

Research Article



Conservation of Local Geese (*Anser Anser*) in Egypt: Characteristics of Production Systems and Breeders' Perception

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Abstract | Geese are highly valued in Egypt for their consumption at home and due to cultural considerations. This study aimed to understand the geese production system, focusing on the traits and perspectives of breeders. The goal was to gather information that could aid in the conservation of local geese in Egypt and improve their production system. The study was conducted in the governorates of El-Fayoum, Luxor, and Kafr El-Sheikh, representing the three main regions in Egypt. The research involved a cross-sectional survey of 78 randomly selected villages. Semi-structured questionnaires and field observations during interviews were used to collect necessary data from farmers. The findings revealed that geese were exclusively raised by smallholders, with women primarily responsible for flock care. Interestingly, some householders expressed no intention of rearing geese again. The incidence of disease was higher in goslings compared to mature or grower geese. Additionally, the majority of people preferred to market the oldest geese. Respondents agreed that geese are easy to handle, exhibit high growth rates compared to other poultry species, and hold cultural significance as part of local Egyptian heritage. Furthermore, geese meat was considered delicious. Most breeders concurred that the geese population has decreased over the past decade. Opportunities within the geese production system include serving the domestic market and increasing income. Notably, women play a significant role in managing and selling geese. Overall, this study provides valuable insights into geese production practices in Egypt.

Keywords | Geese, Egypt, Luxor, El-Fayoum, Disease

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INTRODUCTION

The world's biological resources are endangered by many factors of change, and the poor are expected to suffer more from the effects of biodiversity loss (Turner et al., 2009). The roles of livestock vary according to the geographical regions where humans live, and their social, cultural, economic, political, and scientific contexts. Livestock biodiversity is a condition of villages, where food options are scarce (Djermanovic et al., 2023). To prevent the loss of AnGR, a conservation program or strategy may be needed. The first step in implementing conservation is to

describe the production system and identify the challenges and opportunities to make a comprehensive improvement (Mtileni et al., 2009). However, designing this program requires detailed information about the value of local breeds, and the production systems under which they are maintained and produced need to be examined first (Wollny, 2002; Zander, 2006). Geese were domesticated in Egypt about 3000 years ago and are now bred commercially (Abdel-Kafy et al., 2021). Compared to other poultry species, Pingel (2011) suggested that increasing waterfowl production could reduce the gap between supply and demand of animal protein and improve food security, especially for

rural families. Geese are highly valued in Egypt for their cultural and provisioning services. The local production system of geese involves small-sized flocks reared by small breeders, which are used as a source of eggs, and meat, and as guarding birds, especially in north of Egypt (Abdel-Kafy et al., 2021). However, there are few studies on geese conservation and improvement in Egypt. It seems that most of the local geese are found in villages, and a participatory approach is essential to conserve geese and ensure that research outcomes are integrated into local policy (El Sabry and Almasri, 2023). which makes them particularly suitable for providing farmers with an extra income. Keeping the geese has some benefits, such as low feeding costs and feeding on cheap by-products which reduces competition between waterfowl and human nutritional resources (El Sabry and Almasri, 2023). Animal production systems are the outcome of agroecological forces combined with the awareness and effort of the breeders to ensure their sustainability. To improve the efficiency of the production of geese, there is needed to more studies for their biological and economic features. To support the conservation and production of local geese in Egypt and to improve food security, the current study aimed to gain insight into the current geese production system by focusing on the characteristics and societal views of breeders to develop a strategy for the production systems.

MATERIALS AND METHODS

ETHICAL APPROVAL

The study protocol was approved by the Research and animal care committee of the Animal Production Research Institute (APRI; ethical approval number: 20210615 153429).

STUDY AREA AND METHODOLOGY

The study was carried out in El-Fayoum, Luxor, and Kafr El-Sheikh (Figure 1), which were chosen as representatives of the main three zones in Egypt using purposive sampling. The cross-sectional survey involved 78 randomly selected villages and 465 breeders as meantioned in Table 1. Semi-structured questionnaires and interview field observations were used to collect the necessary information. The questionnaire aimed to understand the current system of geese production by focusing on the characteristics of the breeder that included the gender, education level, years of experience, flock ownership and decision making, to identify the challenges and opportunities to enhance production. Producers were asked to answer questions about their social characteristics (such the gender, education level, experience) and their views on the main features of the production system in geese. Geese health and biosecurity were taken into account, including vaccination, drugs and actions taken when geese are sick (advice from veterinarian,

or relatives and others), mortality rate, and disposal of dead birds. Geese keepers were asked to answer questions about their social status, such as age, gender, education, and years of experience. This information is crucial for implementing conservation strategies because these programs should be appropriate for the social condition of the respondents. A Likert scale was used to assess respondents' opinions about their breed characteristics (Harpe, 2015). Likert scales are usually used to measure responses and perceptions of the breeders to the question or a certain statement.



