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Male Baladi Red

Female Baladi Red

Male Baladi Black

Female Baladi Black

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SUMMARY – A description of the Egyptian Baladi rabbits is carried out. Items that have been dealt with are: (i) a general description; (ii) climate and main features of its farming; (iii) performance; (iv) stress resistance; and (v) genetic improvement.

Key words: Baladi, description, performance, genetics.

RESUME – *"Les lapins Baladi (Egypte)". Cet article présente une description de la race égyptienne de lapins Baladi. Les éléments suivants ont fait l'objet d'études : (i) une description générale ; (ii) le climat et les principales caractéristiques d'élevage ; (iii) les performances ; (iv) la résistance au stress ; et (v) l'amélioration génétique.*

Mots-clés : *Baladi, description, performances, génétique.*

1. Breed name

(i) *Breed name synonyms:* El-Baladi El-Mohassan.
(ii) *Strains within breed:* Baladi Red, Baladi White, Baladi Black.

2. General description

2.1. Population data

2.1.1. Population size and Census data: 1000

(i) Total number of females being used in purebreeding: about 150 females (most of them scattered in state farms).
(ii) Total number of females being used in crossbreeding: about 200 females.
(iii) Percent of females being bred pure: about 50% (most of them scattered in state farms).
(iv) Total number of males used for breeding: about 150 bucks.
(v) Number of bucks used in AI-service: none.

Source of data: Statistics of Wealth for Animal, Poultry, Fish, Bees and Silk, 1991-1993, Bulletin published by Economic Sector, Ministry of Agriculture, Egypt.

2.1.2. Herd sizes (Table 1)

2.1.3. Origin of breed

Crossbreeding for several generations was practised between local (native) rabbits and Flemish Giant (G) in stations of the Poultry Breeding Section, Ministry of Agriculture (Badawy, 1975; Galal and Khalil, 1994). The breeding plan used for producing three native strains of Baladi Red (R), Baladi White (W) and Baladi Black (B) is presented in Table 2.

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Table 1. Herd sizes of Baladi strains of rabbits in governmental and small-scale farms

	Governmental farms	Small-scale herds
Mean		
Adult animals	30	3
Young animals	120	15
Range		
Adult animals	20-50	1-6
Young animals	50-200	15-150

Table 2. Breeding plan used

	Selecting does with heavy weight and particular colour		
	Red-coloured Baladi (R)	White-coloured Baladi (W)	Black-coloured Baladi (B)
Parents	G R	G W	G B
F1	GR	GW	GB
Parents of back-cross	G GR	G GW	G GB
Back-cross	GR	GW	GB

Heavy does of Giant Baladi genotype were upgraded by mating them to pure Giant Flander bucks for several generations and selection for pure colour of red, white and black was practised for producing strains of Red Baladi, White Baladi and Black Baladi. Does of each strain were mated with bucks of the same strain for several generations until characters and colour were established.

2.1.4. Situation with respect to danger of extinction

The three strains of Baladi are *endangered* since the total number of breeding rabbits is less than 1000.

2.2. Use of the breed in a descending order of product importance

This breed is a medium-sized breed and is used mainly for meat production.

2.3. Colour

Photograph of males and females of each strain are shown.

2.4. General-type

2.4.1. Body parts

Body parts of the three strains of Baladi rabbit are well-rounded hips with well-filled loin. The ribs are carried forward to combine with shoulders that balance with the rest of the body. The shoulders blend smoothly into midsection, and the midsection smoothly extends into the hindquarters. The body is of medium length with good depth as shown in Table 3. The top body line rises in a gradual curve from the base of the ears to the centre of the hips and then falls in a smooth curve downward to the base of the tail. The sides taper slightly from hindquarters towards shoulders. Back is markedly convex ventrally without being pot-bellied. The skin is smooth.

Table 3. Body measurements (cm) in Baladi strains of rabbits at 12 weeks of age

Trait	Baladi Red		Baladi White		Baladi Black	
	Mean	Range	Mean	Range	Mean	Range
Body length	23	21-26	21.6	20-23	28.3	22.7-29.5
Chest circumference	22	18-25	16.4	13.2-19	21.7	20-23.5
Loin width	4.6	4.2-5.5	4.0	3.8-4.8	4.6	3.8-4.8
Loin length			13.9	12.5-14		
Thigh circumference					11.1	10.5-11.5
Ear length	8.5	7.8-9.0	8.1	7.8-8.6	8.4	7.6-8.8

2.4.2. Head

All three strains have a convex head.

2.4.3. Eyes

Eyes of the three strains are black.

2.4.4. Ears

All three strains have erect ears.

