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Evaluation of the Community-based Animal Genetic Improvement Studies: Kilis Goat

Abdurrahman KARA[1*]

[1*] Faculty of Agriculture, Dicle University, Diyarbakır. E-mail: abdurrahman_kara@hotmail.com

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[*]**Corresponding author:**
✉
abdurrahman_kara@hotmail.com

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ABSTRACT

This study examines the economic and technical impacts of the genetic improvement studies on Kilis Goat, commenced in Kilis, Türkiye in 2009 within the context of Community-based Animal Genetic Improvement National Scheme. This study also aims to provide a comprehensive overview of Kilis goat farming, and to establish a baseline for future assessments in this breed. The National scheme was first launched in 2006 and has since been extended in five-year intervals. Because genetic improvement studies commenced in 2009 in Kilis Goat, this study focuses only the first six years and considers the firstly included Kilis goat breeders into the scheme, excluding the later inclusions. The complete counts of the scheme-participating farmers (PFs) and randomly selected non-scheme-participating farmers (non-PFs) were the sources of the study data. Kilis goat breeders were interviewed face-to-face during 17 - 22 January 2015, resulting in 59 complete questionnaires (43 participants and 16 non-participant farmers). Descriptive statistics, t-tests, chi-square tests and Mann Whitney U tests were used for two group comparisons as one-way ANOVA with post-hoc LSD test and Krusskal Wallis tests were used for multiple group comparisons in data analysis. The results showed that PFs performed better but this was not enough to produce a significant difference in gross profit per female. The study concluded that own feed production, effective control of goat diseases and parasites and improvement of housing conditions are crucial for successful genetic improvement and overall goat production.

1. INTRODUCTION

Türkiye has a rich biodiversity and farm animal genetic resources accumulated and blended in time by the distinct cultures that prevailed in the past in Anatolia. Dissimilar needs and preferences of livestock breeders in its wide geography also contributed to this rich diversity (TAGEM 2011). So, numerous indigenous small and big ruminant breeds and types are adapted to different ecological conditions in the wide geography of Türkiye. The Kilis goat is just one of these indigenous breeds.

The Kilis goat is a medium-sized, long and strong-bodied domestic goat breed with a well-developed chest and rump. It has a straight back line, a long neck and long pendulous ears. The body is covered with long hair. The colour is usually black, but grey, brown and spotted colours are also seen. Males and females can be horned or hornless (Figure 1). Live weight is 50-60 kg for males and 35-45 kg for females. The lactation period is 210-260 days with a milk yield of 200-300 kg per head. It is a dual-purpose goat breed, but mostly for milk. Its meat is not valuable except for young and newly weaned kids. This goat breed is reared in Kilis, Gaziantep and Hatay provinces. It can walk long distances on rugged terrain and is resistant to diseases, heat and cold weather conditions (TAGEM, 2009; Keskin et al. 2012; ESK, 2024). It is believed that the Kilis goat was formed by the crossbreeding of Damascus and Hair goats in the hands of the public over many years (Keskin and Tüney, 2016).

Fig 1. The Kilis Goat (TAGEM, 2011)

Although Türkiye is rich of indigenous farm animals the yield level of them is not satisfying. Earlier studies conducted in Türkiye before 2000 to increase the meat and milk yield of small ruminants did not yield significant results (Ertuğrul et al. 2010). The most comprehensive studies on this subject began in 2003 with the establishment of sheep and goat breeders' associations and thus the forming of a state support infrastructure for small ruminants. Afterwards, on-site breeding and protection infrastructure was set up with national sheep-goat genetic improvement projects and animal genetic resources protection projects with the cooperation of the General Directorate of Agricultural Research and Policies (TAGEM), Breeders' Associations, Universities and Research Institutes (Cengiz et al, 2015).

Within the framework of the Council of Ministers Decision No. 2005/8503 on Supporting Livestock, in the first 5-year period covering the years 2006-2010, National Small Ruminant Genetic Improvement studies in the Hands of the Public were put into practice in 13 provinces in 12 breeds and types. In the second 5-year period covering the years 2011-2015, these studies continued with one large ruminant and 26 small ruminant breeds and types under the name of "National Animal Genetic Improvement Project in Public Hands" (TAGEM 2012).

Even though aesthetic, sentimental or intangible reasons may sometimes become obvious in traditional small ruminant production systems the main drive of the producers' decision-making is the

maximization of the economic well-being (James 1986). Thus, the main aim of the genetic improvement programs is ultimately to maximize the return on the investment. On the other hand, an important part of an improvement program is the regular analysis of the results obtained (FAO, 2010). These regular analyses should show economic impact at total and unit output, farm and national levels, as well as improvements in all important targeted traits (Philipsson et al. 2011). Herewith, not only corrective measures can be taken to improve the program, but also continued support for the program is ensured by showing the impact of the genetic improvement program.

The present study evaluated the genetic improvement efforts in the hands of the public on the Kilis goat between the years 2009-2014. This study evaluates the first six years of the genetic improvement studies but more importantly addresses major aspects of goat farming and builds a basis for later evaluations. It is expected that the findings will shed light on the decisions about the ongoing and other genetic improvement studies.

2. MATERIAL and METHOD

2.1. Animal Genetic Improvement National Scheme

Community-based genetic improvement programs target low-input systems with farmers working together to improve their genetic resources within a certain geographic area (Mueller et al., 2015).

Launched in 2006 in 13 provinces, the Turkish model of the program initially focused on ten sheep and two goat breeds, including Kilis goat, and has been expanded every five years. In later expansions, the scope of the plan included other indigenous breeds. The current fourth expansion (2021–2025) includes 21 sheep and seven goat genotypes.

Following the three-tier open nucleus breeding model, elite, semi-elite and base flocks were set up for each targeted breed at the beginning of their inclusion in the scheme. In this model, superior animals are promoted from subordinate flocks to superior flocks, and the superior flocks produce males for the one-step subordinate flocks as illustrated in Figure 2.

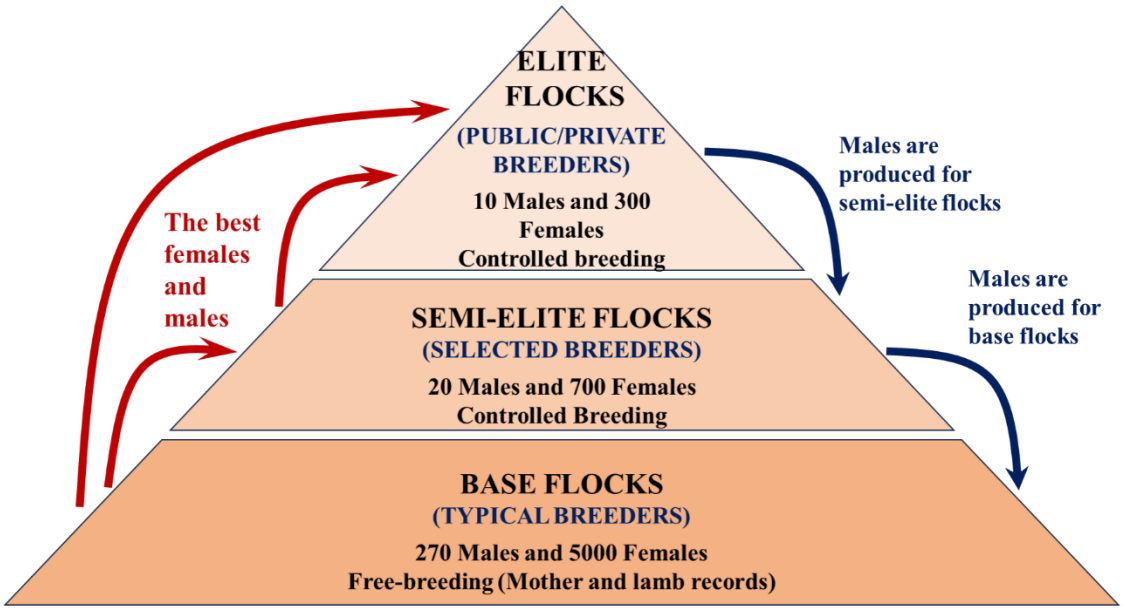

Fig 2. A three-tier open nucleus breeding program employed in the Community-based Animal Breeding National Scheme (adapted from Karaca, 2014)

The scheme is conducted following the Edict on Livestock Implementation Principles and the Instructions for the Community-based Animal Breeding National Scheme Implementation Principles issued by the Ministry of Agriculture. All specified work is conducted according to the work schedule prepared by the project leader of the targeted breed. A project technical staff is employed for each targeted breed to conduct the required field operations and maintain relevant records. Fulfilling their

obligations under the scheme the breeders receive support payments.

2.2. Present Study Material

What needs to be done in evaluating the impact of the genetic improvement project is to be able to reveal whether the result would have been different if the breeding project had not been implemented. It should be expected that the progress achieved through breeding studies, if any, will have a positive contribution to the farm income. So, it was necessary to establish a comparison group to estimates the changes attributable to the scheme (Gertler et al., 2016). For that reason, in this study, breeder farmers included in the genetic improvement scheme (participant farmers, PFs) were compared with their counterparts did not take part but farming with the same breed of animal in the same agroecological environment (non-participant farmers, non-PFs).

