

## Morphological and productive characterization of Sohagi sheep strain as a step towards identifying it as a new breed added to Egyptian Germplasm

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### ABSTRACT

The aim of this study was to morphologically characterize the Sohagi sheep and identifying some productive traits such as birth weight (BW), weaning weight (WW90) and year of age (W360) and some genetic parameter estimates as a new breed ready to add to the animal genetic resource in Egypt, The results presented in this work were collected from the data recorded in the farm of the Faculty of Agriculture of following up the performance of Sohagi sheep herd kept in closed population through a period of 22 years, The traits recorded are body weights at birth weight (BW); weaning weight (WW90) and one year age 360 days. The data included 1290 lambs records originated from 44 sires and 490 dams. The records of BW, WW90 and W360 were analyzed. The results showed that these group have a unique and homogenize morphological performance which successfully allow to suggest that these group of animals could be identified as a new breed that given the name Sohagi sheep. This group characterized also by the following: birth weight (BW) is  $2.96 \pm 0.03$ kg, weaning weight(W90) is  $14.61 \pm 0.16$  kg and one year age (W360) is  $30.20 \pm 0.33$  kg in females. While in male, birth weight (BW) is  $3.03 \pm 0.03$  kg, weaning weight (W90) is  $15.65 \pm 0.17$  kg and one year age (W360) is  $36.32 \pm 0.36$  kg. Daily growth rate in males from birth to weaning was  $138.63 \pm 1.15$  gm, from weaning to 6 months  $62.83 \pm 0.98$  gm, from 6 to 9 months  $71.49 \pm 1.21$ gm and from 9 to 12 months  $90.24 \pm 1.41$ gm. Daily growth rate in females from birth to weaning was  $128.37 \pm 1.10$ gm, from weaning to 6 months  $53.02 \pm 0.79$ gm, from 6 to 9 months  $53.54 \pm 0.99$ gm and from 9 to 12 months  $60.70 \pm 0.80$ gm. The estimate of heritability of birth weight, weaning weight and weight of one year age were  $0.09 \pm 0.045$ ,  $0.56 \pm 0.061$  and  $0.29 \pm 0.055$ , respectively. Parallel to this work, a group of molecular characterization studies were implemented which confirmed that Sohagi is an independent breed.

**Keywords:** Body weights, Daily growth rate, Heritability, Sohagi sheep

### INTRODUCTION

Sheep meat and milk efficiently help the goal of overcoming the human dietary protein insufficiency., Small ruminants compared to large ruminants could maintain good production while consuming less concentrates and more roughages which compromise with the scarce of concentrates supply in Egypt (Elshazly and youngs 2019). The livestock production accounts for over 30% of total agricultural revenue, where sheep represent an important part of Egyptian agriculture. The statistics showed that in 2017 more than 2.34 million sheep produced 72,296 tons of red meat 7, accounting for about 7.4% of all red meat output in Egypt (FAO STAT.,

2018). The average weight of the carcass was around 30.9 kg. Total production of sheep milk was 99.322 ton. In Egypt, small ruminants play an important role in the rural parts of Upper Egypt where sheep and goats represent the main source of income to landless and small landowners (Alary et al., 2014). The main breeds in Egypt are Ossimi, Barki and Rahmani, which are widespread in the middle of Egypt, western Mediterranean coastal region and the north of Nile delta, respectively. In the south of Egypt, Sohagi and Saidi are the most popular breeds (ICARDA., 2006). Sheep are raised mainly for meat, while wool is a secondary product in In Egypt. Wool is of coarse type and usually used