Figure 1: Map of study regions (El-Fayoum (F), Luxor (L), and Kafr El-Sheikh (K)).

Table 1: Number of villages and breeders involved in the study.

Governorate	Villages	Breeders /village	Breeders
El-Fayoum	24	3-10	135
Luxor	26	3-10	162
Kafr El-Sheikh	28	3-10	168
Total	78		465

STATISTICAL ANALYSIS

Three governorates included of El-Fayoum, Luxor, and Kafr El-Sheikh were the basis for classifying the data from 465 breeders. The data were subjected to a Chi-square Test using the Chisq technique in SAS 9.2 (2002, software [SAS, Cary, North Carolina, USA]) and the significance level was at 0.05.

RESULTS AND DISCUSSION

The survey marked a pioneering effort in Egypt to study the production system of the geese that included 78 villages. Geese are only produced by smallholders in small-scale

extensive production, and there is no commercial production. The majority of the birds are slaughtered for home consumption, and some are sold live in local markets in the present study. So, the domestic Egyptian geese are essential for the economy in rural areas. Kumar (2009) said that Egypt is among the leading geese producers, but small farmers produce most of young geese and distribute them in the middle of the Egyptian delta.

Table 2: Social characteristics of geese owners of the Egyptian geese.

Items	Governorates			P-Value
	El-Fay- oum %	Luxor %	Kafr El- Sheikh %	
(1) Gender				P =0.018
Male	13.89	43.59	29.79	
Female	86.11	56.41	70.21	
(2) Education level				P=0.0004
Illiterate	33.33	56.76	70.27	
Non-Illiterate	52.78	16.22	10.8	
School graduate or more	13.89	27.03	18.92	
(3) Years of experience				P =0.537
1-5	9.52	2.56	3.85	
6-10	2.38	5.13	1.92	
>10	88.10	92.31	94.23	
(4) Flock ownership				P =0.0001
Women	2.63	25.53	0.00	
Men	0.00	0.00	0.00	
Family	97.37	74.47	100.00	
(5) Decision making				P =0.448
Women	100.00	94.59	95.00	
Men	0.00	2.70	0.00	
Family	0.00	2.70	5.00	

SOCIAL CHARACTERISTICS

Gender issues and the identification of the most suitable approach are crucial for implementing development projects. Table 2 displays the social characteristics of geese owners, and women were the majority of the respondents in the three governorates, with percentages of 86.11% in El-Fayoum, 56.41% in Luxor, and 70.21% in Kafr El-Sheikh. Moreda et al. (2013) and El-Sheikh et al. (2017) reported comparable results. The majority of householders were illiterates with average 75.61% and the geese owners were females with around 94.51% (El-Sheikh et al., 2017). The social attributes of geese owners reveal significant differences in gender, education level, and flock ownership across different governorates (p < 0.05). However, the experience years and decision-making processes do not significantly vary among the three governorates (Table 2). Illiteracy rates among householders were found to be

33.33%, 56.76%, and 70.27% in El-Fayoum, Luxor, and Kafr El-Sheikh, respectively, mirroring the findings of El-Sheikh et al. (2017). Ndahitsa (2008) emphasized the importance of education in shaping farmers' abilities and skills, and their awareness of innovations and technologies. Similarly, Musaba (2010) found a positive correlation between the level of education and the adoption of technology.

The level of experience plays a key role in a farmer's ability to manage resources effectively. It also influences the acquisition of skills necessary for utilizing technological innovations (Hume et al., 2011). Most householders have more than 10 years of experience, a trend also noted by El-Sheikh et al. (2017). Greater experience leads to a broader knowledge base for problem-solving and potentially higher income, as suggested by Conrad et al. (2022). Geese production primarily follows the family system (extensive system), with families being the main geese owners in El-Fayoum (97.37%), Luxor (74.47%), and Kafr El-Sheikh (100.00%). These results align with the findings of El-Sheikh et al. (2017), but contradict those of Bennett et al. (2005). Notably, women in Luxor had the highest ownership percentage (25.53%) compared to other governorates. Hence, enhancing the practices of smallholder geese farmers is crucial for the growth of geese production in rural regions. In El-Fayoum (100.00%), Luxor (94.59%), and Kafr El-Sheikh (95.00%), women are the primary decision-makers concerning all facets of geese production and marketing.