2.4.5. Feet and legs

Feet and legs are medium in length for all three strains.

2.4.6. Tail

Tails of the three breeds are straight and relatively short.

2.5. Basic temperament (for males or females)

The three strains are docile.

2.6. Special characteristics of the breed

The three strains are moderately adapted to hot climates.

2.7. Nest quality

Pooled and sometimes scattered.

3. Pattern

3.1. Climate

3.1.1. Elevation and topography

Valley and well drained.

3.1.2. Favourable climate

Temperature from 15°C up to 35°C and relative humidity from 25% up to 75%.

3.2. Main features of farming

3.2.1. Socio-management system

Extensive system in batteries (production starts in September and ends in May) or underground cells.

3.2.2. Mating method

Natural mating.

3.2.3. Nutrition

(i) *Concentrates:* pelleted or mash.
(ii) *Water:* available free all year-round.
(iii) *Seasonality of nutrition:* Berseem (*Trifolium alexandrinum*) available from December to next May while Darawa (fodder maize) is used in summer.

3.2.4. Housing

(i) *Cages:* wired cages, indoor rabbitries.
(ii) *Photoperiod:* variable periods.

3.3. Common diseases and parasites

Pasteurellosis, coccidiosis, enteritis, feet and ear mites.

4. Performance

4.1. Reproduction

Differences among Baladi strains in buck and doe ages at first service are small (Table 4) since the three strains mature at about 7 months of age (Soliman, 1983). On the other hand, Baladi White rabbits have the lowest adult weight (2250 grams), while Baladi Red and Baladi Black are nearly similar in their adult weights (2850 grams). A wide variation among Baladi strains in semen characteristics was observed (Table 5; Soliman, 1983). Semen of Baladi Red bucks recorded the highest ejaculate volume and sperm concentration along with the least dead and abnormalities of sperms.

Table 4. Sexual maturity in Baladi strains of rabbits

Trait	Baladi Red		Baladi White		Baladi Black	
	Mean	Range	Mean	Range	Mean	Range
Age of buck at 1st service (month)	7.2	6.5-8.0	6.5	6.2-7.8	7.0	6.5-8.2
Age of doe at 1st mating (month)	7.5	6.8-8.5	6.8	6.5-8.0	7.4	7.0-9.5
Age of doe at first kindling (month)	8.5	8.0-10.2	7.7	7.8-9.5	8.6	8.2-10.5
Weight of buck at first service (g)	2850	2190-3360	2250	1900-3200	2830	2260-3780
Weight of doe at first mating (g)	2970	2270-3670	2300	2160-3280	2850	2200-3800

Table 5. Semen characteristics of 8-month bucks in Baladi strains of rabbits

Trait	Baladi Red		Baladi White		Baladi Black	
	Mean	Range	Mean	Range	Mean	Range
Reaction time (seconds)	21.0		18.0		22	
Ejaculate volume (ml)	0.49	0.40-0.65	0.50	0.40-0.65	0.38	0.34-0.46
Sperm concentration per ml (10^6)	383.0	260-450	360	280-460	282	240-330
Sperm abnormalities (%)	17.7	12-24	27.0	18-38	30.5	27-32
Dead sperm (%)	11.3	9-16	20.3	11-23	22.6	17-24

Baladi strains of rabbits have a medium or high conception rate since this rate ranges from 42% to 85%, while they have relatively long kindling intervals (Table 6). This may be due to a high number of Baladi rabbits having poor fertility since their first matings after kindling. Also, conception rate of Baladi strains is relatively lower than the rate recorded for Giza White rabbits (Afifi and Emara, 1986). Figures given in Table 6 indicate also that size and weight of Baladi White litters are slightly smaller and heavier than litters of Baladi Red and Baladi Black rabbits (Emara, 1982; Hassan, 1988; Khalil *et al*., 1988; Soliman, 1988; Hilmy, 1991).

Table 6. Fertility and fecundity traits in Baladi strains of rabbits

Trait	Baladi Red		Baladi White		Baladi Black	
	Mean	Range	Mean	Range	Mean	Range
Conception rate (%)	75.0	65-85	72.0	68-84	53.4	42-53
Kindling interval (days)	66.6	49-78	58.0	52-66	55.0	45-62
Litter size						
Total at birth	6.0	5.4-7.0	5.3	4.5-6.5	5.5	4.7-5.9
At 21-day	4.8	4.0-6.2	4.4	4.2-5.4	4.4	3.8-4.9
At weaning (4 weeks)	4.8	4.0-6.0	4.5	4.2-5.0	4.2	3.2-4.8
At weaning (5 weeks)	4.6	3.7-6.0	4.5	4.2-4.8	3.8	3.0-4.5
Litter weight (g)						
At birth	322	278-370	320	290-360	258	240-320
At 21-days	1040	860-1370	960	630-1100	990	910-1080
At weaning (4 weeks)	1550	1150-1890	1145	1230-2010	1320	1090-1780
At weaning (5 weeks)	1780	1380-2590	1675	1360-2105	1520	1280-1800