The research material consists of data collected through surveys conducted with a) Kilis goat breeders registered to the project since 2009 b) Kilis goat breeders not registered to the project and working in the same agro-ecological environment. The survey study was completed in a period of six days between 17-22 January 2015. In addition, earlier studies on the subject and public and private institution records were used.

2.3. Study Area

The genetic improvement studies on Kilis goats were first started with the breeders in Musabeyli, Polateli and Central districts and their villages of Kilis province in 2009, during the first five-year period (2006-2010) of the national scheme. So, these firstly included Kilis goat breeders were considered, and later inclusions were disregarded in this study aiming to evaluate the genetic improvement efforts in Kilis goat. For that reason, the scope of the study includes the said province, districts and villages.

With an average elevation of 680 m asl, Kilis province has a surface area of 1521 square kilometres and is located between the latitude 36 degrees North and the longitude 32 degrees East in the southwest of the Gaziantep Plateau, which extends between the Euphrates and the Hatay-Maraş trough in the Southeastern Anatolia region, and borders Syria (Figure 3). There are no major altitude differences, and generally, it has the characteristics of a southern slope surrounded by elevations from the northwest, north and northeast (Kilis Valiliği, 2024). Because of its location at the intersection of the Mediterranean climate (tropical) and continental climate, even though it is generally within the Mediterranean climate, Kilis and its locality are under the effect of hot and dry tropical Mediterranean climate in the summer; and the cool and humid air masses specific to the continental climate in the winter.

While the temperature difference between the hottest and coldest month averages is below 20 degrees Celsius on the Mediterranean coast, it is 32,6 degrees Celsius in Kilis, despite not very far from the Mediterranean (approximately 60-80 km as the crow flies) due to the high mountain masses inhibiting effect of the sea. The long-term average (1959- 2023) of annual mean temperature is 17.3 degrees and total precipitation is 499.3 mm (MGM, 2024).

Fig 3. Map of Kilis province and its districts along with the villages where the survey conducted

2.4. Sampling

In this study, breeders and their flocks included in the scheme in the first five-year period (2006-2010) in Kilis goats were considered. Later inclusions were disregarded.

Genetic improvement studies in the public hands are conducted in base, semi-elite and elite flocks. The first two flocks are the breeder flocks as the elite flocks are managed by universities or research institutes.

Since the number of base flock breeders (participant farmers, PFs) was not large, the complete enumeration method was used to collect data (Çiçek and Erkan, 1996). For this purpose, it was planned to conduct surveys with all PFs and with non-PFs roughly equal in number to make comparisons. Face to face interviews resulted in 60 completed questionnaires. Of all 44 were conducted with PFs and only 16 with non-PFs due to the difficulties in finding non-PFs[1]. Yet, a total of 59 questionnaires (43 PFs and 16 non-PFs) were evaluated. The data collected through the questionnaires was entered into the computer according to the previously prepared coding key. Data entries were checked, and incorrect ones were corrected.

2.5. Handling the Data

There are many factors that interact with animal production in extensive production systems and affect success. Therefore, when evaluating a program that aims to improve the entire system, it is necessary to consider these factors together. Some of these factors are related to the farmer (education, age), some are related to the characteristics of the farm (herd size, labour force, type and breed of animals raised, barn size, feed, etc.), and some are related to herd management (feeding, housing, and health). Therefore, PFs and non-PFs were compared in terms of technical and economic success indicators.

2.5.1. Technical Success Indicators

Litter size, kidding rate, infertility rate, abortion rate, kid birth weight, twin or more birth rates, kid mortality rate and milk yield were considered as technical success indicators in the study. It was thought that significant differences between the groups in favour of PFs in terms of these indicators would show the success of the genetic improvement efforts in Kilis goat.

- Litter size was calculated by dividing the number of kids born alive by the number of goats delivered.
- Goat kidding rate was calculated by dividing the number of goats delivered by the number of goats exposed to a male.
- Infertility rate was calculated by dividing the number of empty goats by the number of goats exposed to a male.
- The abortion rate was calculated by dividing the number of goats that aborted divided by the number of goats exposed to a male.
- Twin or multiple birth rate was calculated by dividing the number of twins or multiple births by the number of goats delivered.
- The mortality rate was calculated by dividing the number of kids that died at all ages by the number of kids born alive (Kaymakçı 2016).

In general, breeders do not have the practice of monitoring kid live weights. In PFs' flocks, kid live weights are measured and recorded by project technical staff at birth and certain intervals thereafter. Since kid live weight changes are not monitored in non-PFs' flocks, comparisons between groups could not be possible in terms of postnatal weight gains. However, the existence of some curious non-PFs who recorded kids live weights at birth made it possible to make comparisons between groups in terms of kid birth weight.

2.5.2. Economic Indicators:

In case of desired changes in above-mentioned technical performance indicators within the scope of

[1] Most of the Kilis goat breeders were already included in the national scheme during the second extension period (2011-2015), and those who were not yet included were also aspiring to participate in the scheme.

genetic improvement efforts, an increase in income per female is expected. According to the principles of fully competitive market and production economics, gross production value should at least cover variable costs (Erkuş and Demirci 1996; Drummond and Goodwin 2004). In other words, variable costs are the cost group that plays a role in the production decisions of the producer (here goat farmer). Therefore, gross profit is one of the important criteria that shows the success of the farm and the competitiveness of farm activities. Therefore, gross profit per goat has been considered as the basic economic success in revealing the effect of genetic improvement efforts.

For this purpose, revenue and cost elements were calculated based on the single product budget method, only for the goat farming activity, instead of all products produced in the farms (Aras 1988; Çetin and Tipi 2007). Gross profit per female used in group comparison was calculated by dividing the gross profit calculated per farm by the total number of females at the beginning of the production period.

Gross profit is calculated by subtracting variable costs from gross production value (Erkuş and Demirci 1996; Karagölge 2001). Gross production value is defined as the total value obtained from the main and by-products of the production activity (Karagölge, 2001). It is calculated by adding the productive increases[2] in animal capital to the value obtained by multiplying the amounts of animal products by the prices received by the farmer (Erkuş and Demirci 1996). Variable costs are defined as costs that increase or decrease proportionally depending on the production volume (Erkuş and Demirci 1996). Variable costs are calculated as the total of roughage and concentrate feeds, veterinary, medicine, vaccination, insemination, energy costs, other consumables and shepherd costs (Karagölge, 2001).

In both groups of farms, in addition to Kilis goats, sheep are also raised, albeit in small numbers. Yet, it was not possible to separate goats and sheep in revenue, (e.g. milk and dairy products) and variable cost calculations (e.g. shepherd wages, feed costs, vaccination and medicine-treatment, energy). However, because the number of sheep is generally negligible in respondent breeders whose main activity was Kilis goat, sheep and goat production was evaluated together assuming that sheep activity would not affect the result.

Farm labour was calculated in adult male equivalent (MLE) to eliminate age and gender differences (Erkuş and Demirci 1996). Gross profit was calculated by subtracting variable costs from gross production value (Erkuş and Demirci 1996; Karagölge 2001). Gross production value includes the total value of by-products, and the main product obtained during the production period (Karagölge 2001) and is adjusted with local trade prices and production asset increases (Erkuş and Demirci 1996). Variable costs include roughage, concentrate, veterinary care and medicines, vaccination, energy, consumables, shepherd wages and revolving fund interest (Karagölge 2001).

The revolving fund interest is calculated by applying the real interest rate to half of the variable cost. The real interest rate was calculated as 1.76% for 2014 by considering the producer price index increase (7.9%) and the current interest rate (9.8%; Kıral et al. 1999). As the ability of household members to do farm work varies by age group and gender, the age and gender distribution of households can also vary significantly across farms. So, farm labour was calculated in adult male equivalent to eliminate age and gender differences. In doing this, women aged between 15-64 and men aged 65 and over were converted with a coefficient of 0.75, and children aged between 7-14 and women aged 65 and over were converted with a coefficient of 0.50 (Erkuş and Demirci 1996).

While bought animals were assessed based on their purchase cost, animals raised in the farm were valued based on the local trade prices (Yıldırım and Şahin 2003). The farm-produced manure, straw and grass that was used as input was not valued further considering them as the internal success of the farm (Erkuş 1979).

2.6. Other Notable Subjects:

Common goat diseases, internal and external parasites (GDIEPs) and their effects on technical success indicators (e.g. birth rate, litter size and mortality rate) and the Kilis goat farming challenges were other issues addressed in the study. For this purpose, breeders were asked to evaluate GDIEPs as

[2] It is the income generated by the increase in the value of young animals within a year as a result of age change in farms that raise their breeding material and is calculated by adding the value of the animals sold and slaughtered to the end-of-period flock value and deducting the beginning-of-period flock value and the value of the purchased animals (Kıral et al. (1999).

well as important breeding challenges on a scale of 1-5 (lowest to highest). Unanswered questions were considered as "not affected". To eliminate the noise in the data and to disclose more serious GDIEPs and challenges, scores of 4 and 5 were coded as 1 and the others as 0 and the evaluations were made accordingly.