## Morphological and productive characterization of Sohagi sheep strain as a step towards identifying it as a new breed added to Egyptian Germplasm

for rug and blanket production. The great majority of sheep are of local breeds, only very few being exotic breeds. Local Barki sheep are found in the North West coast, Rahmani and Fallahi in the delta, Ossimi, Saeidi, Sanabawi and Sohagi in mid and Upper Egypt (FAO STAT., 2019). Egyptian sheep breeds are known to have high fertility, long breeding season, and low prolificacy (Gabr et al., 2016). Sheep are spread geographically in Upper Egypt, Central and North Upper Egypt, and governorates beyond the valley, where the breeds have adapted to their respective environmental conditions over time (North and South Sinai, Marsa Matruh, New Valley, Red Sea and Nubaria. Gharbia, Matrouh, Sharqiya, Minya, and Sohag governorates are some of the most high population density provinces for sheep (Elshennawy, 1995). The sheep population widespread in Sohag in upper Egypt has not previously characterized morphologically or genetically. ICARDA., 2006 reported that the main breeds in Egypt are Ossimi, Barki and Rahmani, which are widespread in the middle of Egypt, western Mediterranean coastal region and the north of Nile delta, respectively. In Addition, in the south of Egypt, Sohagi and Saidi are the most popular breeds. Sohagi sheep is one of the most prevalent types of sheep in Upper Egypt, which used by small farmers to improve their livelihoods and annual income. Sohagi sheep represent one of the breeds in Upper Egypt and is considered an important source of meat and wool in Sohag governorate. Sohagi sheep is one of the most prevalent types of sheep in Upper Egypt, which are used by small farmers to improve their livelihoods and annual income. However, Sohagi sheep has not been widely reported in literature (Galal et al., 2005). A small flock of Sohagi sheep has been formed in 2001 by Dr. Gamal Salouma and Dr. Mohamed El-Shennawy, Department of Animal Production, Faculty of Agriculture, Sohag University. An animal germplasm information system was applied to definethis group of sheep where all collections of data and descriptions provide guidance to

prove dependency of Sohagi sheep. The body of the Sohagi sheep is shallow, medium in size with an average weight of 40kg for females and 65 kg for males with relatively long neck and legs. The head is small with a straight profile and ewes are mostly polled while rams horned and polled and a small percentage of rams, about 20%, do not have horns. The ears are vestigial. The body is covered with coarse wool ranging from cream to white with cream being dominant (Galal et al., 2002). White with cream being dominant (Galal et al., 2002). It show absence of ear pinna. Researchers in Egypt gave little attention to this breed compared with other sheep breeds and no breeding program has been applied to Sohagi sheep (Elnahas et al., 2017). Sohagi sheep represents one of eight minor native breeds in Egypt. It mainly locate in Upper Egypt at Sohag. In another study aimed to improve the productive performance of Sohagi Sheep. Hamden., (2010) reported that there is a certain beneficial effect of feeding treated canola meal on milk yield, composition and consequently lambs performance during suckling period. Kassab et al., (2009) reported that Sohagi sheep is a non-dairy sheep and suggested intensive production system, early weaning and early lambs fattening system for Sohagi sheep because of their low milk production. The studies on molecular characterization of sheep in Egypt done by Eman R. Mahfouz, et al. (2008), Othman, et al. (2016), and Elbeltagy, et al. (2015) found that Sohagi sheep is an independent breed with a significant purity degree. They also explained the degrees of kinship between the local Egyptian sheep breeds. .

