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Review of Sheep and Goat Research and Development in Egypt Since the Forties: II-Phenotypic Characteristics, Production, and Reproduction Performance of Local Sheep Breeds

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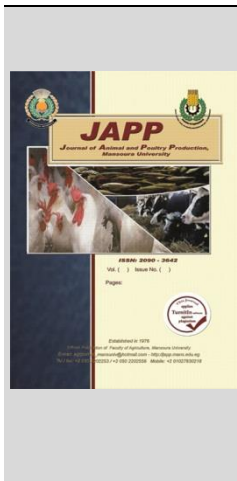
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ABSTRACT

Egyptian local sheep breeds are widely spread over the country; raised mainly by smallholders and contribute significantly to their livelihood. Local breeds are well adapted to the prevailing hot dry conditions, and limited feed resources. They are fat-tailed sheep, open coarse wool and raised mainly for meat and lamb production. There are four major sheep breeds in Egypt; Rahmani sheep in north-Delta, Ossimi sheep in Mid-Egypt, Barki sheep in the Mediterranean coastal zone, and Saidi sheep in Upper Egypt. Minor local breeds are Fallahi, Wahati, Abudeleik, and Suhagi sheep located mainly in the south and in boarder governorates. Special and unique phenotypic characteristics are described for each breed. Production performance of the main local breeds include body weights, carcass quality, wool, and milk production, are tabulated as reported in the literature. Reproduction performance involving age at puberty, estrous, and breeding activity are discussed. Adaptability of local breeds to the prevailing subtropical environment, specially heat stress are presented. Key issues as the advantages of the local breeds, within the ongoing debate on breeding adapted law producing local animals, vs. high producing low tolerant exogenous breeds are discussed. Improvement programs for local sheep breeds requires sort of nucleus flock structure, as breeders association or village flocks, and the utilization of the recent findings of genomic analysis.

Keywords: Egyptian sheep breeds, phenotypic characteristic, production, reproduction, adaptation.



INTRODUCTION

Local Egyptian sheep breeds are spread over different agroecological zones in the country; under intensive (Nile valley and Delta) or extensive (Coastal zone of Western Desert, Red Sea and Sinai) production systems. They are able to cope with the prevailing hot dry conditions and limited feed resources. They are raised mainly by the small holders, representing significant socioeconomic component in their livelihood, as source of food and capital. Their main products are meat and lamb, wool and milk are secondary products.

Under extensive production system, the breeders (mainly Bedouins) rely on them for their livelihoods, raised on natural ranges and rainfall -barley as animal feed. Sheep and goat flocks are their main capital means facing the frequent incidence of drought, and for home consumption. They are raised in mixed flocks of 20-200 heads of sheep and 5-30 heads of goats (Aboul-Naga *et al.*, 2021). The farmers in the intensive agriculture system of Delta and Nile Valley, keep 1-2 of large ruminants and few heads of small ruminants (2-10), in crop-livestock integrated system, on limited pieces of land (less than one hectare). They rely on green fodder (clover) to feed their animals, beside crop residues and some concentrates. Information on the productive capability and dynamics of the local breeds under the small holder farming systems is lacking due to the absence of any recording system or animals identification.

Average consumption per capita of mutton in Egypt is less than 1.5 kg/year (CAPMAS, 2000). Demand on sheep

and goat meat is seasonal, especially in urban areas, the biggest demand occurs during the religious events of Ramadan and El Adha. It is estimated that more than 6 million families are raising sheep and goats in the Nile Valley and the majority of the families in the coastal zone, New Valley, Red Sea, and Sinai, are benefited from sheep and goats business, raising, trading, fattening, and processing.

Sheep breeds and population distribution in the country:

Livestock population surveys in Egypt are conducted by governorate and not by breed. Breaking down sheep populations by breed was approximately inferred from the geographical surveys (CAPMAS, 2000) and ICARDA study for characterization of small ruminant genetic resources in WANA region (Iniguez, 2005; De Pauw *et al.*, 2011; Figs.1 and Table 1).

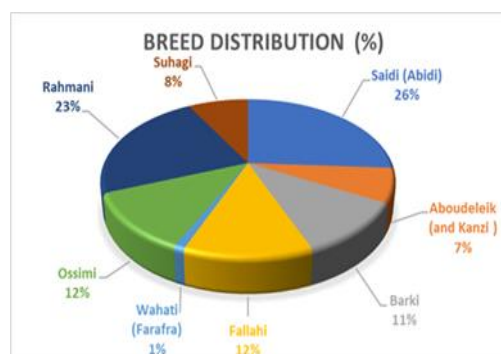


Fig. 1. Geographical distribution of local sheep breeds (De Pauw *et al.*, 2011)

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Table 1. Main characteristic of local breeds and production system (De Pauwi *et al.*, 2011).