2.7. Data Analysis:

In statistical analyses, descriptive statistical methods were used to reveal the status of the farms. The gross profit difference between PFs and non-PFs was checked with the Independent Samples t Test; as the comparisons for the differences regarding GDIEPs, GFCs and other categorical variables were made with the chi-square test. When using the independent samples t test, Levene's test (Levene 1960) was employed to check if the groups had equal variances.

In addition, the two-sample Kolmogorov-Smirnov test was used to assess whether PFs and non-PFs were drawn from the same population. Normality assumptions were checked using the Skewness-Kurtosis and Kolmogorov-Smirnov tests. Skewness-Kurtosis values were assumed to indicate the normal distribution of the targeted variable when they lay between 1.5 and +1.5 (Sokal and Rohlf 1994; Tabachnick and Fidell, 2013). Non-parametric Mann-Whitney U test was used when the normal distribution assumption was violated. Data analysis was performed using the IBM SPSS 23.0 software package (IBM Corp. 2015).

3. FINDINGS

3.1. Descriptive Statistics

To present the status of the Kilis goat breeder farmers, demographic characteristics of the farms, farm labour, farmland, flock size, number of female goats and sheep in the flock, animal pens and own produced and purchased feeds were presented with relevant statistical comparisons in Table 1.

Table 1. Descriptive statistics for the study variables

Variable	Non-participant farmers			Participant farmers			t/U*	P
	N	Mean	Sx̄	N	Mean	Sx̄		
Farmer age	16	42.94	3.48	43	48.58	2.07	-1.41	0.164
Farmer experience	***16***	***20.00***	***2.66***	***43***	***28.60***	***1.79***	***-2.56***	***0.013***
Farmer schooling years	16	5.25	0.74	43	4.77	0.30	U	0.475
Male labour	16	2.44	0.30	43	2.99	0.24	U	0.207
Female labour	16	1.61	0.21	43	1.70	0.13	-0.35	0.727
Total labour	16	4.05	0.37	43	4.69	0.30	U	0.249
Own land	16	2.01	0.58	43	2.35	0.50	-0.39	0.701
Rented land	***16***	***0.65***	***0.28***	***43***	***0.30***	***0.17***	***U***	***0.018***
Farmland	16	2.66	0.76	43	2.65	0.50	0.00	0.998
Number of ewes	16	11.88	4.27	43	16.09	3.22	-0.72	0.477
Number of goats	***16***	***99.94***	***9.11***	***43***	***153.42***	***11.63***	***U***	***0.010***
Flock size (number of females)	***16***	***111.81***	***9.70***	***43***	***169.51***	***12.71***	***U***	***0.010***
Pen size	16	148.13	13.64	43	159.86	16.29	U	0.678
Pen size per female	***16***	***1.41***	***0.13***	***43***	***0.99***	***0.08***	***U***	***0.010***
Own-produced feedstuffs (%)	16	5.43	3.31	43	11.36	3.56	U	0.411
Purchased straw (%)	16	14.89	4.17	43	21.93	2.99	U	0.208
Purchased grains (%)	16	38.35	5.02	43	43.39	3.93	-0.71	0.484
Purchased compounds (%)	16	2.13	1.02	43	3.85	1.11	U	0.376
Purchased concentrates (%)	16	79.61	5.77	43	66.64	3.89	1.78	0.080
Purchased cotton seed/pulp (%)								
Percentage of Ewes (%)	16	9.72	3.37	43	9.02	1.83	U	0.993
Gross revenue per female (₺)	16	570.33	58.64	43	560.60	38.64	0.134	0.894
Variable costs per female (₺)	***16***	***214.48***	***32.85***	***43***	***153.78***	***15.55***	***1.876***	***0.066***
Gross profit per female (₺)	16	355.85	48.35	43	406.82	38.60	-0.73	0.469

*U: Mann-Whitney U test

As can be seen from Table 1, only the differences between the groups in terms of farmer experience, number of goats raised, flock size and pen floor area per female were found to be significant ($p<0.05$). The average farmer age was 47.1±1.8, and it was higher in PFs.

In PFs, the farmer experience was also higher, and the average of all breeders was calculated as 26.3±1.6 years. The schooling years, time spent in a formal education institution, was higher in favour of non-PFs, and was calculated as 4.9±0.3 for all breeders.

Since small ruminant farming is a labour-intensive activity, the labour force potential of the goat farmers is important and was calculated to be 2.8±0.2 and 1.7±0.1 in adult male equivalent (AME) for males and females, respectively.

Total labour potential for all breeders was 4.5+-0.2 AME. The average own and rental lands per farm were found to be 0.23±0.04 ha and 0.04±0.01 ha respectively. Kilis goat breeders also raise sheep, albeit in small numbers, and approximately 9% of the females per farm were sheep.

The average number of Kilis goats and sheep were 138.9±9.3 and 14.9±2.6 per farm as the average pen floor area was 156.7±12.4 square meter per farm, and 1.1±0.1 square meter per female. Although the total pen floor area per farm was less in non-PFs, this was reversed for the pen floor area per female. In other words, the pen floor area per female was significantly higher in non-PFs ($p<0.05$).

The shares of home-grown feed, total concentrated feeds and the purchased grain feeds in total diet were calculated to be 10.3±3.3, 70.2±3.3 and 42.0±3.2 per cent, respectively. A significant portion of Kilis goat breeders (66%) also reported that they purchased cottonseed pulp or seed, corresponding to around 25% of the total diet. The feeds and their compositions used by PFs and non-PFs were given in Figure 4.

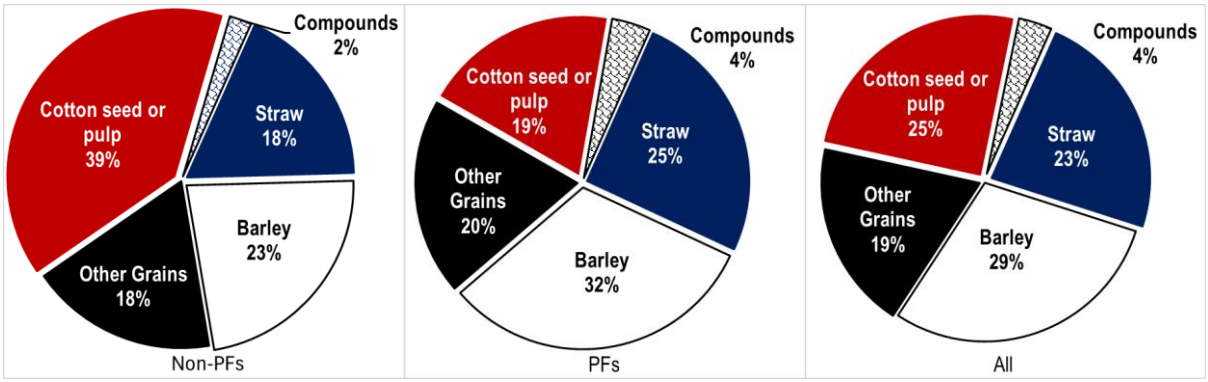

Fig 4. The feeds and their compositions in total diet used by PFs and non-PFs

As seen in Figure 4, PFs used more barley and straw, less other grain feeds and cottonseed or pulp, while non-PFs used more cottonseed or pulp, less barley and other grain feeds and less straw.

On the other hand, approximately 54% of the pens were traditional and the rest were concrete buildings. 12 per cent of the non-PFs and 33% of the PFs had concrete pens. However, the difference between the groups was not significant ($p>0.1$).

3.2. Technical Success Indicators

Although it is generally related to herd management and breeder expertise, it is expected that animal gene improvement efforts will cause increases in live weight, milk yield, fertility rate, and litter size, along with decreases in abortion rate, infertility rate and postnatal lamb mortality rates. The results related to technical success indicators were given in Table 2. There were significant differences between the two breeder groups in favor of PFs on milk yield, twin birth rate, and kid birth weight ($p<0.05$). Although insignificant ($p>0,1$), non-PFs had higher kidding rates, litter size, abortion rate, infertility rates and kid mortality rates. Non-PFs had about two times higher kid mortality rates compared to the PFs but the non-parametric Mann-Whitney U test did not justify the difference between the groups (Table 2).