UTILIZATION OF GEESE AND MANAGERIAL PRACTICES

Table 3 outlines the objectives of rearing geese and the distribution of management tasks among family members. The breeding goal is typically aligned with the production system. Householders were queried about their motivations for raising geese. The purpose of rearing, consideration for future geese rearing, and house construction varied significantly (p < 0.05) across governorates (Table 3).

The highest percentages of home consumption as geese meat were recorded in Luxor and Kafr El-Sheikh governorates (65.71% and 52.38%, respectively). The majority of respondents (62.86%) in El-Fayoum stated that the primary reason for breeding geese was for home consumption and income augmentation (Table 3). This trend aligns with El-Sheikh et al. (2017), who found home consumption to be the predominant reason for keeping village geese. When asked if they considered discontinuing geese rearing, the majority of householders across all studied governorates expressed their intention to continue. The highest percentage (87.50%) was observed in El-Fayoum (Table 3). This may be attributed to the market-driven attitudes of the respondents, as the main motivation for breeding geese was home consumption and income enhancement. Rural

villagers largely depend on their farm products for survival. Limited cash availability necessitates the use of cost-effective and easy-to-maintain species, making geese an ideal choice. Romanov (1999) noted that geese are among the fastest-growing bird species. Additionally, geese achieve 40% of their adult weight as meat by the age of 4 weeks, in contrast to 15% for chickens and 5% for turkeys (Frrell 2004). Village poultry significantly contributes to income generation and poverty reduction (Alders et al., 2009; Bell, 2009). The women are primarily responsible for most geese management tasks, such as house construction, feeding, watering, and selling, while the men playing a secondary role in Egypt.

Table 3: Purposes of rearing and division of management tasks among family members in the Egyptian geese.

Items	Governorates			
	El-Fay- oum %	Lux- or %	Kafr El- Sheikh %	P-Value
(1) Rearing purpose				P = 0.0002
Profit gaining	0.00	0.00	0.00	
Home consumption	37.14	65.71	52.38	
Easy to manage	0.00	17.14	0.00	
Ready source of income	0.00	0.00	2.38	
Home consumption + increasing income	62.86	17.14	45.24	
(2) Do you think of not rearing geese again?				P = 0.035
Yes	12.50	47.62	33.33	
No	87.50	52.38	66.67	
(3) House construction				P = 0.0009
Women	97.30	78.72	100.00	
Men	0.00	19.15	0.00	
Family	2.70	2.13	0.00	
(4) Providing water and feed				P = 0.379
Women	97.44	100.0	97.92	
Men	2.56	0.00	0.00	
Family	0.00	0.00	2.08	
(5) Selling geese				P = 0.381
Women	100.00	97.78	100.00	
Men	0.00	2.22	0.00	
Family	0.00	0.00	0.00	

DISEASES AND ACTION TAKEN

Table 4 details the occurrence of diseases and the measures taken for sick geese within the family production system, an extensive system. There were no significant differences between governorates regarding the diseases and actions taken for sick geese (p < 0.05) as showed in Table 4. Minimal health care is offered, and the majority of geese are managed under basic conditions, resulting in high mortality rates and prevalent diseases, thereby reducing geese pro-

ductivity. This could be due to the cohabitation and rearing of various species and ages together (Boulianne, 2013). When inquired about potential infections in the flock, the majority of householders in El-Fayoum (65.63%), Luxor (75.00%), and Kafr El-Sheikh (52.50%) reported no infections (Table 4).

Table 4: Incidence of diseases and the action taken in the Egyptian geese.