Breed	Tail/Wool	Size	Production System
Aboudeleik	fat-tail, long	coarse wool or hair	Transhumance following rain; mixed flocks
Kanzi	fat-tail, long	coarse wool or hair	Transhumance following rain; mixed flocks
Maenit	fat-tail	coarse wool or hair	Transhumance following rain; mixed flocks
Barki	fat-tail	open fleece less coarse / 69% fine 26.2% coarse	extensive transhumance grazing
Fallahi	fat-tail	open coarse medium length luster	mixed cropping
Farafra	fat-tail	no info	Oasis
Ossimi	fat-tail	open coarse often glossy	mixed cropping
Rahmani	fat-tail	long, straight wool	mixed cropping
Saidi/Sanabawi	fat-tail, long	open, long, coarse, wool / on belly, legs, forehead	mixed cropping
Suhagi	fat-tail	coarse wool	mixed cropping

Phenotypic characterization of local breeds:

Local sheep breeds are fat-tailed open coarse wool, raised mainly for meat and lamb production, with wool and milk as secondary products. There are four major sheep breeds in Egypt, Rahmani in north-delta, Ossimi in middle Egypt, Barki in the Mediterranean coastal zone, and Saidi in Upper Egypt. Rahmani, Ossimi and Seidi are raised in intensive cultivated system in the Nile Valley and Delta; while Barki sheep are raised extensively in the rain fed areas. Minor sheep breeds: Fallahi, Aboudeleik, Wahati, and Suhagi, are located mainly in south Egypt and boarder governate areas (Table 1).

Major Egyptian sheep breeds:**Barki sheep**

Named after the Libyan province "Barka", also called Arabian, Sahrawi, or Bedouin sheep. They have a long neck and legs and short body (Annex 1). Head is small with straight profile, rams have large horns which turn backward and downward, while ewes are often polled (Ragab and Ghoneim, 1961; Seoudy, 1970; Galal *et al.*, 1971; Aboul-Naga and Afifi, 1977). Their fat-tail is relatively small (1.1 to 2.8% of the live weight), triangular in shape with twisted end that does not reach below the hocks. Ears are semi pendulous of medium size. Body color is white with brown or black head and legs; dark spots may be found on the body and around the eyes. The fleece is open and the percentage of fine fibers in the fleece is high, compared to other local breeds.

The Barki sheep are hardy, well adapted to the desert conditions (Aboul-Naga, 1976) and have distinct mothering ability (Galal *et al.*, 1972). Animals have a remarkable ability to live in the arid regions, on sparse vegetation and limited water resources in the summer (Aboul Naga *et al.*, 1985). When Barki animals relocated in the Nile Valley with better environmental and conditions, they performed less compared to the Ossimi and Rahmani sheep (Labban and Radwan, 1963).

Ossimi sheep

Named after Ossim village, Giza Governorate. The body shape is narrow and shallow with well-proportioned trunk and relatively long legs (Annex 1). It is medium in size; head is slightly of convex profile. The rams often have large horns, with backward downward curvature; ewes are often polled, and small buds may be found. The fat-tail is thick and twisted, terminating abruptly in a thin end above the hocks; the main part is round or oval, representing 2.5 to 4 % of its live weight. Ears are semi pendulous and of medium size (Sharafeldin and Mostageer, 1961; Aboul-Naga and Afifi, 1977; Galal, 1987). The color is white with brown or dark brown head. Brown color sometimes extends

to the neck and shoulders. The fleece is open, coarse, and often glossy.

The natural habitat of the breed is South of Delta and Middle Egypt under intensive cropping system with, moderate hot conditions and limited rainfall. It depends on stubble grazing, and as follower to cattle and buffalo on Egyptian clover and crop residues. This breed has good adaptability to various climatic conditions than Barki or Rahmani (Galal, 1987).

Rahmani sheep

The breed is named after Rahmania village, Behaira Governorate, north of Delta. It is the largest Egyptian breed. The body is long, relatively deep and wide at the buttocks. The head is big with convex profile and Roman nose (Annex 1). The rams have large crescent horns switching around the ears. The ewes have small horns and in many cases are poled. The fat-tail is large, thick, and oval in shape with a broad fat base, ending in a fine spiral piece at the hocks, representing 4 to 8.3 % of the live weight. The ears are small and quite often vestigial (Hafez, 1954; Galal, 1987). Color is dark brown that fades with age, the fleece is coarse colored and straight, with short wool on the belly. It is thought to be related in origin to the Turkish Ak-Karama sheep

The natural habitat of the breed is North Delta region with intensive cropping system, the majority of the sheep in the delta are maintained as scavengers and followers to cattle and buffaloes on clover fields from October till May, and on summer green fodder. This breed is more specifically adapted to North Delta conditions and believed to be more resistant to internal parasites. They are known to be good mothers, with the ability to double their milk production when they have twins (Aboul-Naga *et al.*, 1981).

Saidi sheep

It is the oldest Egyptian sheep breed, the name refers to Upper Egypt region, they raised particularly in Assuit and Mania Governorate under intensive cropping system. Narrow body carried on long legs, with relatively long neck and a dewlap. It is medium in size; big head often covered with wool (Annex1). The rams have horns, and the ewes are polled. Fat-tail is long and cylindrical and reaches below the hocks, representing 2.5 % of live weight. Ears are medium to large, hanging down with a forward inclination (Abdel-Hafiz and El-Hommosi, 1975 and 1976; Galal, 1987). The color is dark brown or black and sometimes creamy white; some individuals have the two colors. Fleece is open coarse wool; belly and legs are pared.