Table 2. Calculated technical success and flock health indicators for sheep production in both participant (PFs) and non-participant farmers (non-PFs)

Indicators	Non-PFs			PFs			t/U*	P
	N	Mean	Sx̄	N	Mean	Sx̄		
Milk yield (kg/day)	***15***	***1.12***	***0.13***	***38***	***1.54***	***0.11***	***-2.23***	***0.03***
Twin birth rate (%)	***16***	***28.56***	***5.02***	***43***	***40.03***	***2.78***	***-2.09***	***0.041***
Triplet or more birth rate (%)	16	1.80	0.79	43	1.57	0.29	0.34	0.733
Kid live-weight at birth (kg)	***13***	***2.87***	***0.19***	***43***	***3.39***	***0.11***	***U***	***0.020***
Kidding rate (%)	16	85.81	1.86	43	85.21	1.41	U	0.745
Litter size (head)	16	1.40	0.08	43	1.30	0.07	U	0.627
Abortion rate (%)	16	9.13	1.84	43	6.95	0.76	U	0.426
Infertility (%)	16	4.88	1.06	43	4.72	0.80	0.11	0.917
Kid mortality (%)	15	18.47	4.91	43	9.67	1.10	U	0.194

*U: Mann-Whitney U test

Goat diseases and internal-external parasites (GDIEPs)

GDIEPs cause kid and adult deaths, as well as deterioration in the yield and quality of hair and milk and the reproductive performance of the flock. As sheep, goats live in flocks, graze together and share the same pen. This makes easily spread GDIEPs and makes controlling them challenging. Zoonotic animal diseases, on the other hand, can threaten human health, if not controlled. PFs and non-PFs were compared for the most common GDIEPs, and the results are presented in Table 3.

The severity and ranking of the most important GDIEPs were similar in both groups. PFs were better only for foot and mouth disease, intestinal nematodes, enterotoxaemia, liver fluke, pseudotuberculosis and anthrax in respective order of importance. The farmer groups had no significant difference regarding the first three GDIEPs. PFs were significantly reported enterotoxaemia and pseudotuberculosis less than non-PFs did ($p<0.05$). Again, the difference was marginally significant ($p<0.1$) between PFs and non-PFs on behalf of the first group regarding the foot and mouth disease, liver fluke and anthrax reports (Table 3).

Table 3. Distribution of the most reported goat diseases and internal-external parasites (GDIEPs) by participant (PFs) and non-participant farmers (non-PFs)

Declared GDIEPs	Non-PFs (N = 16)		PFs (N = 43)		Total (N = 59)	Chi-square	P
	N	%	N	%			
Tapeworm	11	68.8	27	62.8	38	0.181	0.671
Goat tick	10	62.5	25	58.1	35	0.092	0.762
Mastitis	9	56.3	21	48.8	30	0.256	0.613
Foot and Mouth Disease	***10***	***62.5***	***15***	***34.9***	***25***	***3.642***	***0.056***
Septicaemia	8	50.0	15	34.9	23	1.120	0.290
Brucellosis	7	43.8	13	30.2	20	0.951	0.329
Intestinal nematodes	8	50.0	12	27.9	20	2.540	0.111
Enterotoxaemia	***9***	***56.3***	***10***	***23.3***	***19***	***5.814***	***0.016***
Goat plague	7	43.8	10	23.3	17	2.388	0.122
Goat pox	6	37.5	10	23.3	16	1.197	0.274
Liver fluke	***7***	***43.8***	***9***	***20.9***	***16***	***3.072***	***0.080***
Contagious agalactia	5	31.3	9	20.9	14	0.686	0.407
Pseudotuberculosis	***6***	***37.5***	***5***	***11.6***	***11***	***5.146***	***0.023***
Anthrax	***4***	***25.0***	***3***	***7.0***	***7***	***3.622***	***0.057***

Goat farming challenges (GFCs)

Many researchers focus on farming challenges since they do not allow farmers to run their businesses more efficiently. The importance of these challenges increases especially as the size of the

farm decreases (Collinson, 1985). Since small ruminant farming is generally conducted by small-sized family farms, knowledge of breeder problems will make it easy to take precautions against these problems and at the same time, it will be possible to see whether there is progress in subsequent surveys.

In this study, respondents were asked about the biggest challenges in goat farming. High shepherd wages and shepherd shortages are interrelated challenges and were combined into a single "shepherd challenge" category. Similarly, old and insufficient pens were combined into a "pen challenge." Table 4 presents the distribution of the most often reported GFCs by PFs and non-PFs. The severity and ranking of most GFCs did not differ between the groups. Low product prices and the shepherd challenge ranked first and second for both groups, although the rankings of the latter's components, high shepherd wages and the shepherd shortage differed in groups. Of all declared breeder challenges only the challenges of high input prices and insufficient rangelands significantly impose more seriousness for the non-PFs compared to the PFs ($p<0.05$). The rest followed the same order of importance in both groups (Table 4).

Table 4. Distribution of the most reported goat diseases and internal-external parasites (GDIEPs) by participant (PFs) and non-participant farmers (non-PFs)

Declared challenges	Non-PFs (N = 16)		PFs (N = 43)		Total (N = 59)	Chi-square	P
	N	%	N	%			
Low product prices	16	100.0	38	88.4	54	2.033	0.154
Shepherd Challenge	13	81.3	38	88.4	51	0.505	0.477
Shepherd shortage	11	68.8	33	76.7	44	0.393	0.531
High shepherd wages	12	75.0	31	72.1	43	0.050	0.823
Lack of grazing water	11	68.8	27	62.8	38	0.181	0.671
High input prices	**14**	**87.5**	**22**	**51.2**	**36**	**6.473**	**0.011**
Diseases	10	62.5	22	51.2	32	0.604	0.437
Pen challenge	10	62.5	21	48.8	31	0.873	0.350
Insufficient Pens	8	50.0	17	39.5	25	0.523	0.470
Old Pens	7	43.8	14	32.6	21	0.637	0.425
Rangeland violations	5	31.3	17	39.5	22	0.342	0.559
Lack of dairy houses	8	50.0	13	30.2	21	1.988	0.159
Wild animals	8	50.0	12	27.9	20	2.540	0.111
Insufficient rangelands	**9**	**56.3**	**10**	**23.3**	**19**	**5.814**	**0.016**
Nomad problem	5	31.3	12	27.9	17	0.064	0.804
Insufficient vet. services	4	25.0	11	25.6	15	0.002	0.964
Lack of livestock exchange	2	12.5	8	18.6	10	0.309	0.578

3.3. Economic Success Indicators

As previously mentioned, the gross profit calculated per female was considered as the economic success indicator in Kilis goat breeding.

Gross Production Value

In the farms studied, gross production value (GPV) was calculated as the sum of animal production value and productive value increases and given in Table 5.

Table 5. Gross revenue components for the respondent goat farmers

	Non-PFs			PFs			All Respondent Farmers		
Gross Revenue Components	N	Mean	%	N	Mean	%	N	Mean	%
Productive Value Increases	16	37936.9	59.5	43	58818.4	61.9	59	53219.4	61.4
Milk and products	16	24930.0	39.1	43	34873.0	36.7	59	32157.0	37.1
Other revenues	16	892.6	1.4	43	1330.3	1.4	59	1213.5	1.4
Total Revenue	16	63759.5	100.0	43	95021.7	100.0	59	86676.5	100.0
Number of Females	16	111.8		43	169.5		59	153.9	
Total revenue per female	16	570.3		43	560.6		59	563.2	

In both groups of farms, the largest share of the GPV was the productive value increases. The share of milk and dairy products in the total GPV was found to be slightly higher in non-PFs. The reason for the higher GPV in PFs was most likely due to the larger flock size. However, this difference in terms of GPV per female changed in favour of non-PFs even though not significant (p>0.1).

Variable Costs

Variable cost components incurred in Kilis goat farming were presented in Table 6. The most important variable cost components were feed expenses and shepherd wages in both groups, respectively. Consumable expenses and energy expenses were given under the heading of other expenses. No significant differences were detected between the groups in terms of variable cost components (p>0.1).

Table 6. Variable cost components incurred in Kilis goat farming

	Non-PFs			PFs			All Respondent Farmers		
	N	Mean	%	N	Mean	%	N	Mean	%
Feed costs	16	15635.7	65.2	43	16840.6	64.6	59	16947.4	64.7
Shepherd wages	16	5875.4	24.5	43	6439.1	24.7	59	6469.9	24.7
Vaccination and cure costs	16	1630.7	6.8	43	1798.8	6.9	59	1807.4	6.9
Other costs	16	431.7	1.8	43	521.4	2.0	59	523.9	2.0
Sub-total	16	23549.4	98.2	43	25599.9	98.2	59	25722.3	98.2
Interest	16	431.7	1.8	43	469.2	1.8	59	471.5	1.8
Total variable costs	16	23981.1	100.0	43	26069.1	100.0	59	26193.8	100.0
Number of Females	16	111.8		43	169.5		59	153.9	
Total var. costs per female	16	214.5		43	153.8		59	170.2	

Gross Profit

Gross profit was calculated by deducting the variable costs from the GPV of Kilis goat farming activity (Table 7).

Table 7. Gross profit calculation for Kilis goat breeding activity

	Non-PFs		PFs		All Respondent Farmers	
	N	Mean	N	Mean	N	Mean
A- Total Revenue	16	63759.5	43	95021.7	59	86676.5
B- Total variable costs	16	23981.1	43	26069.1	59	26193.8
C- Gross profit (A-B)	16	39778.4	43	68952.6	59	60482.7
Number of Females	16	111.8	43	169.5	59	153.9
Gross profit per female	16	355.8	43	406.8	59	393.0

As can be seen from Table 7, PFs made 51.0 TRY more gross profit per female than non-PFs. However, this difference was not statistically confirmed (p>0.1).