Items	Governorates			
	El-Fay- oum %	Luxor %	Kafr El- Sheikh %	P-Value
(1)Is there any infection in your flock?				P = 0.108
Yes	34.38	25.00	47.50	
No	65.63	75.00	52.50	
(2)Do you give any drugs?				P = 0.496
Yes	37.04	23.81	30.00	
No	62.96	76.19	70.00	
(3)Mortality increases in				P = 0.124
Summer	42.86	50.00	11.11	
Winter	57.14	50.00	88.89	
(4)Diseases according to different ages				P = 0.379
Mature geese	9.09	11.11	10.00	
Gosling	81.82	77.78	80.00	
Grower geese	9.09	11.11	10.00	
(5)Action taken in case of sick geese				P = 0.217
Advice from veteri- narian	13.51	22.73	12.82	
Advice from relatives	70.27	70.45	84.62	
Isolate it away from the flock	2.70	4.55	2.56	
Using vet. Drugs	2.70	0.00	0.00	
Using traditional remedies	10.81	2.27	0.00	
Get rid of it by selling	0.00	0.00	0.00	
Slaughter it immedi- ately for eating	0.00	0.00	0.00	

The current findings indicated that during disease outbreaks in geese, the majority of householders in El-Fayoum, Luxor, and Kafr El-Sheikh refrain from using drugs, with respective percentages of 62.96%, 76.19%, and 70.00%. In terms of mortality rates, geese owners unanimously reported higher mortality in winter than in summer, with rates of 57.14%, 50.00%, and 88.89% in El-Fayoum, Luxor, and Kafr El-Sheikh, respectively. This could be attributed to the fact that geese predominantly lay eggs in winter, and the incubation period, which experiences the highest mortality rate, also falls in the winter season. The breeder reported the goslings show a higher percentage of disease occurrence compared to mature or grower geese as answering about the diseases according to different ages.

When asked the breeder about the action taken in case of sick geese, the majority in El-Fayoum (70.27%), Luxor (70.45%), and Kafr El-Sheikh (84.62%) reported they received advice from relatives. A small percentage, 10.81% in El-Fayoum resort to traditional remedies, while 22.73% in Luxor consult a veterinarian. The present results could be due to the limited access to veterinary services that led to the adoption of various ways to manage sick geese.

MARKETING AND CONSUMPTION OF GEESE

The marketing strategies for geese are not clearly defined, and they are often sold alive to cover unforeseen family expenses. As per [Guèye \(2005\)](#), a well-structured market for free-range poultry is essential for the growth of family poultry. However, no studies have been conducted to depict the market trends for geese. Geese are marketed based on their age in days or months, as indicated in [Table 5](#). A small number of people choose to sell birds at a young age, with the marketing age of goslings being 40, 50, and 33 days in El-Fayoum, Luxor, and Kafr El-Sheikh, respectively. Conversely, most respondents prefer to sell older geese at a marketing age of 60, 50, and 66 months in the same governorates. The marketing weight was 2.50, 3.25, and 3.75 kg in El-Fayoum, Luxor, and Kafr El-Sheikh governorate, respectively. In terms of selling patterns, internal marketing of geese is minimal, as the majority of the production is intended for home consumption, accounting for about 62.07%, 84.85%, and 74.07% in the aforementioned governorates. Geese, which have a rapid growth rate and quick protein deposition, are typically raised for meat and hatching eggs ([Akin and Çelen, 2022](#)). Despite their socio-economic significance, domestic geese have not been commercially exploited to the same extent as other poultry species. Goose production has fallen behind other avian industries for various reasons ([Demir and Aksu, 2012](#)). Prices obtained from direct consumer sales were higher than those from merchants. Only 3.45% of householders in El-Fayoum sell live geese to merchants. As for geese meat consumption rates, approximately 40.91%, 52.17%, and 45.16% of respondents in El-Fayoum, Luxor, and Kafr El-Sheikh, respectively, consume geese annually, while 40.91%, 13.04%, and 22.58% of them consume it every six months in the same governorates. When asked if goose meat could replace red meat and fish, the majority of farmers in El-Fayoum (100.00%), Luxor (94.12%), and Kafr El-Sheikh (95.65%) responded negatively. The village market is the primary selling place for geese, possibly due to the small number of geese and the long distance to urban and peri-urban markets. This is due to the breeders either selling their products directly to local markets ([Aila et al. \(2012\)](#)). Therefore, improving transportation could enhance market access and result in better prices for geese owners. [Piabuo et al. \(2020\)](#) suggested that inadequate transport facilities and lack of market information could account for the reduced market access and prices for households in

more remote villages.

Table 5: Marketing and consumer acceptability for meat in the Egyptian geese.