It named also Abidi sheep, after Bani Abid village in Mania Governorate. Therefore, it may be considered as an ecotype rather than breed. It is medium in size; head is medium with straight profile. Rams have long and large horns. Ewes

often polled, but small horns may be found. The fat-tail is triangular, relatively thin and reaches the hocks or below it, with medium size ears. The color is white with brown or dark

head; black color may cover part of the body. Fleece is open, long and straight.



Rahmani



Ossimi



Barki



Saidi

Annex 1. Main Local Breeds

Minor local breeds:

Fallahi sheep

Fallahi sheep is Nile-Delta population raised as scavenging animals, graze on the growing shrubs at the canal's banks, and clover fields after cattle, they are supplemented with straws and hay in the summer. It is known for its good fertility and twinning rate, compared to other sheep breeds. Relatively small in size, head is medium with straight profile, rams have medium size horns with backward curvature, and ewes are often polled. The fat tail is triangular and long with thin end, reaches below the hocks close to the ground (Annex 2).

Ears are semi pendulous of medium size. The color is brown and sometimes black; some sheep have a mixture of colors. Low quality coarse wool with medium length, used in manufacturing carpets and woolly covers (Galal, 1987). Good quality meat is alleged to this breed, but there has been no investigation to substantiate this character. The

number of Fallahi sheep is decreasing in favor of other local breeds. Ewes cycle all year-round and two lamb crops a year are common.

Wahati sheep

The name is derived from its habitat, the desert oasis in the New Valley Governorate, it is also called Farafra after the Farafra oasis. The animals have narrow and shallow bodies and medium length legs, body is of medium size, (Annex2).

The head is of medium size with straight profile. Most of the Wahati rams and some ewes are horned. The fat tail varies in shape with wide base, terminated into a sort of segment to a lesser wide base ending into cylindrical part extending below the hocks, ears are small. Animals are either white with dark brown or black heads or completely white. This breed is known for its high tolerance to heat stress and intensive solar radiation in the New Valley (Aboul Naga *et al.*, 2021).



Fallahi



Wahati (Farafra)



Sohagi



Abodelik

Annex 2. Minor local breeds

Suhagi sheep

It is a Upper Egypt breed, with few reports in the literature. A small flock has been formed by South Valley University, Body is shallow, medium in size with relatively

long neck and legs. The head is relatively small with straight profile. Ewes are mostly polled while rams are either horned or polled (Annex 2). The ears are mostly without vestiges. The body is covered with coarse wool ranging from creamy

to dark brown, but the former is dominant. The head is mostly dark brown, with dark rings around the eyes. The tail is fat, triangular and has a knot at the hocks level (Saloma, 2022)

Aboudeleik sheep

Also called Daboul, the largest sheep among the Red Sea and Halaieb- Shalateen triangle breeds. The body weight of the ewes averaged 45 kg, shallow with long legs covered with short hair. Head is long, sometimes with convex nose in rams; polled in both sexes; long neck often with dewlap.

The tail is long cylindrical reaching below the hocks; ears are absent or small with backward downward inclination; color is dark cream to dark brown solid or piebald; wattles are rare (Desert Research Center, 1996)

Production performance of main local breeds:

Barki sheep

Reported figures for body weight of the Barki sheep varied widely, especially for mature animals (Table 2).

Females are generally small in size, where males are of medium size. Post-weaning growth and fattening performance are generally low. Meanwhile, their leanly carcasses gave them better preference in the market with good prices. Investigating early fattening at 4 months of Barki lambs after weaning with the breeders, showed good potentiality of the breed for weight gain under good feeding conditions (330 g/day vs. 200 g/day for traditional fattening (Aboul-Naga *et al.*, 2022).

Milk production was estimated as 59.3 kg for 20 weeks suckling and 40.6 kg for 12 week hand milking (Table 3). Usually, milk is left for lamb to suckle, Breeders milk their ewes once a day after weaning, with average milk production of 0.28-0.35 kg/day (Aboul-Naga *et al.*,1985). Barki milk contains 5.1- 6.9 % fat and 17.7% total solids (Galal, 1987). Barki sheep has long luster fleece, with high percentage of fine fibers, compared to Ossimi and Rahmani sheep. The wool shorn once a year, (early in the spring), and is used for making traditional rugs, cloaks and blankets (Shehata *et al.*, 1989)

Ossimi sheep

Birth, weaning, and yearling weights of Ossimi sheep are larger than Barki sheep, but less than Rahmani (Table 3). Reported body weights ranged from 45-62 kg for

rams and 39-52 kg for ewes. Fattening Ossimi lambs is usually practiced at 5-6 months of age for a period of 4-6 months, where lambs attain final weight of 38-57 kg or heavier (El-Hommosi and Abdel-Hafiz, 1977).

Carcass weight was estimated as 17.1 to 21.5 kg with high dressing percent of 52% (Ragab *et al.*, 1966), lower dressing of 44% was reported by Aboul-Naga and Elshobokshy (1974) and Aboul-Naga (1988). Red meat percent was 66% (Aboul-Naga *et al.*, 1987), separable fat (including fat tail) ranging from 2.2 to 6.8% (El-Hommosi and Abdel-Hafiz, 1977 and 1981), and lean to bone ratio is moderate of 3:1.