4. DISCUSSION

Farmer's Age and Education Level: Farmer's age is an important factor in the adoption of innovations. Although it is said that older farmers are more resistant to adopting innovations (Haden and Johnson, 1989), it is also a fact that they have more experience because they started farming at an early age.

On the other hand, the level of education plays a key role in easier understanding and use of technical information, easy access to information and therefore better implementation of farming activities (Rogers, 1983) and positively affects farming success. Planning animal breeding activities, their timely and correct implementation, and intervening and resolving the problems encountered in a

prompt and correct manner are essential for successful breeding. This is possible with sufficient and correct knowledge of animal farming.

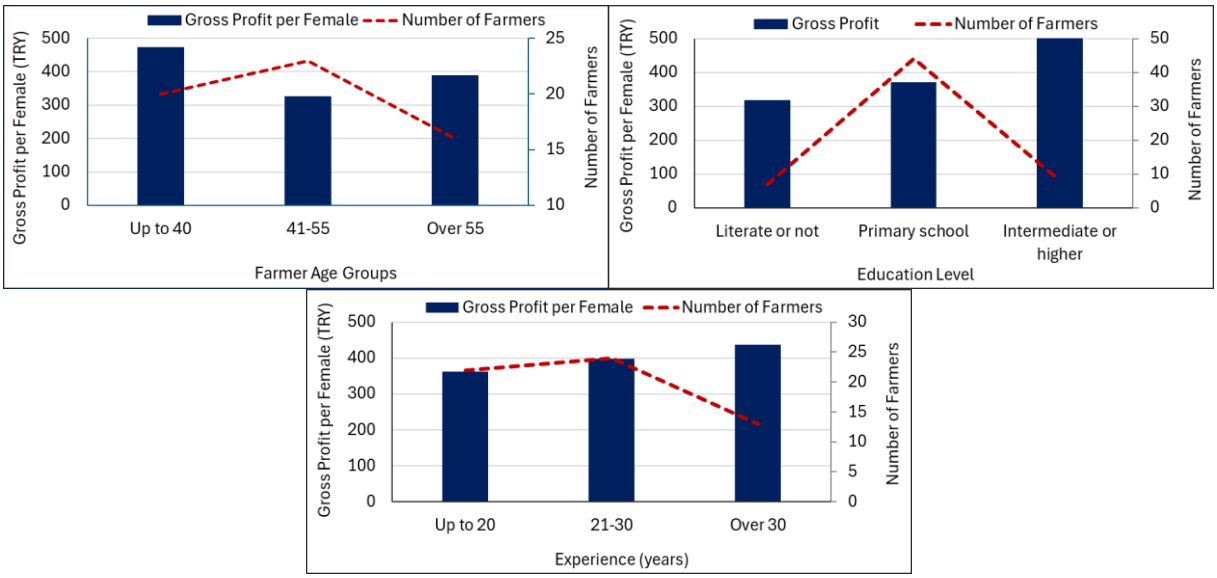

Fig 5. The effect of age, education and experience of the farmer on gross profit per female

Polat (2021) reported that average age of the small ruminant farmers in Kilis province was around 49 years with an average farming experience of 32 years. For the education level of the Kilis goat farmers, Polat (2021) also reported that around 72% had primary school and 13% secondary and high school as 15% had no formal education degree. Of all present study respondents, about 12% had no formal education as around 75% had primary education and 14% graduated from higher level institutions, corresponding to an average of 4,9±0,3 years of formal education. Present study findings regarding age and education level of farmers were more or less in harmony with the Polat (2021). Similarly, PFs and non- PFs did not differ significantly in age and education. However, both groups of farmers significantly differed regarding experience possible due to that more experienced breeders were selected to participate into the scheme.

As earlier stated, age and education positively affect farm success and that it is possible to see the effect of age and education level on gross profit per female, taken as an indicator of economic success in the study, in Figure 5. The difference between farmer age groups 1 and 2 is significant ($p<0.05$). Again, the difference between education level groups 1 and 3 and 2 and 3 is significant ($p<0.05$). In other words, it is seen that breeders aged 40 and younger and breeders with secondary school education and above earn more gross profit. Although experience increases at older ages, education level decreases. It is evaluated that breeders in the middle age group (41-55) generally have primary school-level education and less experience.

Labour: Small ruminant farming is a labour-intensive activity. Milking, grazing, pen cleaning and animal care require significant labour. The source of labour in farms is the family labour force. The need for labour in farms increases with farm size. Therefore, the labour potential of the farmer family is important in meeting labour needs and reducing labour costs.

In Kilis goat farming, although the contribution of men is greater (60%), daily care work is carried out jointly by both sexes. However, shearing is generally conducted by men and milking by women, and a significant portion of the labour required for milk processing (80%) is provided by women.

Kaygısız et al. (2024) reported that about 12% of goat farms in Mersin province hired shepherds as the rest met their needs from farm labour. In similar studies conducted with goat farms in Uşak, Manisa, İzmir and Isparta provinces, it was reported that 90% and more of the goat breeders met shepherd needs with family labour (Demirhan and Erdem 2019; Taşkın et al. 2010a; Acar and Ayhan 2012).

In Kilis goat farming 36% of the goat farms meet their shepherd needs from family labour, while others hire shepherds. It has been determined that goat farms with a majority male workforce tend not to hire shepherds, they tend to meet their needs from their household workforce while the farms with a majority female workforce tend to hire shepherds. It was determined that 75% of the labour required for Kilis goat breeding was provided by men and 25% by women. Figure 6 shows the gross profit distributions per female of the Kilis goat breeders across various labor force and flock size groups.

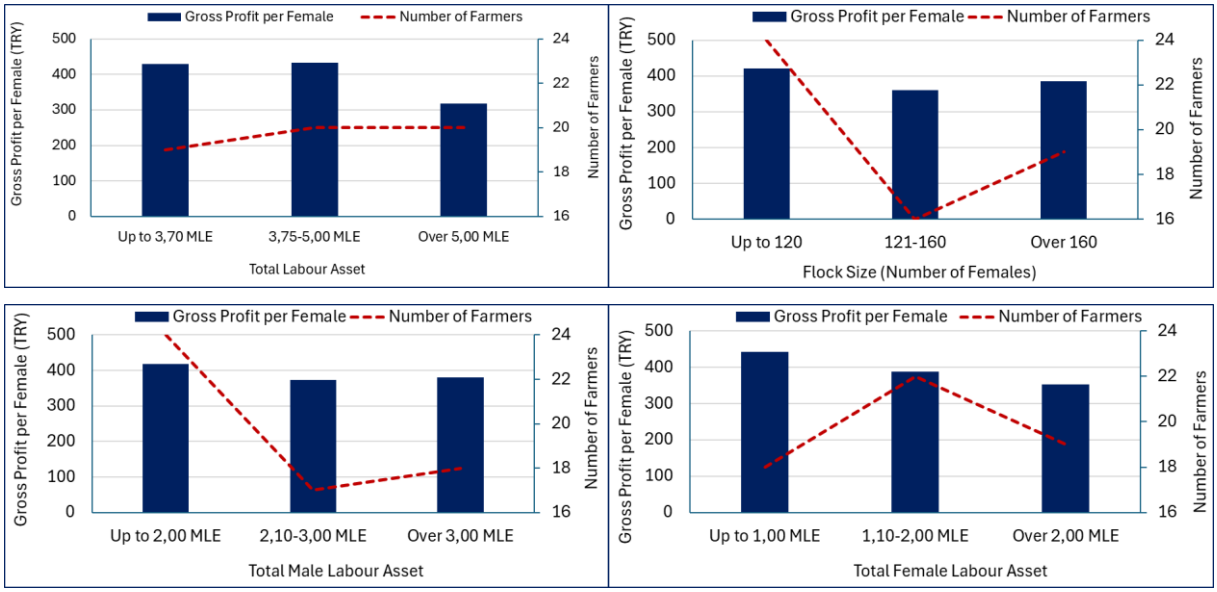

Fig 6. Gross profit per female across labour asset and flock size groups

Although not statistically significant, as the labor capacity of the goat farms increases in favor of female labor, economic success decreases (Figure 6). This may be related to the increasing flock size and the tendency of farms with a majority female workforce to hire shepherds since gross profit per female decreases as the herd size increases. Thus, an inversely proportional relationship existed between the labor potential of farms and the gross profit per female. In other words, farms with more labor force made lower gross profit per female, suggesting that labor, especially female labor, is not used efficiently in goat farms.

Construction type of pens: Small ruminant pens are generally inadequate in design, construction materials and size. Furthermore, ambient cleanliness is often not controlled adequately in pens. The most reliable animal welfare indicators recommended for animal pens are the level of lighting and the floor area per female (Sevi et al. 1999). In the evaluation of animal pens, light intensity and floor area per animal, volume and ventilation rates are key indicators (Caroprese et al. 2009).