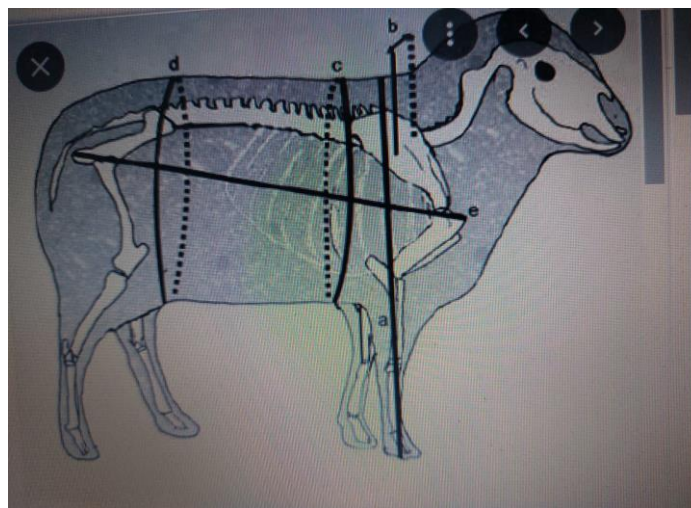
### MATERIAL AND METHODS

**Data collection.** This study was carried out at the Agricultural Experiments Station, Faculty of Agriculture, Sohag University, in Sohag governorate in The Upper Egypt. The sheep flock of this breed was established 20 years ago by College of Agriculture in closed population aiming to select group of animals for improving productive and reproductive traits . The data and

pedigree information used in this study were obtained from the Sohagi sheep flock of Faculty of Agriculture, Sohag University reared from 2001 to 2021. The flock raised under lambing system of three crops every two years. The seasons of mating were January, May and September, where ewes were divided into groups, each of 30 ewes and rams joined for 45 days. The flock fed on concentrates such as soybeans and corn, as well as the green fodder (*Trifolium Alexandrium*) in the winter. The studied traits are body weights at birth, BW; weaning, W120 and yearling, 360 days. The data

included 1290 lamb records originated from 44 sires and 490 dams. Records of BW, W90 and W360 analyzed.

**Morphological Characteristics** : The measurements applied on mature females and males including mature body weight besides fifteen morphological traits (body height at hip, body height at wither, Length of fore leg, Length of hind leg, neck circumference, Neck length, Body length, Heart girth, Paunch girth, Head length, Head width, Ear length, Horn, Tail length, tail width, area of tail) As shown in the following figure



### Statistical analysis

The GLM procedure of SAS program (**Version 9.1, 2003**) was used to determine the fixed factors affecting the investigated traits. In the initial model, all interactions found non-significant were deleted in the final model according to the following model:

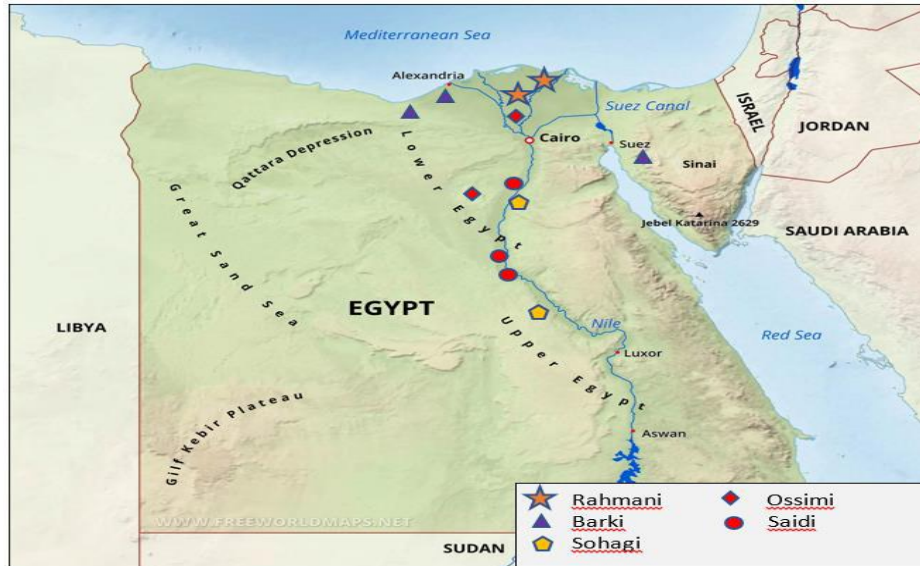
$$Y_{ijklmn} = \mu + G_i + R_j + S_k + T_l + P_m + e_{ijklmn} \quad (1)$$

Where,  $Y_{ijklmn}$  is the observation of the response variable (BW, WW90 or W360) of  $n^{\text{th}}$  animal of

