of August to the end of September.

Animals were kept under extensive conditions. The goats are grazing in forest and open areas from early morning until late evening according to the seasonal conditions. Water needs were met from natural water resources in the pasture. Although the pasture areas differ in terms of the amount and quality of grass, they consist of pine forests, oak forests, maquis and annual grasses. During the heavy winter days and when the pasture is weak, 500-750 g of barley, bran, cotton seed grain and wheat straw were given as a feed mix per animal. Kids were suckled in the morning and evening and kept in the barn for up to one month of age. All offspring were fed with tree branches (leafy olive and oak branches), barley, wheat straw and kid-growing from 2 weeks of age and weaned at 60 days.

Data Collection

The kids were ear-tagged shortly after birth, and the mother's ear tag number, birth weight, birth date and gender were all noted. Weaning weights were recorded on the 60^{th} day to reveal the growth performance of the kids. Milk yield controls were started in goats that gave birth from the 15th day and continued until they were dry. Milking was done by hand by the breeder, and daily milk yield was determined at 28 days intervals according to the ICAR-AT method. The Fleischman method was used to determine lactation milk yield using the daily milk yield data (Gül, 2008). In this study, the data regarding the fertility parameters were calculated according to Keskin *et al.* (2017) as follows;

Pregnancy rate: (number of does give birth/number of does for mating) * 100

Infertility rate: (number of does not give birth/number of does for mating) * 100

Birth rate: (number of does give birth/number of does for mating) * 100

Single kidding rate: (number of does with single kid/number of does giving birth) * 100

Twinning rate: (number of does with twin kids/number of does giving birth) * 100

Triplet rate: (number of does with triplet kids/number of does giving birth) * 100

Litter size: (number of kids born/number of does giving birth) * 100

Kid yield: (number of kids born/number of does for mating) * 100

Statistical analyses

Statistical analysis on growth characteristics and lactation milk yield The data obtained from the project were evaluated with the SPSS statistical program in terms of basic statistical analysis (SPSS, 2012). For this purpose, Duncan's multiple comparison tests were used to compare birth and weaning weights. The mathematical model of Statistical analysis on growth characteristics and lactation milk yield is given in the following equation (Equation 1 and 2).

$$Y_{ijklm} = \mu + \alpha_i + \beta_j + p_k + \delta_l + e_{ijklm} \quad \text{(Eq. 1)}$$

In this model,

Y_{ijklm}, an individual observation,
μ, the overall mean
α_i, the fixed effect of sex (male, female),
β_j, the fixed effect of birth type (single, twin, triplet),
p_k, the fixed effect of the birth year (2018, 2019, 2020, 2021, 2022)
δ_l, the fixed effect of maternal age (1, 2, 3, 4, 5≥),
e_{ijklm}, the random error.

(Eq. 2)

$Y_{ij}=\mu+\alpha_i+\beta_j+e_{ij}$
In this model,
Y_{ij}, an individual observation,
μ, the overall mean

α_i, the fixed effect of maternal age (2, 3, 4, 5≥),

β_j, the fixed effect of the birth year (2018, 2019, 2020, 2021, 2022)

Results

All births were completed in February and March in approximately 45 days. The fertility characteristics of Kilis goats obtained between 2018-2022 are given in Table 1. The project requires that each herd must have 6000 head of goats available for mating.

The number of goats giving birth varied according to the years and birth was observed in all the goats in the last year of the study. Accordingly, the rate of multiple births in herds has also increased. Selection is made in herds every year, considering the birth weight, weaning weight and milk yield of the mothers. Multiple birth rates in herds may have increased due to selection.

The growth characteristics of kids calculated by the years are given in Table 2. As can be seen from this table, the birth weights of kids differed over the years, and these differences were found to be statistically significant (P<0.01).