In the present study, only the pen floor area per female and the type of pen construction were considered with the expectation that pen construction type might provide an idea about the design and ambient cleanliness, although not very definite. According to the results, more than half of the pens in both groups of farms were built in the traditional style, and there was no statistically significant difference between the groups in this respect ($p>0.1$).

As can be seen from Figure 7, the farms with concrete pens had more gross profit per female than those with traditional animal folds, most probably due to their higher animal welfare standards.

Pen Floor Area per Female: The stocking density (animal/area) is a significant factor affecting animal welfare and so performance. Although the space requirements of animals of various ages such as kids, yearlings, and adults vary, an average of 1.5 square meters of pen floor area per female is recommended (Cooper, 2022; El Sabry and Almasri 2023).

Wang et al. (2022) studied three stocking densities (low: 0.67 goat, medium: 1 goat and high: 2 goats per square meter) and reported that stocking density affected the rumen environment and high

stocking density (2 goats per square meter, i.e. 0.5 square meter per head) resulted in a decrease in growth, the digestive and immune function of Matou goats.

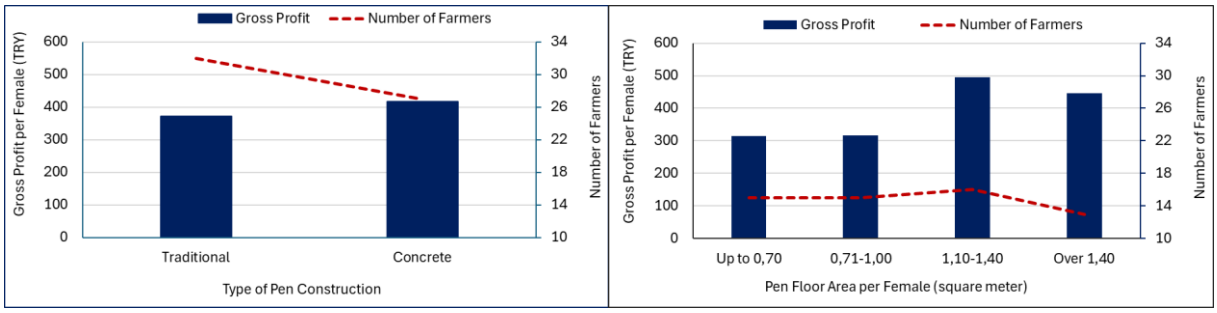

Fig 7. Gross profit per female across construction types of animal pens and pen floor area groups

It is considered that pen floor area requirement may be slightly less than 1.5 square meter per female for Turkish goats due to their small-framed bodies although Taşkın et al. (2010b) recommended 1.8-2.0 square meter indoor floor area per adult goat. Accordingly, in Figure 7, the highest gross profit per female was calculated for goat farms providing 1.1-1.4 square meter floor area per female, and according to the post-hoc LSD test, the differences between Groups 1 and 3, and groups 2 and 3 were significant ($p<0.05$).

Composition of the Supplementary Feed Diet: Goats make the best use of roughage among farm animals, and the basic rule in goat breeding is to benefit from rangelands as much as possible. It is reported that goats do not need to be fed additionally except for lactation and fattening, but in rainy periods when animals cannot graze and so are kept inside, approximately 60-70% of dry matter needs can be met from roughage and 30-40% from concentrates or grains (Taşkın et al. 2010b).

Kilis goats are generally grazed throughout the year, but supplementary feeding is also done in the last stages of pregnancy, in lactation to meet the increased nutrient needs of lactating animals, or in the winter because pasture grass cannot meet the animal needs. The number of breeders using supplement feed is at its highest level in the four-month period between December and March, and begins to decrease by the end of March, and is at its lowest level in June, July and August, and begins to increase again in September (Figure 8).

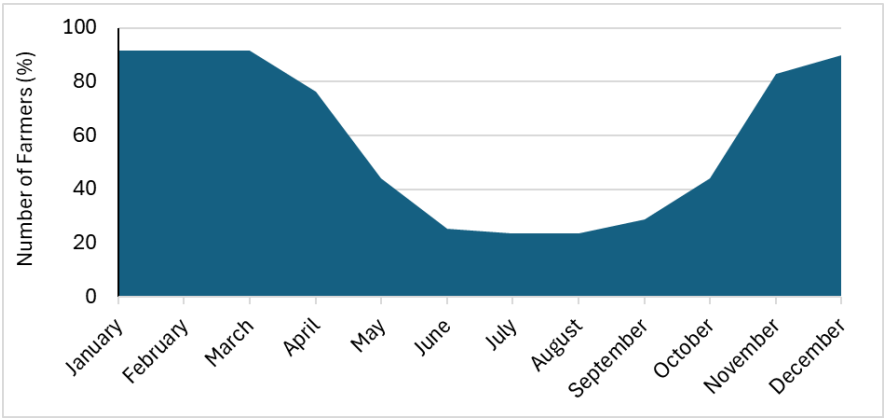

Fig 8. Distribution of the percentage of farmers using supplementary feeding by month (%)

The average amount of feed used per year per female for all farms was calculated about 163 kg. On average, 32%, 34% and again 34% of these farms use 78 kg, 131 kg and 275 kg feed per female, respectively. Approximately one third of Kilis goat farmers produced at least some of the feed they need

themselves (32%). The share of home-grown feed in the total feed used was calculated to be 11.4% by PFs and 5.4% by non-PFs on average. However, the groups did not differ significantly (p>0.1; Table 1). Gross profit per females across the proportions of various feed components in the diet were given in Figure 9.

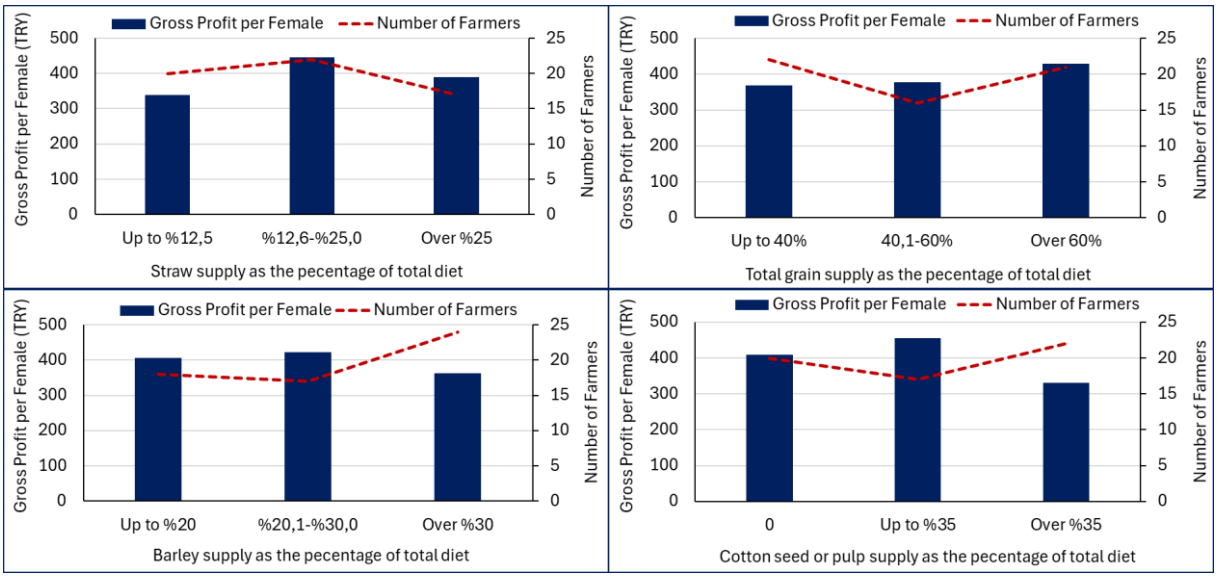

Fig 9. The effect of frequent feed supplies on gross profit per female

Although groups did not differ significantly, Figure 9 suggests that gross profit per female decreases when the percentages exceed 25% for straw, 30% for barley and 35% for cotton seed in the total diet. On the other hand, according to Figure 10, the highest gross profit per female was achieved with the diet composition of straw, grains, cotton seed/pulp and compounds with percentages of 26, 52, 20 and 2 per cent respectively.