Ossimi sheep have a greasy luster fleece, of 1.4 - 2.0 kg (El-Sherbiny and El-Sheikh ,1969; Latif *et al.*, 1972). Animals are usually shared once a year, and first shared at 14-16 months (Aboul-Naga *et al.*, 1972; Aboul-aga and Afifi, 1982).

Rahmani sheep

As mentioned, Rahmani sheep is the largest Egyptian breed, mature body weight ranged from 50-73 kg (Sidky, 1950). They are heavier at birth, weaning and yearling than all other local breeds (Table 2). Fattening of Rahmani lambs started at 6 months of age for 6 months where final body weight exceeds 50 kg (Ghoniem *et al.*, 1959). Dressing percentage is high. being 43.9% (Younis *et al.*, 1972) and 53% with edible parts (Hamada, 1959). Red meat percent is 69% for 6 months' lambs, and 63% for mature rams (Darwish, 1973; Hamada, 1959, respectively). Separable fat (including fat tail) was reported as 6% of the carcass weight for 6 months' lambs, and 17% for mature rams, where bone percent was 24% for lambs and 20% for rams.

Milk is used for feeding lambs till weaning at 4 months of age. Estimated milk production for 16 and 25 weeks were 67.4 and 85.0 kg, respectively (Ragab *et al.*, 1966) (Table 3). Rahmani milk contains 19.0; 7.8; 5.9 and 11.2% total solids, fat, protein, and non-fatty solids, respectively (El-Sokkary *et al.*, 1950). Rahmani sheep are usually shorn twice a year, and fleece weight averaged 1.7-2.0 kg (Karam, 1959) of coarse fibers and high kemp content (Ragab *et al.*, 1956)

Table 2. Body weights and fattening performance

Item	Sheep breed			
	Barki	Ossimi	Rahmani	Saidi
Birth weight	2.3 (M+F)*1	3.3(M),3.0(F) ⁹	3.4 (M) ,3.0 (F) ¹⁶	3.9 (M) ²⁴
	3.5(M+F) ²	3.6(M),3.5(F) ¹⁰ 3.62(S),3.32(T) ²⁷	4.7 (M) ,4.2 (F) ¹⁷	3.5 (F) ²⁴ 3.5 (M+F) ²⁵
Weaning weight (4 months)	16.8(M+F) ¹	20.6(M),18.2(F) ⁹	24.4 (M) ,21.7 (F) ¹⁸	17.0 (M) ²⁴
	21.6(M+F) ³	18.3(M),16.4(F) ¹⁰ 19.1 (M+F) ⁵	28.6 (M) ,24.8 (F) ¹⁹	15.4 (F) ²⁴ 16.0 (M+F) ²⁵
Yearling weight	27.8(M+F) ³	43.8(M),35.9(F) ⁹	40.2 (M) ,34.7 (F) ¹⁹	38.0 (M) ²⁴
	37.4 (M),33.2 (F) ⁴	36.7 (M+F) ¹⁰ 37.3(M),32.4(F) ⁵ 33.3 (M+F) ¹¹	51.0 (M) ,46.0 (F) ²⁰	34.0 (F) ²⁴
Mature weight (1.5-3 yrs.)	60 M) ⁶	44.8(M),39.2(F) ¹⁰	50.0, 73.0 (M) ²¹	52.0 (M) ²⁴
	42 (F) ⁷	62.0 (M) ¹² 51.6 (F) ¹³ 42.1(F) ²⁷	55.0 (F) ²² 59.0 (F) ²³	40.0-45 (F) ²⁴
Final Fattening weight (kg)	45-60 ²⁶	38 ¹⁴ -57 ¹⁵ kg	51.0 kg (65-75kg)	

*M: male, F :female

1: El-Koumi *et al.*,(1974); 2: Guirgis *et al.*, (1982); 3: Younis *et al.*, 1984; 4: Aboul-Naga, (1970); 5: Aboul-Naga *et al.*, (1972); 6: Abou-Basha, (1980); 7: Ghanem, (1960); 8: Kassab and Karam (1961); 9: Ghoneim *et al.*, 1957; 10: Ghoneim *et al.*, 1968; 11: Aboul-Naga and Afifi,1982; 12: Galal *et al.*, 1978; 13: Labban *et al.*, 1971; 14: Aboul-Naga and Shobokshy (1974); 15: El-Hommosi and Abdel-Hafiz (1977); 16: Hamada,(1959); 17: Ragab *et al.*,(1953); 18: Asker *et al.*,1953; 19: Youssef and Seleem,1962; 20: Ghoneim *et al.*, 1959; 21: Sidky, 1950; 22: Rakha *et al.*, 1988; 23: Mounib *et al.*, 1956; 24: Abdel-Hafiz and El-Hommosi, (1975); 25: Abdel-Hafiz and El-Hommosi,(1976)26:aboul Naga *et al.* (2022) 27:Mousa and Shetaewi