An increase is observed in the birth weight of kids when they reach the last year of the study. It can be said that this increase in birth weight is because of the selection made every year in the herd and the improvement in care and feeding. In this table (Table 2), a different situation was displayed in terms of weaning weights in kids from birth weights. While this feature was fluctuating (P<0.01) until the beginning of 2022 in the project, there was a decrease in the last year. Especially in our country and the region, the severe seasonal conditions (winter) made it difficult for the goats to go out to the pasture and prevented the growth of annual grasses grown in the pasture in spring. Adverse weather conditions and deficiencies in supplementary feeding also affected milk yield, so the development of kids slowed down. This negativity experienced in the last year of the study also negatively affected the average daily earnings due to weaning, and the values obtained by years were found to be statistically significant (P<0.01).

Table 3 shows the growth characteristics of kids according to maternal age, sex, and birth type.

Even though the kid's birth weights are very similar, the age of the mother has an impact on the birth weights. (P<0.01). In this group, the lowest weight was determined in aged 4 (3.53 ± 0.01 kg) years and the highest in aged 5 and over (3.59 ± 0.01 kg) (P<0.01). The effect of maternal age was also seen on weaning weights and average daily gains, and both traits were found to be statistically significant (P<0.01). The highest weaning weight and ADG were observed in 2-year-old mothers (15.28 ± 0.02 kg and 195.57 ± 0.40 g).

It was determined that sex affected the birth weights of kids (P<0.01). Although this difference between males and females was expected, it was very low (3.60 ± 0.01 kg vs 3.52 ± 0.01 kg). The weaning

Table 1. Fertility characteristics by the years

Characteristics/Year	2018	2019	2020	2021	2022
Number of does for mating	6000	6000	6000	6000	6000
Number of does giving birth	5968	5980	5963	5951	6000
Number of born kids	7333	7314	7626	7458	7644
Number of weaned kids	7102	6696	7241	6914	7096
Number of single-born kids	4630	4644	4262	4438	4334
Number of twin-born kids	1338	1336	1635	1504	1639
Number of triplet-born kids	---	---	66	9	27
The fertility rate suitable for mating goats (%)	122.2	121.9	127.1	124.3	127.4
The fertility rate for giving birth (%)	122.9	122.3	127.9	125.3	127.4
Single kidding rate (%)	77.58	77.66	71.48	74.58	72.23
Twin kidding rate (%)	22.42	22.34	27.42	25.27	27.32
Triplet kidding rate (%)	---	---	1.10	0.15	0.45
Survival rate at weaning (60. days)	0.97	0.92	0.95	0.93	0.93
Kidding rate per does (%)	1.22	1.22	1.27	1.24	1.27
Kidding rate per birth (%)	1.23	1.22	1.28	1.25	1.27

Table 2. Developmental characteristics of the kids by the years (mean ± se)

Year	n	BW	n	WW	ADG	KR
2018	7098	3.50 ± 0.01^{b}	7098	14.95 ± 0.02^{c}	190.82 ± 0.43^{c}	25.0 ± 0.03^{d}
2019	7331	3.47 ± 0.01^{a}	6769	14.79 ± 0.02^{a}	188.70 ± 0.43^{b}	23.0 ± 0.08^{a}
2020	7625	3.60 ± 0.01^{c}	7247	15.46 ± 0.02^{e}	197.52 ± 0.33^{e}	24.0 ± 0.07^{c}
2021	7458	3.59 ± 0.01^{c}	6920	15.23 ± 0.01^{d}	193.94 ± 0.28^{d}	23.3 ± 0.08^{b}
2022	7643	3.64 ± 0.01^{d}	7100	14.86 ± 0.01^{b}	186.99 ± 0.23^{a}	22.9 ± 0.07^{a}
P		0.000		0.000	0.000	0.000
Overall	37155	3.56 ± 0.01	35134	15.06 ± 0.01	191.64 ± 0.14	23.6±0.03

BW, birth weight; WW, weaning weight; ADG, average daily gain; KR, Kleiber ratio

weight of kids was affected by sex (P<0.01). This value was calculated to be 15.20 0.01 kg for females and 14.92 0.01 kg for males. It was determined that gender was also effective in weaning weight and ADG. There is no significant numerical difference was observed between the sex groups in terms of both characteristics, but differences were found to be statistically significant (P<0.01).