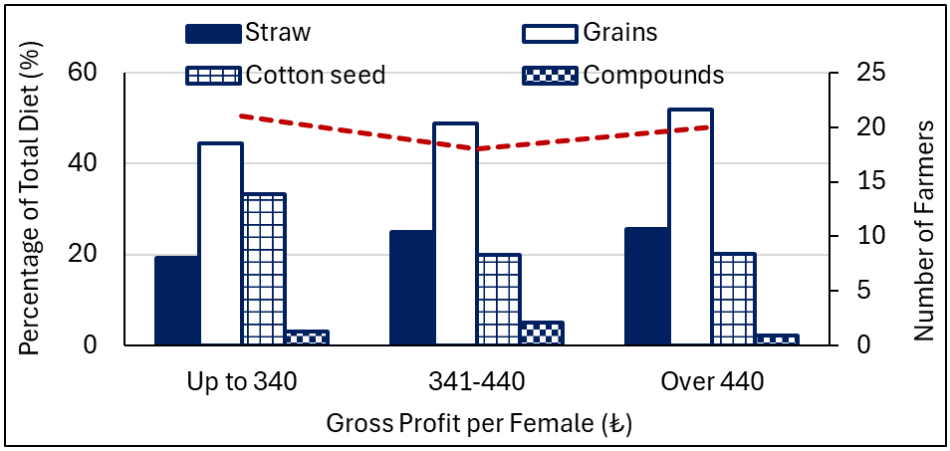

Fig 10. The variation of the gross profit per female by the composition of the total diet

Technical Success Indicators: Although it is generally related to herd management and breeder expertise, it is expected that animal gene improvement efforts and ensuring animal welfare will ultimately cause increases in birth weight, milk yield, kidding rate, and litter size, along with decreases in abortion rate, infertility rate and postnatal lamb mortality rates. The results related to technical success indicators are given in Table 2.

Kilis goats are distinguished with their high milk yield among the native goat breeds in Türkiye. So, the primary aim of community-based Kilis goat breeding studies is to increase milk yield. (Keskin et al. 2022).

Lactation milk yield can vary year to year due to unfavourable conditions in some years by limiting grazing and making use of grasslands. Limited and inadequate grazing together with insufficient supplement feeding, which is quite likely in extensive farming conditions, can cause fluctuation in milk yield (Gül et al. 2024). Thus, different researchers reported different milk yield figures for Kilis goats. Keskin (2000) reported the lactation milk yield and lactation period in Kilis goats raised in Hatay as 348-395 kg and 247.8 days, respectively. Behrem and Keskin (2013) reported the lactation milk yield as 390.6 ± 27.12 kg. In another study, milk yield for Kilis goat x hair goat crosses was reported as 298.6 ± 17.10 litres (Keskin et al. 2016). Daşkıran et al. (2022) gave the lactation period and milk yield under breeder conditions as 225.22 ± 7.75 days and 201.05 ± 6.75 kg, respectively. Keskin et al. (2022) reported that lactation milk yield increased from approximately 175 kg to 346 kg according to the results of a five-year study in Kilis goat breeding herds in Kilis province. Gül et al. (2024) reported the lactation milk yield as approximately 368 kg according to five-year study records in Kilis goat breeding herds in Gaziantep.

On the other hand, the sustainability and profitability of animal production depend on fertility (Keskin and Tüney 2016), the birth rate (kidding rate), the number of offspring obtained per birth (litter size) and the survival rate of the offspring obtained are important parameters in this regard.

Tatar et al. (2019) calculated 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% (corresponding 1,5 offsprings per birth, i.e. litter size) in Kilis goats. Keskin et al. (2022) reported that the fertility in Kilis goats ranged between 114,9 and 126,7%. (i.e. 1,15-1,27 offspring per birth).

Another technical success indicator and important developmental trait is birth weight. Although it varies according to gender and birth type, Gül et al. (2024) reported the average kid's birth weight as 3.56±0.01. Keskin and Tüney (2016) reported the birth weight as 3.9±0.08; Keskin et al. (2016) reported it as 3.5 ± 0.65 kg for Kilis goat x hair goat crosses. Keskin et al. (2022) reported the birth weight for Kilis goat breeding herds as 3.1±0.01. The same researchers reported that the calving rate for the years 2016-2020 varied between 62.4% - 92.1%; and the kid yield per goat that gave birth varied between 114.9% - 126.7%.

On the other hand, the survival rate is also an important parameter, and many relevant studies reported weaning survival rates. Keskin et al. (2022) reported survival rates ranging from 77.6% to 100%. In the present study, the mortality rate was taken as the negative proxy of survival rate and a 12% kid mortality rate was calculated for all farms, corresponding to around an 88% survival rate. In the present study, on the other hand, the lactation period, daily milk yield, twinning rate, litter size and kid birth weight were calculated as 230.6±4.9 days, 1.42±0.09, 36.2%, 1,33±0,05 heads per birth. and 3.27±0.10 kg respectively on average for all respondents.

Considering the above-given evaluations, it can be accepted that the present study findings fall within the ranges of the results reported by previous studies.

Infertility (not being pregnant), abortion or miscarriage (termination of pregnancy) and kid mortality are the causes of economic losses in a flock. Approximately 5-8% of infertility, around 3-5% of miscarriage and a maximum of 10% of offspring mortality rates can be accepted normal (Atasoy, 2016; Rişvanlı et al. 2016).

The infertility, abortion and kid mortality rates were calculated as 4.76±0.65%, 7.54±0.75% and 11.98±1.58% on average for all farms, respectively. According to these results, it can be said that there was no problem in terms of infertility. However, high abortion rates above upper limits imposed a problem for both breeder groups. Similarly, while kid mortality rates pushed the upper limit for PFs, the situation was quite not encouraging for non-PFs (Table 2).

Effect of GDIEPs on several technical indicators: Many studies conducted worldwide have shown that diseases and internal-external parasites of animals cause significant economic losses due to production decrements and high treatment costs, i.e. decreases in milk production and carcass weights, weak offspring, stillbirth and abortions, growth retardation, adult and offspring deaths, skin and leather damage, low feed conversion efficiency, increased labour needs, etc., (Hale and Coffey 2011; Kumar et

al. 2013; Roeber et al. 2013; Koyuncu et al. 2019; Lokamar et al. 2020; Al Moheer et al. 2022; Challaton et al. 2023).

Study findings also revealed similar results for GDIEPs such as scabies, sheep tick and brucellosis, necrotic hepatitis, and anthrax (Table 8).

The effect of septicaemia disease on the kidding rate was found to be significant ($p<0.01$). The differences between the birth weights of kids born in breeders' flocks reporting and not reporting Brucella and pica were significant. But surprisingly kid birth weights were in favour of breeders reporting Brucella ($p<0.05$) but against those not reporting pica ($p<0.01$).

Higher birthweights associated with brucella seem to contradict the current knowledge and to be surprising. However, this may be explained by the selection effect of brucellosis when remembering that singletons have high birthweight compared to twins and triplets (Keskin et al. 2022). That is, weak offsprings may have died at the earlier stages of pregnancy due to brucellosis and the remaining healthy single offspring may have reached a higher live weight. Anyway, 1.4-fold and significantly higher twin birth rates calculated for the farms not reporting brucella might evidence and justify this argument.

Table 8. The effect of some goat diseases and internal-external parasites (GDIEPs) on kidding rate, kid live weight at birth, and kid mortality

GDIEPs	Farmers declaring no problems			Farmers declaring problems			t	P
	N	Mean	Sx̄	N	Mean	Sx̄		
Kidding rate								
Septicaemia	***36***	***87.13***	***1.39***	***21***	***82.28***	***2.02***	***U***	***0.009***
Kid birthweight								
Brucella	***38***	***3.14***	***0.09***	***18***	***3.54***	***0.21***	***-2.05***	***0.046***
Allotriophagia	***51***	***3.35***	***0.10***	***5***	***2.45***	***0.25***	***2.83***	***0.007***
Kid mortality								
Allotriophagia	51	10.98	1.35	5	22.40	11.31	U	0.196
Twin birth rate								
Brucella	***39***	***40.52***	***3.19***	***20***	***29.90***	***3.62***	***2.06***	***0.044***
Tapeworm	***21***	***45.64***	***4.80***	***38***	***32.10***	***2.58***	***2.72***	***0.009***
Goat tick	***24***	***46.58***	***3.99***	***35***	***30.29***	***2.75***	***3.48***	***0.001***
Pseudotuberculosis	***48***	***39.00***	***2.80***	***11***	***27.85***	***5.04***	***1.76***	***0.083***
Liver fluke	***43***	***40.14***	***3.02***	***16***	***28.27***	***3.75***	***2.17***	***0.034***

Allotriophagia or pica refers to abnormal appetite for materials other than normal feed in the forms of licking or eating soil, stone, pieces of broken earthenware pottery, hair, plaster and chalk etc. The reasons may vary from the low serum iron levels to various nematodes (Sharma et al. 2000) and it may also be associated with mismanagement practices that cause stress (Caroprese et al.2009). However, the significant low birthweight offsprings of the respondents reporting pica is most likely related to low serum iron levels since low birthweight is reported as one of the adverse pregnancy outcomes associated with iron deficiency (Georgieff 2020).

Moreover, it was found that tapeworm and goat tick had very significant ($p<0.01$), brucellosis and liver fluke had significant ($p<0.05$) and pseudo-tuberculosis had marginally significant ($p<0.1$) negative effects on twin birth rates.

Effect of GDIEPs on gross profit per female: Farmers were asked about twenty GDIEPs to give marks from 1 to 5 according to their seriousness. As explained earlier, the scores of 4 and 5 were coded as 1 and the rest was 0 to eliminate noise in the data. Again, the respondent farmers were categorized according to their number of complaints about GDIEPs. They varied from zero to 15 complaints out of 20 GDIEPs. Figure 11 represents the relationship between the number of complaints and the achieved gross profit per female.