Table 3. Wool, meat and milk production of the major local sheep breeds

Item	Barki	Ossimi	Rahmani	Saidi
Greasy fleece weight (kg)	2.1 (0.96-3.54) ^{1,2,3}	1.4 ¹⁶ 2.1 ¹⁷	1.5 (1.7-2.0) ³⁰	1-3 ³⁴
% Clean wool	41.9 ⁴ 74.0 ⁵	56.5 ¹⁶ 84.8 ¹⁸	80 ⁵	
% Fine fibers	68.5 (62.9-76.0) ⁶			
% Coarse fibers	26.2 (21.0-2.1) ⁶			
% Kemp	7.0 (4.0-8.6) ^{6,7}	2-8 ¹⁹	7.6-17.8 ³¹	3.5-3.8 ³⁵
Staple length (cm)	12.1 (9.8-15.5) ^{8,9}	7.7 ¹⁷ 20 ²⁰	8.3-18.2 ³¹	15.9-16.5 ³⁶
Fiber length (cm)	16.0 (11.8-1.6) ^{9,10}	11.7 ¹⁷ 17.6 ²¹	8.5-17.0 ³¹	19.7-21.6 ³⁵
Fiber diameter (μ)	32.2 (30.3-5.7) ^{6,11}	35.4 ²² 32.4 ¹⁸	24-31 ³¹	57 ³⁵
Wool density (fib./cm ²)	1846-2020 ^{7,9}	1384 ²⁰		
Carcass weight	12.-18.4 ¹² 21.3 ¹³	17.1 ²³ 21.5 ²⁴		17.0-22.1 ³⁵ 28.5-29.2 ²⁵
Dressing %	43.5 ¹² 46.1 ¹³	44.1 ²⁵ 52.2 ²⁴		
Feed conversion	8.4 ¹³	3.99 ²⁸ 3.84 ²⁴ 4.35 ²⁹		5.7-6.3 ³⁵ 8.0-11.3 ²⁵
Milk yield (kg)	59.3(20 wks.) ¹⁴ 40.6(12 wks.) ¹⁵		47 (milk/7 wks.) ³² , 53.5 (suck 12wks) ²⁶ 65(suck/12wks) ¹⁴	200 gm/day (12-16 wks.) ²⁵
Milk Production (4 months)Kg		48 ²⁶		
Milk Under good feeding kg		65.4 ¹⁴		
Milk content :fat%, TS% and NFS%		6.3,16.9 and 0.729	7.8, 19 and 11.2 ³³	7.6,18.5 and 10.9 ³⁶

1: Aboul-Naga *et al.* (1972); 2: El-Oksh *et al.* (1979); 3: Kassab and Karam (1961); 4: Guirgis *et al.* (1982); 5: Aboul-Naga and Affi (1977); 6: Guirgis (1973); 7: Seoudy *et al.* (1969); 8: Marai (1975); 9: Ragab and Ghoneim (1961); 10: Ghanem (1960); 11: Guirgis (1980); 12: Younis *et al.* (1976); 13: Galal *et al.* (1975); 14: Aboul Naga *et al.* (1981); 15: El-Shahat (1970); 16: El-Sherbiny and El-Sheikh (1969); 17: Latif *et al.* (1972); 18: El-Sherbiny *et al.* (1979); 19: Aboul-Naga and Affi (1982); 20: Badreldin *et al.* (1952); 21: El-Sherbiny *et al.* (1979); 22: Aboul-Naga and Affi (1982); 23: Younis *et al.*, (1972) 24: Ragab *et al.* (1966); 25: Aboul-Naga (1988); 26: Aboul-Naga and ElShobokshy (1974); 27: El-Hommosi and Abdel-Hafiz (1977); 28: Sharafeldin and Mostageer (1961); 29: Hassan (1994); 30: Karam (1959); 31: Ragab *et al.* (1956); 32: Sirry *et al.* (1950); 33: El-Sokkary *et al.*, 1950; 34: El-Hommosi and Abdel-Hafiz, (1976); 35: El-Hommosi and Salem, (1982); 36: Abdel-Hafiz and El-Hommosi, (1976)

Saidi sheep

Saidi sheep is the smallest local breed of 40-45 kg body weight for ewes and 52 kgs for rams (Table 2). Lambs are generally fattened late at 7-8 months of age. Carcasses of 2 years old fattening rams contained 63.5 to 65.3% red meat; 16.8 to 18.3% separable fat (including fat tail); and 16.9 to 19.7 bone percent (El-Hommosi and Abdel-Hafiz, 1977) (Table 3) .Milk production of Saidi ewes is low ,estimated as 260 g/day for 12-16 weeks milking period , contained 7.6% fat, 5.8% protein, 18.5% total solids and 10.9% non-fatty solid (Abdel-Hafiz and El-Hommosi, 1976). Saidi sheep are usually shorn once a year in March. Wool is used in manufacturing the locally famous klim rugs and blankets., which is flourished in Upper Egypt due to its natural colors ranging from white to brown and black.

Reproduction performance of the major local breeds:

Barki sheep

Barki is reported to be good fertile sheep under the harsh aridconditions ,with low twinning rate (Table 5), where multiple birth is not favored for desert conditions . They showed continuous estrous activity around the year (Fig. 3), and capability to breed more than once / year (Badawi *et al.*, 1973 and Aboul Naga and Aboul-Ela, 1984) with lower performance in spring mating . Their lambing season is usually organized with the availability of natural ranges (November and December).