4.2. Pre-natal mortality per litter

Pre-natal mortality in Baladi rabbits is large compared to other standard breeds. The estimates range from 5% to 14% (Table 7). However, both pre-natal mortality (%) and stillbirths are nearly similar in the three strains of Baladi rabbits.

Table 7. Pre-natal mortality rates and stillbirths in Baladi strains of rabbits

Trait	Baladi Red		Baladi White		Baladi Black	
	Mean	Range	Mean	Range	Mean	Range
Pre-natal (%)	12	8-22	11	8-23	14	12-25
Stillbirths (%)	7.0	3-12	5.6	4.5-15	6.5	3-13

4.3. Milk yield traits

Baladi strains of rabbits (Baladi Red and Baladi Black) are low in their lactating abilities to suckle their young. This poor milking ability in Baladi strains may be the main factor for these rabbits to produce low litter size and weight at weaning along with high mortality rates. Means and ranges given in Table 8 indicate that the milk yield curve for Baladi Red is similar to that for Baladi Black, but both strains are very low in their milking ability compared with exotic breeds raised in Egypt. In this respect, total milk yield in Baladi rabbits is about 3300 grams compared to 7200 grams for New Zealand White raised in Egypt.

Table 8. Milk yield in Baladi strains of rabbits

Trait	Baladi Red		Baladi Black	
	Mean	Range	Mean	Range
21-days milk yield (g)	2150	1670-2380	2180	1650-2480
Total milk yield (g)	3200	2480-4180	3550	2450-4200

4.4. Lifetime production per doe

Baladi strains of rabbits could be used for breeding for about 5 years. Therefore, they are characterized by a long period of lifetime production compared to exotic breeds raised in Egypt (Afifi and Emara, 1986). Although this period is relatively long, the productivity of doe *per annum* is low. This poor productivity is clear in Baladi rabbits since the number of litters obtained per doe *per annum* is ranged from 2.1 to 3.5.

4.5. Pre-weaning food utilization per litter

Pre-weaning daily feed intake per litter (0-5 weeks) for Baladi Red and Baladi Black rabbits are about 230 and 240 grams, respectively (Radwan *et al.*, 1978). It ranges from 160-255 grams for Baladi Red and from 170 to 270 grams for Baladi White rabbits.

4.6. Post-weaning body weight, gain and food utilization

Figures presented in Table 9 show that post-weaning body weights and daily gains in Baladi rabbits are lower than those for native Giza White and for other exotic breeds raised in Egypt (e.g., New Zealand, Californian, Chinchilla, Bouscat, etc.) as cited by Khalil (1980), Afifi and Emara (1990), Tag El-Din *et al.* (1992), Youssef (1992) and Afifi *et al.* (1993). Opposite to Giza White, figures showed in Table 10 point out that feed intakes by Baladi rabbits are low (about 70 grams during fattening period). On the other hand, feed conversion of 5.2 for Baladi Red is similar to that for Giza White (Boulos, 1978), while Baladi White has better conversion rate, about 4.2.

4.7. Carcass traits and meat composition

According to criteria and terminology cited by Blasco *et al.* (1992), means and ranges given in Table 11 indicate that carcass of Baladi Red and Black rabbits are characterized by: (i) late age at slaughter (about 15 weeks for Baladi Red and Black and 18 weeks for Baladi White); (ii) moderate weight of hot carcass along with moderate weight of giblets, loin and head; (iii) moderate dressing percentage along with low lean percentage and moderate meat:bone ratio; (iv) heavy weight of fur; and (v) moderate contents of moisture in meat along with high protein content. However, carcass performance of Baladi strains is lower than performance given by standard breeds (e.g., New Zealand White, Californian, etc.) raised in Egypt.