$i^{\text{th}}$  gender,  $j^{\text{th}}$  year of birth,  $k^{\text{th}}$  season,  $l^{\text{th}}$  type of birth and  $m^{\text{th}}$  parity;  $\mu$  is the overall mean;  $G_i$  is the fixed effect of gender (1=male and 2=female);  $R_j$  is the fixed effect of year of birth (2001 to 2021),  $S_k$  is the fixed effect of season (1, 2 and 3),  $T_l$  is the fixed effect of type of birth (single and twin),  $P_m$  is the fixed effect of parity (1, 2, .and 8) and  $e_{ijklmn}$  is the random residual error assuming to be NID ( $0, \sigma^2 e$ )

# Morphological and productive characterization of Sohagi sheep strain as a step towards identifying it as a new breed added to Egyptian Germplasm

## The locations and spread of the sohagi sheep



## RESULTS AND DISCUSSION

### Characteristics and morphological parameters of Sohagi sheep.

Data in Tables 1, 2 and 3 show the appearance and distinguishing features of Sohagi sheep. According to body measurements, the body of the Sohagi sheep is shallow, medium in size with an average weight of  $37.00 \pm 0.64$  kg for mature females and  $54.15 \pm 1.31$  kg for mature

males with relatively long neck averages  $34.42 \pm 0.75$  cm and length for fore legs averages  $46.90 \pm 0.66$ ,  $45.58 \pm 1.26$  cm for males and females, respectively. Length of hind legs averages  $54.50 \pm 0.99$ ,  $53.00 \pm 1.05$  cm for males and females, respectively. The head is small with a straight profile and ewes are mostly polled while rams may be horned or polled (Picture No. 1, and 3).

**Table 1.** Morphological measurement (breed characteristics) of mature males of Sohagi sheep.

Traits	acronyms	Mean $\pm$ SE	Minimum value	Maximum value
Mature Body weight	kg	$54.15 \pm 1.31$	46	60
Body height at hip	cm	$64.20 \pm 1.04$	58	68
Body height at wither	cm	$62.60 \pm 0.95$	58	67
Length of fore leg	cm	$46.90 \pm 0.66$	44	50
Length of hind leg	cm	$54.50 \pm 0.99$	50	60
Neck circumference	cm	$46.80 \pm 0.99$	43	52
Neck length	cm	$30.10 \pm 1.50$	25	39
Body length	cm	$73.50 \pm 1.40$	66	79
Heart girth	cm	$79.70 \pm 0.79$	85	93
Paunch girth	cm	$92.70 \pm 1.45$	86	98
Head length	cm	$25.90 \pm 0.66$	23	29
Head width	cm	$13.30 \pm 0.3$	12	15
Ear vestiges length	cm	Absence (the ears are vestigial)		
Horn		Horned and polled		
Tail length	cm	$25.60 \pm 0.93$	22	31
Tail width	cm	$21.30 \pm 0.79$	18	25
Area of tail	cm <sup>2</sup>	$275.20 \text{ cm}^2 = 1/2 \text{ Tail width} * \text{Tail length}$		

**Table2.** Morphological measurement (breed characteristics) of mature females of Sohagi sheep

Traits	acronyms	Mean ±SE	Minimum value	Maximum value
Mature Body weight	kg	37.00 ± 0.64	34.00	39.00
Body height at hip	cm	60.85 ± 0.80	57.00	63.00
Body height at wither	cm	58.71 ± 1.69	50.00	64.00
Length of fore leg	cm	45.58 ± 1.26	41.00	50.00
Length of hide leg	cm	53.00 ± 1.05	50.00	58.00
Neck circumference	cm	29.28 ± 0.94	26.00	34.00
Neck length	cm	34.42 ± 0.75	32.00	37.00
Body length	cm	78.14 ± 1.62	73.00	84.00
Heart girth	cm	63.00 ± 1.73	59.00	73.00
Paunch girth	cm	86.42 ± 1.59	82.00	94.00
Head length	cm	22.57 ± 0.36	21.00	24.00
Head width	cm	14.42 ± 0.29	13.00	15.00
Ear vestiges length	cm	Absence ( the ears are vestigial)		
Horn length	cm	Absence ( mostly polled)		
Tail length	cm	20.21 ± 0.53	19.00	22.00
Tail width	cm	18.00 ± 1.05	14.50	22.00
Area of tail	cm <sup>2</sup>	181.89cm <sup>2</sup> = 1/2 Tail width* Tail length		