Items	Governorates			P-Value
	El-Fayoum %	Luxor %	Kafr El-Sheikh %	
(1) What is the marketing age?				P = 0.682
Days	40.00	50.00	33.33	
Months	60.00	50.00	66.67	
Marketing weight kg	2.50	3.25	3.75	
(2) Selling pattern				P = 0.011
Consumer	10.34	15.15	25.93	
Merchant	3.45	0.00	0.00	
Breeding	3.45	0.00	0.00	
Home consumption	62.07	84.85	74.07	
Relatives	20.69	0.00	0.00	
(3) Selling periods				P = 0.057
Monthly (different ages)	13.16	14.63	11.76	
According to demand	21.05	12.20	0.00	
All over the year	13.16	9.76	2.94	
In certain occasions	52.63	63.41	85.29	
(4) Rate of geese meat consumption				P = 0.603
Monthly	4.55	8.70	12.90	
Every 2 months	4.55	4.35	6.45	
Every 4 months	9.09	21.74	12.90	
Every 6 months	40.91	13.04	22.58	
Every year	40.91	52.17	45.16	
(5) Does geese meat substitute red meat and fish?				P = 0.606
Yes	0.00	5.88	4.35	
No	100.00	94.12	95.65	

BREEDERS' PERCEPTION OF GEESE CHARACTERISTICS

Assessments of breeders' opinions toward local geese characteristics were recorded. It is very important to know and understand the characteristics of geese because it is very crucial in designing a breeding program therefore, the householders were asked to identify geese characteristics as shown in [Table 6](#).

[Table 6](#) documents breeders' perceptions of local geese traits. Understanding these characteristics is vital for the development of a breeding program. Consequently, householders were asked to identify specific geese traits as depicted in [Table 6](#). When questioned about the taste of geese meat, all householders (100%) in El-Fayoum, Luxor, and Kafr El-Sheikh rated it as delicious. Most householders agreed with the statement "Are geese resistant to diseases?" with the highest agreement percentages recorded in Lux-

or and Kafr El-Sheikh governorates (83.33% and 75.00%, respectively), and the lowest in El-Fayoum (37.50%). This issue are agreed with findings of (El-Sheikh et al., 2017; Abdel-Kafy et al., 2023).

Table 6: Assessments of householders' opinions toward local geese characteristics in the Egyptian geese.

Items	Governorates			P-Value
	El-Fayoum %	Luxor %	Kafr El-Sheikh %	
Do you agree with the following statements about geese characteristics				
(1)Geese meat is delicious				P=0.607
Agree	100.00	100.00	100.00	
Disagree	0.00	0.00	0.00	
(2)Geese are resistant to diseases				P= 0.080
Agree	37.50	83.33	75.00	
Disagree	62.50	16.67	25.00	
(3)Geese have compact body				P= 0.916
Agree	100.00	38.46	80.00	
Disagree	0.00	61.54	20.00	
(4)Geese have high growth rate				P = 0.603
Agree	80.00	75.00	83.33	
Disagree	20.00	25.00	16.67	
(5)Geese are easy to handle				P = 0.414
Agree	100.00	90.91	75.00	
Disagree	0.00	9.09	25.00	

In response to the question “Do geese have a compact body?” the majority of farmers agreed. The highest agreement percentage was recorded in El-Fayoum (100.00%), and the lowest in Luxor (38.46%). Regarding the question “Do geese have a high growth rate?” over half of the householders in Kafr El-Sheikh, El-Fayoum, and Luxor governorates (83.33%, 80.00%, and 75%, respectively) agreed. A similar trend was observed for the statement regarding ease of handling, as shown in Table 6. Findings of Abdel-Kafy et al. (2023) are in line with the high growth rate of geese.

Local breed geese exhibit excellent adaptability to climatic conditions and high productivity potential. These geese represent a valuable asset for farmers and a strategy for authorities to meet the population’s animal protein needs (El Sabry and Almasri, 2023). Family poultry farming is a significant protein source for farmers. However, while the farming of other poultry species such as ducks and turkeys is on the rise, geese farming remains underdeveloped throughout these governorates as householders’ opinion (data not shown) and maybe throughout Egypt (Abdel-Kafy et al., 2021).

Table 7: Risk status in the Egyptian geese.