Table 9. Post-weaning growth traits of body weights and gains (g) in Baladi strains of rabbits

Trait	Baladi Red		Baladi White	
	Mean	Range	Mean	Range
Body weight				
Weaning (28 days)	318	255-495		
Weaning (35 days)	450	365-545	370	220-390
6-week weight	530	470-830	460	320-550
8-week weight	785	690-920	595	510-680
10-week weight	1035	880-1330	710	620-850
12-week weight	1310	1065-1410	815	750-1100
14-week weight	1560	1240-1680	890	820-1250
16-week weight	1847	1500-2160	980	880-1320
Daily gain				
4-8 weeks	15.0	10.6-19.3	13.5	9.5-16
8-12 weeks	13.0	9.2-17.8	12.6	10.2-14.6
12-16 weeks	12.7	8.8-17.0	9.2	8.5-13.4
16-24 weeks	9.5	8.0-14.0	8.5	7.2-12.5

Table 10. Postweaning food utilization per young in Baladi rabbits

Trait	Baladi Red		Baladi White	
	Mean	Range	Mean	Range
Daily feed intake (g)				
5-6 weeks	54	51-56		
6-7 weeks	68	63-72		
7-8 weeks	73	67-82		
8-9 weeks	86	80-90		
9-10 weeks	90	82-112		
Feed conversion†				
5-16 weeks	5.23	2-6.4	4.1	3.8-6.8
30-60 days	4.8	4.2-5.5	3.4	3.2-4.6
30-90 days	5.24	5-5.5	4.6	4.3-5.7

†Grams intake per gram gain.

Table 11. Carcass traits and meat composition in Baladi strains of rabbits at 16 weeks of age

Trait	Baladi Red		Baladi White		Baladi Black	
	Mean	Range	Mean	Range	Mean	Range
Slaughter age (weeks)	14	12-18	18	18-26	16	14-18
Slaughter weight (g)	2085	1800-2230	1450	1080-2230	1885	1580-2230
Hot carcass weight (g)†	1063	775-1225	670	480-1100	965	720-1180
Dressing percentage	51	43-55	47	43-49	52	46-53
Giblets weight (g)	83	58-110	55	50-90	90	70-125
Fur weight (g)	155	150-240	135	125-180	250	210-290
Loin weight (g)	138	105-212	90	80-170	140	98-185
Meat:bone (%)	78:22	72:28-80:20				
Lean percentage	65	62-70	64	58-68	78	72-82
Head weight (g)	97	92-107	78	60-90	87	75-115
Moisture (%)	74.8	72-82	76.6	70-78	69.5	62-79
Protein (%)	19.3	16-22	18.2	16-21	21.6	18-24
Ether extract (%)	2.1	1.8-4.2	3.4	2.1-4.8	6.4	2.1-7.2
Ash (%)	1.2	1.1-1.6	1.6	1.2-2.2	3.4	1.2-3.4

†Without head.

4.8. Hair traits (Table 12)

Baladi rabbits are normal-haired strains (35-40 mm in length). Length of down- and guard-hairs of the three strains of Baladi are longer than the hairs of standard breeds (e.g., Bouscat and Flemish Giant) raised in Egypt (Ibrahim, 1980). Diameter of down- and guard-hairs of Baladi strains are thicker than those of standard breeds. Hairs of Baladi strains have high percentages of medullation since they have a light density fur.

Table 12. Hair traits characterizing fur of adult rabbits of Baladi strains

Trait	Baladi Red		Baladi White		Baladi Black	
	Mean	Range	Mean	Range	Mean	Range
Length of down-hairs (mm)	24	23-25	23	23-25	23	22-24
Length of guard-hairs (mm)	38	37-39	36	34-38	36	33-37
Diameter of down-hairs (micron)	20	19-21	20	19-22	20	18-22
Diameter of guard-hairs (micron)	95	90-113	94	89-109	93	89-110
Percentage of hair medullation	48	42-45	48	41-45	48	40-55
Hair density (per mm^2)	3350	2740-4125	3625	3105-4460	3560	3160-4250

5. Physiological reaction to climatic stress

Different colours of black, red and white for Baladi strains showed high differences in physiological reactions in terms of skin, ear-lobe and hair temperatures as well as in respiration and pulse rates (Shafie *et al.*, 1970). Under an annual average temperature of 23.5°C, Baladi strains are characterized by high responses to climatic stress as shown in Table 13. With regard to adaptation to heat stress, data given in Table 13 show that Baladi White rabbits are the best and Baladi Black rabbits are the worst.