The ears are vestigial so that the Sohagi sheep is the only local breed with reduced **ear pinnae** (Picture No. 1 -(vestigial) in Egypt. The area of tail (Picture No. 3) refers to Sohagi sheep has

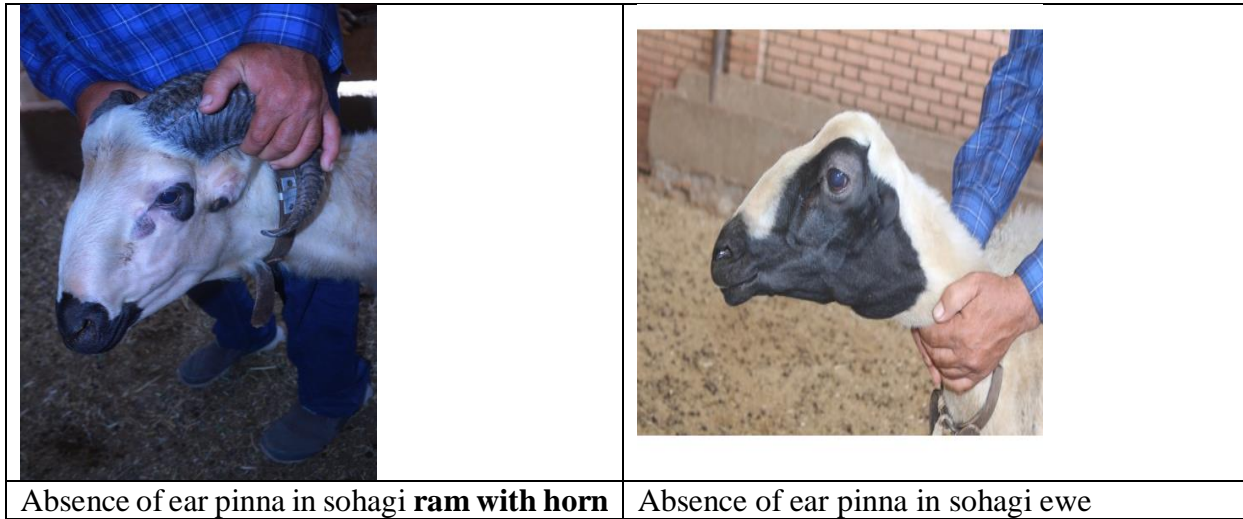
medium fat-tailed less than Rahmani breed which has the largest tail. The external appearance of Sohagi breed evidence to be differ than other local breeds,

**Table 3.** Means and standard error (SE) of body weights of Sohagi sheep at birth, BW; weaning, W90; one year age, W360 according to gender, type of birth and season.