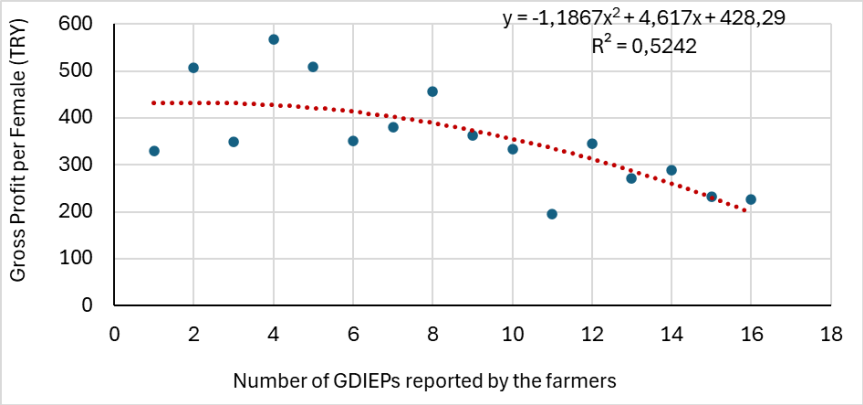

Fig 11. The effect of GDIEPs on gross profit per female

It is clearly seen from the Figure that the farmers with a greater number of complaints about the GDIEPs achieved less gross profit per female. Again, significant differences in gross profit per female were detected between the declaring and not declaring breeder groups for some certain GDIEPs.

Respondents reported goat plague and scabies in their flocks achieved significantly less gross profit per female. Again, marginally significant less gross profit per female was calculated for those reported anthrax, liver fluke and intestinal nematodes (Table 9).

Table 9. The effect of some goat diseases and internal-external parasites (GDIEPs) on gross profit per female

	Farmers declaring no problems			Farmers declaring problems				
GDIEPs	**N**	**Mean**	**Sx̄**	**N**	**Mean**	**Sx̄**	**t**	**P**
Anthrax	*52*	*412.89*	*33.34*	*7*	*245.23*	*61.85*	*1.78*	*0.080*
Goat plague	***42***	***440.14***	***34.39***	***17***	***276.52***	***58.22***	***2.50***	***0.015***
Intestinal nematodes	*39*	*432.18*	*38.96*	*20*	*316.58*	*47.47*	*1.80*	*0.077*
Liver fluke	*43*	*425.82*	*37.05*	*16*	*304.80*	*51.35*	*1.77*	*0.082*
Scabies	***51***	***420.89***	***32.33***	***8***	***215.15***	***76.04***	***2.36***	***0.022***

5. CONCLUSIONS

Genetic improvement studies aim to increase farm animal productivity per head to achieve sustainable food production. In Türkiye, farm animal genetic improvement studies started in 2006 in nine sheep and two goat breeds continue with five-year extensions. One of the two goat breeds included in the breeding program in 2006 was the Kilis goat, and studies were started in 2009 with a three-year delay.

One of the objectives of the study was to reveal the economic and technical impacts of the genetic improvement studies conducted on Kilis goats at the farm level. However, considering that genetic improvement studies are a long-term process, and the short span of the coverage only between 2009-2014 years of the scheme, this study is of greater importance in terms of revealing the status of Kilis goat breeding and obtaining basic data for future evaluations.

The difficulty in ensuring homogeneity in PFs and non-PFs groups that were compared was the limitation of this study. In order to reveal whether the two groups differ in terms of a trait or practice examined, randomness in forming the groups is thought to provide the homogeneity of the groups which is important to make sure whether the observed changes on the dependent variable (technical and economic indicators in the present study) are really due to the treatment effect (here, genetic improvement studies). Otherwise, the reliability of the estimates will be questionable. In such studies, the propensity score matching technique is used to obtain homogeneous groups and avoid this problem. However, in the present study, this technique could not be used due to the difficulties in finding non-PFs in adequate numbers.

On the other hand, in the present study comparing PFs and non-PFs, it was inevitable that there would

be differences between the two groups regarding either the breeders or their flocks due to the criteria taken into consideration in the selection of breeders and animal material to be included in the scheme, e.g. selecting more experienced breeders and selecting the animals that phenotypically have the breed characteristics (TAGEM 2012). Moreover, since working with the minimum number of breeders possible to provide a total of 5700 female and 300 male animal materials (Figure 2) in each breed will facilitate the studies of the scheme, it should be expected that the flock size of the PFs will be larger than the non-PFs, due to the selection of the breeders with relatively larger flock sizes.

In the comparison of two groups of breeders, litter size, kidding rate, infertility rate, abortion rate, live weight of kids at birth, twin or multiple birth rate and kid mortality rate were considered as technical success criteria, while gross profit per female (GPpF) was used as financial success indicator.

Although the homogeneity of the goat breeder groups is questionable, among the socioeconomic variables that reveal the status of the farms, only the differences in terms of farmer experience, flock size and pen floor area per female were found to be significant ($p<0.05$). The differences between the groups in terms of farmer age, education level, male and female labour force and total labour force, farmland, pen floor area, the rate of feed provided by the farm and the rate of purchased straw, grain feed and concentrated feed in total feed are insignificant.

The reason for the less pen floor area per female in PFs was their larger flock size but the difference regarding pen floor area was insignificant ($p<0.1$).

According to the results, PFs significantly differed from non-PFs in terms of milk yield, twinning rate, live weight of kids at birth ($p<0.05$). Again, although not significant, non-PFs had higher kidding rate, more litter size, higher abortion, infertility and kid mortality rates. As a result, PFs obtained higher gross profit per female but the difference between the two groups was not significant.

The better financial performance of the PFs might be due to their more experience (Figure 5). On the other hand, larger sized flocks' ownership can be said to have a negative rather than positive effect on PFs' gross profit achievement, due to the inverse relationship between the gross profit per female and the flock size (Figure 6). In addition, non-PFs were statistically better off in terms of pen floor area per female, which had a positive effect on gross profit up to a certain extent. Therefore, since some indicators were in favour of PFs as some others were in favour of non-PFs, heterogeneity of the groups can be considered balanced regarding their achieved financial success.

However, better performance of the PFs in terms of technical indicators did not suffice to yield significant financial performance possibly for their less pen floor area per female and the similarity in severity and ranking of the most important GDIEPs and the GFCs in both groups.

There was no significant difference between the two groups of farmers in terms of diseases and internal-external parasites, and the farmer challenges. The most often mentioned diseases and parasites by both breeder groups were ticks, tapeworms and mastitis. Similarly, the importance and order of most challenges were found around the same for both groups. Low product prices and the shepherd challenge ranked first and second for both groups. Of all declared breeder challenges only the challenges of high input prices and insufficient rangelands significantly imposed more seriousness for the non-PFs compared to the PFs ($p<0.05$).

Polat (2021) mentioned similar small ruminant diseases and parasites and breeder challenges in her study conducted in 2017 with farmers who were members of the Sheep-Goat Breeders Association in Kilis province. It is most likely that these diseases and parasites and the breeder challenges presented in Tables 3 and 4 still prevail today.

Feed expenditure and shepherds' wages were the most significant cost components in goat farming, accounting for approximately 65% and 25% of the variable costs, respectively. High feed expenditures hinder profitability, even though small ruminants generally have lower nutritional requirements. Shepherd wages were high due to a shortage of shepherds, a problem rooted in social issues such as a lack of social security and low societal status.

Based on the study results, the following suggestions can be made for the success of genetic improvement studies and Kilis goat farming:

(1) Feedstuff production: Farmers should be encouraged and supported to produce their own feedstuff to minimize feed costs and perform profitable goat farming.

(2) Address shepherding problems: Shepherding is one of the most important challenges in livestock farming. As a solution:
- Shepherding should be made more appealing through employing certified shepherd system with attractive social security benefits.
- As an interim solution, breeders' unions can recruit shepherds, who have flock management and rangeland management certificates, through service procurement from commercial companies.
- In the long term, associate degree shepherding programs should be offered by universities and only the graduates of these programmes should be accepted into the profession to ensure effective animal grazing and sustainable rangeland use.

(3) Improving housing conditions: Farmers should be encouraged and supported to renovate animal pens to ensure adequate floor area and volume per female, ventilation, aeration, lightning and ambient cleaning.

(4) Regular assessments: At least every ten years assessments should be repeated to monitor progress and take measures.

Ethics Approval

With the decree dated 01.10.2014 and numbered 1550, the Committee on Scientific Research and Publishing Ethics at Dicle University confirmed that the present study conforms to the generally accepted scientific and ethical principles.

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Researchers' Contribution Rate Declaration Summary

AK performed all the work related to the design of the study, collection and analysis of the data, interpretation of the results, and drafting and substantive revision of the manuscript.

Conflict of Interest Declaration

The author reports that there are no competing interests to declare.

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