Barki ewes reported to have good mothering ability (Galal *et al.*, 1972), which is crucial for arid areas . Aboul Naga *et al.* (1992) investigated the manipulation of reproductive activity of local breeds , reported that 30% of the Barki ewes are lambing twice a year. Lamb production in the extensive range scheme is affected by the physiological rhythm of the cyclic activities ,beside the

availability of feed resources .Under the system of crop each 8 months , lambs weaned /ewe/year increased by 19% (Table 4). Fertility and prolificacy are better in the autumn than in the winter and spring. Zaher (1988) mating local breeds (Barki, Ossimi and Rahmani) each 4 months , confirm that May mating have the lowest conception rate for all local breeds.

Barki ewe-lambs are early matured sheep compared to Rahmani and Ossimi .Age at sexual maturity was reported to be 9 months vs.12 months for Ossimi and Rahmani ewe- lambs under the farm conditions.

Ossimi sheep

Ossimi ewes are good fertile sheep , cycling all year-round (Fig. 2), consequently they can produce more than once a year. Reported figures showed that Ossimi ewes performed well under accelerated lambing of 3 lambing /2yrs (Aboul-Naga *et al.*,1992),with better performance for September mating (95%). Twining rate is moderate (14%) and influenced by the geographical region and breeding season (Gabr *et al.* 1998; Aboul-Naga *et al.*,1992).They reported ovulation rate of 1.2-1.37/ewe ,where Mousa and Shertaewi (1994) reported higher ovulation rate of 1.47. Lamb losses are affected largely by season of lambing and management system at different agroecological regions in the country , to range from 7.3 to 20.0 (Table 4).

Investigating reproductive performance of Ossimi sheep, under accelerating lambing. Aboul-Naga *et al.* (1992) reported that mating Ossimi sheep each 8 months increased the number of weaned lambs by 45%. Light treatment of prolonged day light followed by abrupt decrease in the spring, increased cyclic activity of Ossimi ewes (Fig 3)

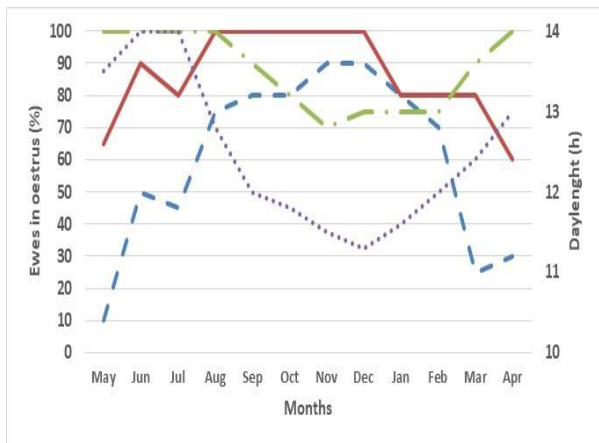


Fig. 2. Estrus activity of Ossimi(---), Rahmani (---) and Awassi(---)ewes at different months of year

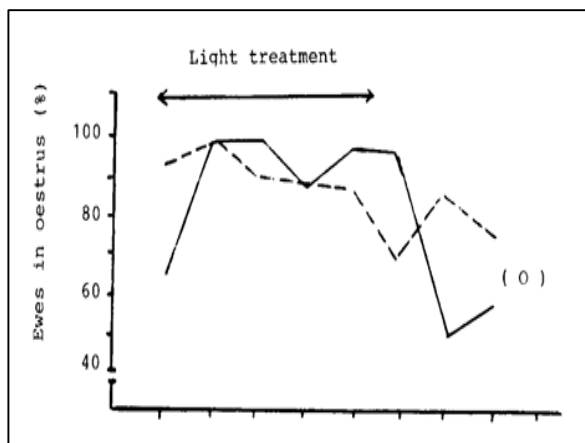


Fig. 3. Estrus activity of Ossimi (O) as affected by light regimes (—) vs. control (- -)

Table 4. Reproductive Performance of local sheep breeds.