The birth type has affected the birth weight, weaning weight and ADG. Average birth weight was found to be 3.59 ± 0.01 kg in single born, 3.52 ± 0.01 kg in twins and 2.76 ± 0.01 kg in twins. There was no statistical difference between single and twin-born kids, the difference between these two groups and triplets was found to be significant (P<0.01). It was determined that was found to have an impact on WW and ADG as well. There was no statistical difference between single and twins in terms of both characteristics(P>0.05), but a statistical difference was found between these two groups and those born with triplets (P<0.01).

The Kleiber ratio was developed as a reflection of feed conversion efficiency. While 2-year-old goats had the greatest KR value (24.1 0.07), it was found that the lowest KR value varied depending on the mother's age. a statistical difference was observed between 3 and over-aged and 2 aged in terms of KR (P<0.01). KR values were calculated to be close in female and male kids (23.7 ± 0.04 vs 23.5 ± 0.04). However, this difference was statistically significant (P<0.01). An interesting situation was revealed when KR values were evaluated according to sex. Normally, it was expected that single-born (23.2 ± 0.04) are to be higher than twins (24.3 ± 0.04) and triplets, while triplets received a higher value (25.3 ± 0.02).

Lactation milk yields adjusted for 210 days according to years and ages are given in Table 4.

It was observed that there is a systematic change in the milk yield of Kilis goats depending on age, and the effect of year and age has been determined. Accordingly, the effect of year and age on milk yields was determined (P<0.01). Lactation milk yields decreased in the last year of the study. Due to the long-lasting snowfall in the region, the goats could not be taken to the pasture, and due to the harsh weather conditions, seasonal grasses could not be grazed in sufficient quantities. An insufficient amount of supplementary feeding also caused a decrease in milk

Table 3. Developmental characteristics of kids in Kilis goats by the age of the mother, sex, and birth type (mean ± se)

Age	n	BW (kg)	n	WW (kg)	ADG (g)	KR
2	6002	3.54 ± 0.01[a]	5746	15.28 ± 0.02[d]	195.57 ± 0.40[d]	24.1 ± 0.07[b]
3	8173	3.58 ± 0.01[b]	7729	15.03 ± 0.01[b]	190.97 ± 0.29[b]	23.6 ± 0.06[a]
4	9174	3.53 ± 0.01[a]	8662	14.78 ± 0.01[a]	187.55 ± 0.30[a]	23.4 ± 0.06[a]
5 and over	13806	3.59 ± 0.01[b]	12997	15.17 ± 0.01[c]	193.02 ± 0.23[c]	23.6 ± 0.05[a]
P		0.000		0.000	0.000	0.000
Sex						
Male	18729	3.60 ± 0.01	17756	15.20 ± 0.01	193.23 ± 0.21	23.7 ± 0.04
Female	18426	3.52 ± 0.01	17378	14.92 ± 0.01	190.01 ± 0.20	23.5 ± 0.04
P		0.000		0.000	0.000	0.000
Birth type						
Single	22230	3.59 ± 0.01[b]	20667	15.11 ± 0.01[b]	191.90 ± 0.20[b]	23.2 ± 0.04[a]
Twin	14892	3.52 ± 0.01[b]	14434	15.00 ± 0.01[b]	191.29 ± 0.20[b]	24.3 ± 0.04[ab]
Triplet	33	2.76 ± 0.01[a]	33	13.45 ± 0.01[a]	178.16 ± 3.45[a]	25.3 ± 0.02[b]
P		0.000		0.000	0.003	0.000
Overall	37155	3.56 ± 0.01	35134	15.06 ± 0.01	191.64 ± 0.14	23.6 ± 0.03

BW, birth weight; WW, weaning weight; ADG, average daily gain; KR, Kleiber ratio

Table 4. Milk yield of Kilis goats (l)

Year	LMY	Age	LMY
2018	324.53±0.93[a]	2	348.19±1.27[a]
2019	359.06±0.97[b]	3	370.62±1.11[c]
2020	373.54±1.05[c]	4	381.19±0.94[d]
2021	408.19±1.02[d]	5 and over	362.98±0.85[b]
2022	359.63±1.30[b]		
P	0.000		0.000
Overall		367.64±0.51	

LMY, lactation milk yield

yield. It was determined that there is an increase in milk yield with the effect of selection made in the herd and the improvement of environmental factors.