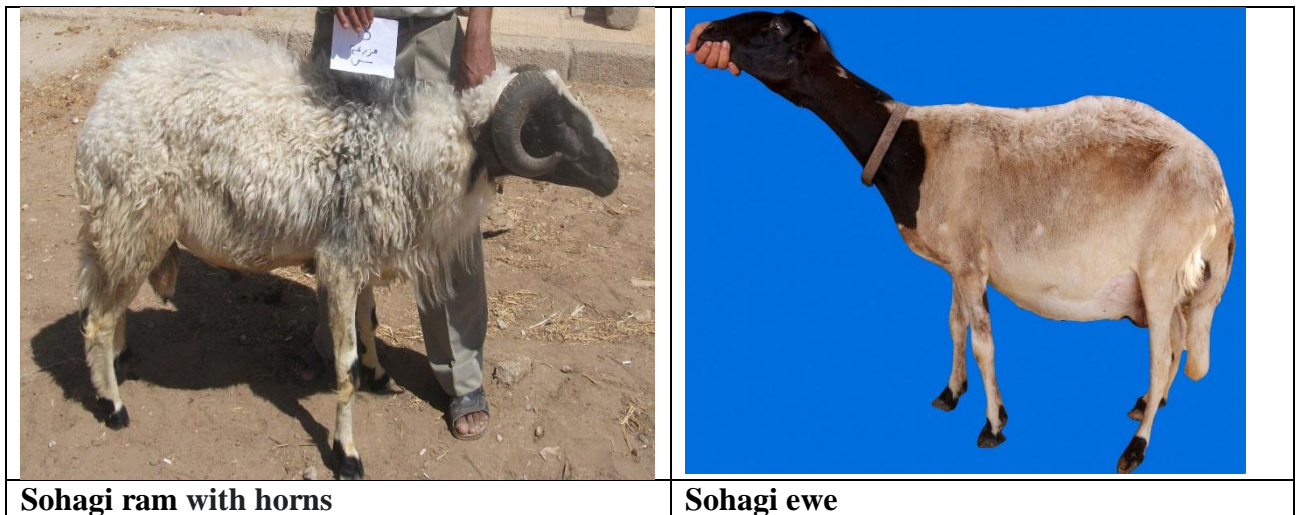
Item	N	Birth weight (KG)	Weaning weight (KG) at three month	Yearling weight (KG) at 12 month
		Mean±SE	Mean±SE	Mean±SE
overall	1290	2.98±0.001	15.05±0.07	32.61±0.17
gender				
male	685	3.03 <sup>a</sup> ±0.03	15.65 <sup>a</sup> ±0.17	36.32 <sup>a</sup> ±0.36
Female	605	2.96 <sup>b</sup> ±0.03	14.61 <sup>b</sup> ±0.16	30.20 <sup>b</sup> ±0.33
Type of birth				
single	670	3.15 <sup>a</sup> ±0.03	15.79 <sup>a</sup> ±0.16	34.03 <sup>a</sup> ±0.33
Twins	530	2.84 <sup>b</sup> ±0.3	14.47 <sup>b</sup> ±0.17	32.49 <sup>b</sup> ±0.36
Season				
1 February to March	444	3.07 <sup>a</sup> ±0.04	15.75 <sup>a</sup> ±0.18	33.38 <sup>a</sup> ±0.38
2 June to July	395	2.95 <sup>b</sup> ±0.04	15.04 <sup>b</sup> ±0.18	33.78 <sup>a</sup> ±0.38
3 October to November	451	2.95 <sup>b</sup> ±0.04	14.59 <sup>c</sup> ±0.18	32.62 <sup>b</sup> ±0.38

**Morphological and productive characterization of Sohagi sheep strain as a step towards identifying it as a new breed added to Egyptian Germplasm**

**Picture No. 1 shows the absence of ear pinna in**



**Picture No. 2 shows rames and ewe in sohagi sheep**



Picture No. 3 Shows Sohagi ram without horns



Sohagi ram without horns

The fat-tailed in Sohagi sheep

**Table 4.** Mean of growth rate (g/d) at different ages for Sohagi sheep from data of 1290 record

Age	ADG(g/d)		
	Male	Female	Male and females
Growth rate from birth to weaning	138.63 <sup>a</sup> ± 1.15	128.37 <sup>b</sup> ± 1.10	133.22 ± 0.77
Growth rate from weaning to 6 months	62.83 <sup>a</sup> ± 0.98	53.02 <sup>b</sup> ± 0.79	57.65 ± 0.64
Growth rate 6 months to 9 months	71.49 <sup>a</sup> ± 1.21	53.54 <sup>b</sup> ± 0.99	62.03 ± 0.81
Growth rate 9 months to 12 months	90.24 <sup>a</sup> ± 1.41	60.70 <sup>b</sup> ± 0.80	74.62 ± 0.88

**Table 5.** Sohagi sheep heritability estimates for birth weight, weaning weight and one year age weight.

Trait	Heritability, h <sup>2</sup>	Sample size
Birth weight	0.09 ± 0.045	1290
Weaning weight	0.56 ± 0.061	1290
Weight at one year of age	0.29 ± 0.055	1290

The data in Table 4 shows the growth rates of Sohagi sheep at different ages, for males and females.