	Barki	Ossimi	Rahmani	Saidi
Lambing/ewe/yr.	1.07 ¹ 1.05 ⁵	1.10 ¹ 0.83 ² 1.28 ²	1.10 ¹ 0.93 ² 1.32 ²	
Age at maturity(days)	267 (S) ,283(T) ²	346-366 ⁷	275-320 ¹⁸ 378-427 ¹⁹	348-367 ²¹
Estrous cycle (days)	17.3(F) & 16,4(EL) ²³	17.9 (14-19) ⁸	17.4 (8.2-21.5) ¹⁸	
Estrous duration (hrs.)	32.0(S) 31.5(W) ²³	32.6 (30.2-37.7) ⁹	35 ¹⁸	
Conception rate (%)	88 ³ 70-100 ⁴	90 ¹⁰ , 95 ¹¹ 75 ²⁷	0,93	82-92 ²¹
Ovulation rate		1.20-1.39 ² 1.47 ²⁷	1.30-1.59 ²	
Twining rate (%)	4.5(5-14) ³ 0-11 ⁴ 1-3 ⁶	14.3 (6.9-28.6) ⁸ 5- 21 ² 20 ²⁷	24 ²⁰ 45 ¹⁹ 12- 36 ²	5.0 ²²
Age at first lambing (month)		15 ⁸ 22 ¹²		
Mortality rate at 4 months(%)	6.3-16.6 ⁵	11.8 (7.3-20.0) 13,14,15,16,17 27	14.6 ²⁰	
Lambs wean./ewe lambd	0.91-0.97 ³ 0.83(1/yr.) ² 1,28(3/2yr) ²	0.83(1/yr.) ² ,0.99(3/2yr) ²	0.93(1/yr.) ² ,1.32(3/2yr) ²	
kg weans./ewe lambd(kg)	20.4-20.8 ³	14.5 ²⁷		
Cyclic activities	Estrous activity around the year with best performance in Sept. & lowest in May ^{2,26}	Very long breeding season best perform in Sept. & lowest May ^{10,26}	Estrous activity all the year ,never less than 70% ^{2,10,6}	Cycling all the year around ²¹

*S: Single; T: Twins , F: female, EL: Ewe-lambs, S: summer, W: winter

1: Aboul-Naga (1983); 2:Aboul -Naga et Al.1992); 3: Aboul-Naga (1976); 4: Mokhtar *et al.* (1983); 5: Labban *et al.* (1969); 6: Younis *et al.* (1984); 7: El-Hommosi and Abdel-Hafiz(1982); 8: El-Wishy *et al.* (1971); 9: Aboul-Naga and Aboul-Ela (1984); 10: Aboul-Naga *et al.* (1991); 11: Gabr *et al.* (1989); 12: Hassan (1994); 13: Ragab *et al.* (1955); 14: Labban *et al.* (1966); 15: Galal *et al.* (1972); 16: Aboul-Naga *et al.* (1972); 17: Aboul-Naga and Affi (1982); 18: Mounib *et al.* (1956); 19: Hafez (1954); 20: Karam (1957); 21: El-Hommosi and Abdel-Hafiz (1982); 22: Galal (1987); 23: Badawy *et al.* (1973) 24,Affi *et al.* (1984),25.Galal *et al.* (1981)26 Zaher (1988)27:Mousa and Shetaewi(1994)

Rahmani sheep

Rahmani sheep are well performed local breed from the reproductive point of view, they have the highest multiple births. Twinning rate averaged 24 up to 45 %, with frequent incidence of triplets. Ovulation rate ranged from 1.3-1.59 /ewe and is largely affected by the breeding season (being the highest in September and the lowest in May),by lambing system (once per year vs. lambing each 8 months) , and increased further with advance in age (Hafez ,1954;Karam ,1957 and Aboul Naga *et al.* ,1992);(Table 4).

Ewes cycle regularly all the year around and produce more than once a year. Number of lambs born /year under accelerated lambing of 3 crops /2 years averaged 1.32 lambs weaned / ewe lambd (Aboul Naga 1976 and Aboul-Naga *et al.*1992). Conception rate varies with lambing system

being 0.75 for crop every 8 months and 0.86 for a crop a year .

Manipulating the reproductive performance of Rahmani ewes, either by light treatment ,melatonin injections or pre- mating ram induction, improved significantly , conception and ovulation rate of the Rahmani ewes, and insignificantly number of lambs weaned (Aboul Naga *et al.*, 1991 and Hassan *et al.*, 1988). Galal *et al.* (1981) reported that Rahmani ewes and lambs survived well under the breeders' conditions.

Saidi sheep

Saidi sheep are known to be good fertile sheep, capable of cycling all year-round and produce more than once / year. Conception rates are reported to rang from 82 to 92 % (Table 5) .Breeding under the hot dry conditions of Upper Egypt, gave low twinning rate and cause late

maturity. Saidi sheep are sexually matured at one year of age (El -Hommsi and Abdel Hafiz, 1982; Galal, 2005). Their lambs have good livability under the intensive agriculture conditions of hot Upper Egypt (Galal *et al.*, 1981; Afifi *et al.*, 1984)

Adaptation to environmental stress

Environmental stress and climate change (CC) are major problems facing animal production in the hot dry areas. It negatively affect their production and reproduction performance. Aboul-Naga *et al.* (2010) summarized effect of the environmental stress on subtropical sheep in different paths: indirect effect on feed -grain availability and natural ranges ;and direct effect on lamb production and diseases incidence

Local sheep utilized their respiratory mechanism to maintain their homoeothermic status under hot dry conditions .Accelerate panting, is the main mechanism of local sheep to tolerate physical activity under heat stress (Aboul Naga *et al.*, 2021b) .With extra energy needed for grazing on poor pasture or crop residues , they turn to deep breathing. The authors acknowledge that local sheep are producing and reproducing successfully under the environmental stress of hot dry areas, where they have been raised and naturally selected for centuries. Individual variation in animals' response to heat stress is related in principle to body weight of the animals . Medium weight sheep seems to be more compatible with hot dry conditions, than either heavy or light ones. They reported no antagonism between selection for production performance, and selection for tolerance to environmental stress in Barki sheep.