Items	Governorates			P-Value
	El-Fayoum %	Luxor %	Kafir- El-Sheikh %	
(1) Geese Number decreased in the last ten years				P = 0.608
Agree	100.00	100.00	100.00	
Disagree	0.00	0.00	0.00	
(2) Geese is a part of the local Egyptian inheritance				P = 0.381
Agree	77.78	50.00	70.00	
Disagree	22.22	50.00	30.00	
(3) I earn a high income from rearing geese				P = 0.890
Agree	42.86	84.62	70.00	
Disagree	57.14	15.38	30.00	
(4) I keep geese because government has a support-ing program for it				P = 0.804
Agree	16.67	9.09	14.29	
Disagree	83.33	90.91	85.71	
(5) Non-governmental organizations supporting geese keeper				P = 0.691
Agree	16.67	7.14	12.50	
Disagree	83.33	92.86	87.50	

THE RISK OF GEESE PRODUCTION

Householders were surveyed to gather their opinions through a series of statements assessing the risk status, as presented in Table 7. The survey focused on householders’ perspectives regarding geese population dynamics, the roles of government and non-governmental organizations in geese conservation, and the cultural and economic importance of geese. In response to inquiries about the decline in geese numbers over the past decade, all farmers unanimously acknowledged this trend. Notably, high mortality rates were observed at an early age due to inadequate management practices among economically disadvantaged farmers. Challenges included a lack of accessible credit and appropriate equipment for optimizing geese management. These findings hold significant implications for prioritizing geese conservation programs, especially considering the risk of extinction. Additionally, the relatively high cost of live geese may hinder breeding pair acquisition, while women tend to play a more active role in trading easily marketable goose products. The study underscores the cultural significance of geese as part of Egypt’s local heritage, with a majority of householders affirming their role in the country’s inheritance. Agreement percentages varied across governorates, with El-Fayoum and Kafr El-Sheikh recording the highest (77.78% and 70.00%, respectively) and Luxor the lowest (50.00%). Regarding income from geese rearing, Luxor and Kafr El-Sheikh had the highest percentages of households reporting substantial earnings (84.62% and 70.00%, respectively), compared to El-Fayoum (42.86%), as detailed in Table 7. Table 7 indicates that

both government and non-governmental organizations did not actively support geese keepers. All householders disagreed with the statements suggesting government or NGO assistance in geese keeping. The primary objective of farmers engaged in geese production was to provide meat for household consumption. These diverse goose farmers face challenges such as diseases, mortality, theft, and predation. Consequently, goose farming in Egypt predominantly operates within family-based systems, exhibiting variations in farmer practices, farming methods, and dietary approaches. Despite the cultural and economic significance of geese, they encounter constraints such as high feed costs and low productivity. Addressing these challenges is essential to enhance geese production.

This study is expected to stimulate further research and more efforts toward the sustainable utilization to conservation of geese. Using the social characteristics and breeders' opinions data, it can analyze the geese production system in Egypt based on its strengths, weaknesses, opportunities, and threats (SWOT). The strengths of this system include the long experience of geese owners (>10 years), the family ownership of the flock, the deliciousness of geese meat, the high growth rate and easy handling of geese, and the local heritage value of geese. These strengths agree with [El-Sheikh et al. \(2017\)](#) who reported that a high growth rate for gosling assists in the waste disposal system by transforming leftovers of human foods into delicious meat, beside a high resistance to diseases. The weaknesses of this system include the high illiteracy rate of geese owners in Luxor and Kafr El-Sheikh, the reliance on relatives' advice for geese management, the lack of drug treatment for sick geese, the limited consumption of geese meat to certain occasions, and the low substitution of geese meat for red meat and fish. These weaknesses sides are in harmony with the opinions of [El-Sheikh et al. \(2017\)](#) who indicated a lack of breeding the potential of geese, a lack of policy initiative to give attention to developing a family geese production system to transfer it into a market-oriented entity for generating income. The opportunities of this system include the involvement of women in decision-making, ownership, consumption, and income generation from geese rearing, the potential for improving the management of goslings (young geese) to prevent diseases, the relative advantage of Fayoum in selling geese to merchants, consumers, and breeders, and the high-income perception of geese rearing among householders. Guaranteeing food security for poor villagers and empowering women are main the opportunities for the production of geese that greed with [El-Sheikh et al. \(2017\)](#). As the women are mainly responsible for geese production and increasing productivity will lead to a win-win situation for all the stakeholders. The threats of this system include the decline of geese population in the last decade, the inability of many breeders to rear geese again, the absence of government support for geese pro-

duction, and the lack of non-governmental programs for geese conservation. No breeding program for genetic selection has occurred in geese and no governmental program for geese conservation in smallholders is the main threat to geese production as reported by [El-Sheikh et al. \(2017\)](#).