Table 5 shows that the estimate of heritability of birth weight in the present study is low. It means that expression of the traits are mainly under the influence of environmental factors like feeding and other managerial factors thus improvement of these traits can be obtained by improving the environmental factors influencing the birth and weaning weight (M.E.

babar et al., 2003). But the estimate of heritability of weaning weight and weight at one year of age is high and more than estimate of heritability of weaning weight and weight at one year of age in Barki breed (Galal et al., 2005).

### CONCLUSION

The results of productive and morphological traits in the current study, besides the parallel genetic studies applied, could refer to that Sohagi sheep is an independent breed could added to the

## Morphological and productive characterization of Sohagi sheep strain as a step towards identifying it as a new breed added to Egyptian Germplasm

Egyptian sheep germplasm as a new breed that was recognized to increase genetic diversity of animal genetic resources in Egypt.

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### الملخص العربي

توصيف الصفات المورفولوجية والإنتاجية لسلالة أغنام السوهاجي بهدف تقييمها كنوع جديد ضمن السلالات المصرية

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تهدف هذه الدراسة إلى توصيف الاغنام السوهاجي شكلياً ومورفولوجيا وانتاجيا لبعض الصفات مثل الوزن عند الميلاد والوزن عند الفطام والوزن عند عمر سنة نحو تقييم هذه الحيوانات كسلالة جديدة تضاف الى الموارد الوراثية الحيوانية في مصر. تم جمع النتائج المعروضة في هذه الدراسة من مزرعة الاغنام - كلية الزراعة - جامعة سوهاج من خلال العمل لمدة 22 سنة من متابعة أداء قطيع الاغنام السوهاجي كقطيع نواة مغلقة . البيانات تمثل 1290 سجل من الحملان السوهاجي ناتجة من 44 كبش و 491 ام خلال 22 عام. اوضحت نتائج التحليل الاتي: ان سلالة الاغنام السوهاجي سلالة مستقلة من حيث الصفات المورفولوجية والانتاجية . ايضا متوسط الوزن عند الميلاد وعند الفطام وعند عمر سنة في اناث الاغنام السوهاجي هو  $0.03 \pm 2.96$  كجم و 14.61  $\pm 0.16$  كجم و  $0.33 \pm 30.20$  كجم على التوالي. كذلك متوسط الوزن عند الميلاد وعند الفطام وعند عمر سنة في ذكور السوهاجي هو  $0.03 \pm 3.03$  كجم و  $15.65 \pm 0.17$  كجم و  $0.36 \pm 36.32$  كجم على التوالي. كذلك اوضحت نتائج التحليل ان متوسط معدلات النمو من الولادة وحتى الفطام ومن الفطام حتى 6 شهور ومن 6 شهور الى 9 شهور و من 9 شهور الى عمر سنة في ذكور الاغنام السوهاجي هي  $1.15 \pm 138.63$  gm و  $0.98 \pm 62.83$  gm. ومن 9 أشهر إلى 12 شهرًا بمتوسط  $0.80 \pm 60.70$  جم. تقدير المكافء الوراثي لوزن الولادة ووزن الفطام وعمر سنة واحدة هي  $0.09 \pm 0.045$  و  $0.56 \pm 0.061$  و  $0.29 \pm 0.055$  على التوالي.

بالتوازي مع هذه الدراسة قام عدد من الباحثين بعمل توصيف جزيئي لسلالات الاغنام في مصر ، التحليل الجيني لهذه الدراسات أثبت أن الاغنام السوهاجي هي سلالة مستقلة وهي الاقرب الى الاغنام العواسي في سوريا وانتقلت الى مصر عبر هجرة الرهبان من الشام الى مصر.