Major changes in the respiration rate of the Wahati oasis sheep with exposure to summer heat stress was reported by Aboul -Naga.*et al.* (2021a), as the main mechanism to get rid of the extra heat load .When accelerating respiration is not enough to cope with the severe heat stress, animals practice deep breathing . Individual differences in respiration rate of sheep under heat stress was recommended as reliable parameter for the breeders to assess their animals tolerance to heat stress and select them for breeding under the hot dry conditions .

Exposing Saidi sheep to summer heat stress in Upper Egypt (Thermal Humidity Index over 100) raised their respiration rate by more than 200 % ,with the incidence of deep breathing (Aboul-Naga *et al.*, 2021b). Rectal and skin temperature increased also with summer heat stress; and the carry-on effect continued up to 8 pm. The wide variation in the response of Saidi and Wahati sheep to heat stress, recommend the selection within Saidi (Upper Egypt breed) and Wahati (desert oasis breed) for tolerance to heat stress .

CONCLUSION

The major local Egyptian sheep breeds (Barki, Ossimi, Rahmani and Saidi) have common physical characteristic of small to medium body size ,coarse wool fleece ,fat tail ,and large curvature horns in rams .Their main differences are in the color of face and legs , fat tail shape and ears style . From the productive point of view, they have low to medium growth performance ,low milk production, and open coarse fleece. In the reproductive

side, they are good fertile sheep, ewes cycle all the year around, and can breed more than once /year, with relatively better performance in the autumn and lower rates in the spring .Twinning rates are generally low, with good lamb livability, and relatively low fattening performance ,however their carcasses are lean and have its preference by the consumer. Local breeds are rather specific for certain geographic zones in the country with certain ecological conditions, but generally they proved to be well adapted to heat stress and drought conditions . Desert Barki breed are revealed in the coastal zone of Western Desert, Rahmani in North Delta, Wahati sheep in the New Valley and Saidi sheep in Upper Egypt. Only the Ossimi is producing and reproducing in wider areas in Delta and Mid Egypt.

The issue of breeding well adapted local low producing animals, versus high producing low tolerant exogenous breeds, has been widely debated locally and globally .Adaptation strategies for heat stress and CC in the hot dry areas , is relying on identifying and selection of local animals that are adapted to heat stress . No antagonism was found between selection for production performance and selection for heat tolerance in local breeds under hot dry conditions. Therefore, it is recommended to select within local breeds for tolerance to heat stress beside production performance. Changes in respiration rate with heat stress is a reliable indicator for the breeders to identify heat tolerant animals, to breed them in their flocks.

A national breed improvement program is needed for each local breed, which requires some aggregation between the breeders. A nucleus structure for each breed could be the realistic mode to introduce genetic improvement program, starting with the major breeds, that are raised and reproduced under hot dry conditions . Local communities can be organized to carry out these tasks. The successful Barki Sheep Breeders Association in Matrouh could be an example to follow.

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بحث مرجعي لبحوث وبرامج تطوير الأغنام والماعز في مصر منذ الأربعينيات: (٢) الخصائص المظهرية ، والأداء الإنتاجي والتناسلي للسلاسل المحلية من الأغنام

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المخلص

تنتشر سلالات الأغنام المحلية المصرية على نطاق واسع في جميع أنحاء البلاد. وتربى بشكل رئيسي من قبل أصحاب الحيازات الصغيرة وتساهم بشكل كبير في معيشتهم.. تتكيف السلالات المحلية بشكل جيد مع الظروف الجافة الحارة السائدة وموارد العلف المحدودة. وهي اغنام صوف خشن ذات لية ، يتم تربيتها بشكل أساسي لإنتاج اللحوم والحملان. هناك ٤ سلالات رئيسية من الأغنام في مصر هي: الرجماني في شمال الدلتا ، والأوسيمي في وسط مصر ، والبرقي في منطقة ساحل البحر الأبيض المتوسط ، والصعيد في صعيد مصر. تتواجد السلالات المحلية الأخرى (الفلاحي ، الواحاتي ، وأبوديليك ، والسوهاجي) بشكل أساسي في المحافظات الجنوبية والحدودية. تم توصيف الخصائص المظهرية الخاصة والفريدة بكل سلالة. والأداء الإنتاجي للسلالات المحلية الرئيسية وجدولت أوزان الجسم وصفات الذبيحة وإنتاج الصوف والحليب وفق ما ورد في التقارير والمراجع العلمية كذا الأداء التناسلي: البلوغ والشبق والنشاط التناسلي، و مناقشه قدرة السلالات المحلية على التكيف مع البيئة السائدة ، وخاصة الإجهاد الحراري. يتم مناقشة القضايا الخاصة بمزايا تربيته السلالات المحلية في الجدل الدائر حول تربية الحيوانات المحلية المتكيفة ومنخفضة الإنتاج ، مقابل الحيوانات المستوردة منخفضة التحمل وعالية الإنتاج. وتتطلب ذلك برامج تحسين سلالات الأغنام المحلية بناء نوع من بنية قطع النواة ، وتكوين تجمعات للمربين مثل اتحاد المربين أو قطاعان القرية ، والاستفادة من الاكتشافات الجينومية الحديثة.