Discussion

Table 1 shows reproductive characteristics of Kilis goats. Factors influencing reproductive performance in any animal can be classified as intrinsic or extrinsic. Extrinsic factors are associated with the environment, management practices, and farm conditions, whereas intrinsic factors are related to the genotype of the animal. Tatar *et al.* (2019) calculated the pregnancy rate as 95.30%, the birth rate as 99.30%, the single birth rate as 53.35%, the twin birth rate as 41.73%, the triplet birth rate as 4.08%, and the fertility rate as 150.70% in Kilis goats. Keskin *et al.* (2018) reported that the fertility range in Kilis goats was between 123-136%. Therefore, our results are in line with the reports of researchers.

The growth performance of kids determined by the years are given in Table 2. The variation in birth weight, weaning weight and average daily gain in different years can be considered a reflection of rainfall, environmental conditions, pasture quality, grass, and feed production. In animal production, effective reproduction is crucial for overall production. Goat reproduction is influenced by genetic factors and environmental with a high sensitivity to the latter (Song & Sol, 2006). Gül *et al.* (2016) reported that birth and weaning weights in Kilis goats are affected by the age of the mother, gender and year, and the average birth and weaning weights are 3.0 kg and 16.0 kg. Similarly, Özdemir & Keskin (2018) stated that the developmental characteristics of Kilis goat kids are affected by the environment. The differences between the numerical values obtained can be explained as there is a wide variation in Kilis goats and it is caused by environmental effects. Our results for growth performance correlated with a review of the literature.

Table 3 shows the developmental characteristics of kids of Kilis goats by the maternal age, sex, and birth type. Does age have a significant effect on the birth weight of kids. The significant influence of maternal age on the birth weight of kids was reported in previous studies (Elmas *et al.,* 2020; Ceyhan *et al.,* 2021; Gül *et al.,* 2022). Also, the dam's maternity ability affects the weaning weight of kids (Gül *et al.,* 2017).

It is well known that males are heavier birth weights than females. Researchers working on Kilis goats (Keskin *et al.,* 2017; Gül *et al.,* 2022; Keskin *et al.,* 2022) and other breeds (Kuthu *et al.* 2013; Dinçel *et*

al., 2019; Topbaş & Dağ, 2019; Erdem *et al.,* 2022) have published a research article on this subject. Also, sex affects growth characteristics due to the positive relationship between male gonadal cells and growth hormones related to growth performance (Mourad and Anous, 1998; Koşum *et al.,* 2004; Gökdal *et al.,* 2013).

In multiple pregnancies, due to the presence of multiple fetuses, the secretion of placental lactogen, progesterone and prolactin hormones, which are mammary gland stimulants, increases and more milk is produced (Lobo *et al.* 2017). However, females carrying multiple fetuses during pregnancy tend to produce more milk due to the lactation reflex and physiological mechanism that prepares the udder to produce more milk (Idowu and Adewumi 2017).

The analysis of the variance table revealed that maternal age, sex, and birth type had a significant effect on birth weight, weaning weight, and ADG. Keskin *et al.* (2018) reported that birth weight in Kilis goats was affected by maternal age, sex, and birth type. The birth weight in kids ranged between 3.4 and 3.7 kg, and weaning weight was between 11.9 and 12.8 kg in Kilis province. Gül *et al.* (2022) stated that environmental factors were effective on the developmental characteristics of Kilis goat kids in Gaziantep and calculated the average birth weight as 3.5 kg, weaning weight as 15.2 kg and average daily body weight gain of 193.4 g in kids. Our findings of the study were in partial agreement with the findings of many researchers (Zeleke, 2007; Adenaike and Bemji 2011; Güngör *et al.,* 2021; Keskin *et al.,* 2022; Tüfekci, 2023). The slight variations between the findings from this study and those from other studies are believed to be caused by the large variety of breeds, individual effects, and environmental factors.