This study aims to catalyze further research and concerted efforts toward the sustainable utilization and conservation of geese. Leveraging data on social characteristics and breeders' opinions, we can conduct a comprehensive analysis of the geese production system in Egypt using a Strengths, Weaknesses, Opportunities, and Threats (SWOT) framework. Strengths of the geese production system are Geese owners, with over a decade of experience, contribute valuable insights (Experience), the system predominantly operates within family units (Family Ownership), geese meat is considered delicious (Culinary Appeal), Geese exhibit a high growth rate and are easy to handle (Growth Rate and Manageability) and geese hold local heritage value (Cultural Heritage). These strengths align with [El-Sheikh et al. \(2017\)](#) findings, which highlight the benefits of geese, including efficient waste disposal through goslings transforming food leftovers into delectable meat while maintaining disease resistance. Weaknesses of the system are geese owners in Luxor and Kafr El-Sheikh face high illiteracy rates (Illiteracy), advice from relatives drives geese management decisions (Reliance on Relatives), lack of drug treatment options for sick geese (Healthcare Gap), geese meat is primarily reserved for specific occasions (Limited Consumption) and geese meat is not a common substitute for red meat or fish (Substitution Challenges). These weaknesses resonate with [El-Sheikh et al. \(2017\)](#) observations, emphasizing the need to address breeding potential and develop market-oriented family geese production systems. Opportunities for Improvement are women play key roles in decision-making, ownership, consumption, and income generation from geese rearing (Women's Involvement), enhancing gosling management can prevent diseases (Gosling Management), Fayoum has a relative advantage in selling geese to merchants, consumers, and breeders (Fayoum Advantage), and geese rearing is perceived as a high-income activity by householders (Income Perception). These opportunities align with [El-Sheikh et al. \(2017\)](#) perspective, emphasizing food security for impoverished villagers and women's empowerment as critical drivers for successful geese production. Threats to the system are: Geese populations have decreased over the last decade (Population Decline), many breeders struggle to rear geese again (Breeder Challenges), absence of government initiatives for geese production (Lack of Government Support), and insufficient non-governmental efforts for geese conservation Non-Governmental Programs. [El-Sheikh et al. \(2017\)](#) underscore the urgency of addressing these threats, emphasizing the need for breeding programs and government support to safeguard geese production.

CONCLUSIONS AND RECOMMENDATIONS

Geese production in Egypt primarily involves small-scale farmers. The system's advantages lie in the extensive experience of these families, who view breeding geese as an integral part of their cultural heritage. Opportunities within the geese production system include domestic geese for home consumption and income generation. Notably, women play key roles in constructing housing and selling geese, often focusing on easily marketable products. Fayoum presents favorable opportunities for geese sales. However, the system faces threats, including a decline in geese numbers over the past decade. Additionally, there is no government or NGO support specifically dedicated to preserving geese. To address these challenges, integrating knowledge and strategies related to genetics, nutrition, reproduction, and management is essential. This holistic approach can enhance existing production systems and fully unlock the genetic potential of geese.

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AUTHOR'S CONTRIBUTIONS

Conceptualization, Amal S. Omar, El-Sayed M. Abdel-Kafy and Sabbah F. Youssef; formal analysis, El-Sayed M. Abdel-Kafy and Amal S. Omar; data curation, Hoda A. Shabaan, Wael A.H. Ali, Sabbah F. Youssef and El-Sayed M. Abdel-Kafy; methodology, Amal S. Omar, Nada A. El-Shahawy and Mahmoud A. Ahmed; supervision, El-Sayed M. Abdel-Kafy, and Hoda A. Shabaan project administration, Sabbah F. Youssef and El-Sayed M. Abdel-Kafy; writing—review and editing, Amal S. Omar, Mahmoud A. Ahmed and Nada A. El-Shahawy. All authors have read and agreed to the published version of the manuscript.

DECLARATIONS

AVAILABILITY OF DATA AND MATERIALS

The underlying research data can be obtained from the corresponding author, who can be reached by email: sayedabdkaffy@yahoo.com

ETHICAL CONSIDERATION

Ethical approval number: 20210615153429 to this study by Resaeash and animal care committee of the Animal Production Research Institute (APRI).

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CONFLICT OF INTEREST

The authors declared no competing interests.

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