The values we calculated for KR in Kilis goats were higher than the reports of researchers in different breeds (Supakorn & Pralomkarn, 2012; Kahadda *et al.,* 2018; Hammoud *et al.,* 2019). However, it is in agreement with the values obtained from Kilis goats by Gül *et al.* (2023). According to the results of this study, it can be said that environmental factors played a role on the Kleiber ratios in the kids of Kilis goats.

Descriptive values for lactation milk yield in Kilis goats are given in Table 4. Milk yield in animals increases with age due to increases in metabolic activity, hormone levels used in milk synthesis, secretory cells and food intake (Idowu and Adewumi 2017). Milk yield in goats increases physiologically up to 4-5 lactations and tends to decrease in subsequent lactation periods (Kaymakçı, 2006). Özdemir & Keskin (2018) reported lactation milk yield in Kilis goats as 212.8 kg in Gaziantep and 306.8 kg in Kilis provinces; Gül *et al.* (2016), on the other hand, found this value to be 293.7 l in the control group and 408.3 l in the supplemental feeding group in Hatay province; Daşkıran *et al.* (2022) reported the milk yield of Kilis goats as 201.05 kg in breeder conditions. Our findings the present study is higher than Özdemir & Keskin (2018) and Daşkıran et al (2022), in line with the report of Gül *et al.* (2016) in the supplementary feeding group.

Kilis goats are an important genetic resource that has been taken to different regions in Türkiye. Studies have been carried out on this breed in the regions where it is grown. Koşum *et al.* (2004) in İzmir, Alizadehasl and Ünal (2011) in Ankara, Gül *et al.* (2016) in Hatay, Tatar *et al.* (2019), in Diyarbakir, Keskin *et al.* (2018) Kilis province and Gül *et al.* (2023) in Gaziantep province conducted studies on progeny, milk yield and kid yield in Kilis goats. When all studies are compared, it is seen that milk yield performances in goats are very close to each other, but it can be said that the differences are caused by care, feeding and environmental factors. In addition, as seen in this study, there are serious variations between regions in Kilis goats. From this point of view, it becomes necessary to go a long way in terms of improvement.

Conclusion

Livestock activities should be evaluated with their economic, social, cultural and environmental aspects. If one of these components is absent, discussing sustainability will be challenging. The first step towards a well-structured and sustainable animal breeding and conservation program is to uncover detailed information about intra- and inter-species genetic diversity. This shows how important it is to reveal the genetic structure of the breeds.

Data from this study were provided under extensive farm conditions. The inclusion of modern breeding methods in this system, which is completely carried out in traditional and extensive conditions, will provide an increase in the quantity and quality of production and continuity in animal breeding.

Some reproductive traits and milk yield of Kilis goats that is one of the local genetic resources were investigated in this study. it is seen that there is a significant variation in Kilis goats. The reproductive parameters and milk yield are generally affected by factors such as year, age, management, nutrition and regional conditions in does. Also, it has been determined that non-genetic factors are effective on the growth characteristics of kids. It is crucial for selection to identify these environmental elements that have an impact on animal growth and development and to take them into account when choosing animals. In addition, taking the first steps from the classical breeding method to the genomic breeding method and using these two methods together will increase the success. If we make a general evaluation of Kilis goats, it can be easily said

that this breed has an important place for the country's economy.

Funding Information

This project was supported by Republic of Türkiye Ministry of Agriculture and Forestry General Directorate of Agricultural Research and Policies under National Public Small Ruminant Improvement Project in Gaziantep province (Project number: 27KLS2012-01).

Author Contributions

Sabri GÜL: Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Visualization and Writing -original draft; Mahmut KESKİN: Data Curation, Methodology, Visualization, Writing -review and editing; Şerafettin KAYA: Data Curation, Methodology, Visualization, Writing -review and editing; Mustafa DİKME: Data Curation, Methodology, Visualization, Writing -review and editing

Conflict of Interest

"The author(s) declare that they have no known competing financial or non-financial, professional, or personal conflicts that could have appeared to influence the work reported in this paper."

Acknowledgements

We would like to thank TAGEM, Gaziantep Sheep and Goat Breeders' Association, and the technical staff of project for their valuable contributions to the project.

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