Table 13. Physiological parameters of responses of Baladi adult rabbits to climatic stress

Trait	Baladi Red		Baladi White		Baladi Black	
	Mean	Range	Mean	Range	Mean	Range
Hair temperature (°C)	33.6	29.8-36.0	31.5	30.7-37.8	34.6	30.9-37.7
Ear-lobe temperature (°C)	32.0	26.8-37.0	31.0	27.1-37.8	33.6	27.7-37.8
Pulse rate	236	188-320	212	160-256	239	180-288
Respiration rate	222	148-344	157	88-220	237	148-320

6. Genetic improvement

6.1. Genetic parameters

References concerning repeatabilities and heritabilities for economic traits in Baladi rabbits are Khalil *et al.* (1988), Soliman (1988) and Afifi *et al.* (1989). Repeatability for litter traits in Baladi strains of rabbits are low and range from 0.11 to 0.18. Estimates of heritability for litter traits in Baladi strains are higher than those for exotic breeds. This is because Baladi strains were not subjected to any intensive programme of selection. These moderate estimates of heritability in Baladi strains motivate the Egyptian rabbit breeders to improve doe traits through selection.

6.2. Crossing of Baladi strains with exotic breeds

Results of crossbreeding experiments involving Baladi rabbits (Baladi Red, Baladi White, Baladi Black) in Egypt could be obtained from the following references: Dora (1979), Tag El-

Din (1979), Khattab (1980), Emara (1982), Soliman (1983), Sallam and Hafez (1984), Kosba *et al.* (1985), Sallam and El-Ashmawy (1985), Afifi and Khalil (1989), Oudah (1990), El-Desoki (1991), Tag El-Din *et al.* (1992), Youssef (1992) and Afifi *et al.* (1993).

6.2.1. Sire-breed

Direct genetic effects of exotic breeds compared to Baladi ones are favourable in litters at birth and during the first 21 days of suckling but not at weaning (Afifi and Khalil, 1991). The rabbits sired by Flemish Giant have the heaviest carcass weights but not the best carcass and lean yield value (Sallam and Hafez, 1984).

The New Zealand bucks generally produce litters with larger size and heavier weight along with heavier mean bunny weight at birth and at 21 days of age than do the Baladi Red bucks (Youssef, 1992). In terms of reproductive intervals, the same author found that litters produced by Baladi Red-bucks were associated with shorter lengths of insemination period, days open and kindling interval compared to litters produced by New Zealand White bucks.

Baladi Red-sired progeny are poorer in body weights and gains up to 12 weeks than those sired by New Zealand White rabbits (El-Desoki, 1991). Growth performance at early ages (5 and 6 weeks) of Baladi Red-sired rabbits are not significantly different from rabbits sired by New Zealand White, while significant differences are evidenced during the later ages of growth at 10 and 12 weeks (Afifi *et al.*, 1993).

Baladi Red-sired rabbits are significantly different from New Zealand White-sired rabbits in their carcass performance (Afifi *et al.*, 1993). The edible carcass traits are in favour of New Zealand White-sired rabbits along with lighter non-edible carcass wastes of blood and viscera.

6.2.2. Dam-breed

There is a general trend indicating that crossbreds mothered by exotic breeds (New Zealand White and Californian in particular) have better performances than crossbreds mothered by Baladi breeds (Dora, 1979; Tag El-Din, 1979; Emara, 1982; Oudah, 1990; Tag El-Din *et al.*, 1992; Youssef, 1992). This reveals the superiority of exotic breeds (e.g., New Zealand White, Californian, Bouscat, Giant Flander, etc.) in their maternal ability compared to Baladi strains.

Carcass performance of rabbits mothered by New Zealand White breed are similar to those rabbits mothered by Baladi Red breed (Afifi *et al.*, 1993), i.e., both breeds could be used as a breed of dam. In this study, blood and viscera wastes recorded by Baladi Red-dam progeny were lower than New Zealand White-dam progeny. These results were expected because Baladi Red rabbits originated from a giant breed which has superior maternal effects on postweaning performance (in terms of growth and survival) compared to New Zealand White breed. Therefore, it may be effective to use Baladi Red as a breed of dam in any crossbreeding stratification system for producing broiler rabbits with heavy weights and carcasses in Egypt.

References

Afifi, E.A. and Emara, M.E. (1986). Conception rate and number of litters kindled by the doe per year in Egypt. In: *3rd International Colloquy "The Rabbit as an Animal Model and Breeding Object",* Section 1, Rostock (Germany), 11-13 September 1986. Wilhelm-Pieck-Universität, Rostock, pp. 11-13.

Afifi, E.A. and Emara, M.E. (1990). Breed group and environmental factors influencing postweaning daily gain in weight of purebred and crossbred rabbits. *Journal of Applied Rabbit Research*, 13: 114-118.

Afifi, E.A. and Khalil, M.H. (1989). Observations on purebred and crossbred litters of Giza White and Grey Giant Flander rabbits in Egypt. *Journal of Applied Rabbit Research*, 12: 273-277.

Afifi, E.A. and Khalil, M.H. (1991). Crossbreeding experiments of rabbits in Egypt: Synthesis of results and overview. *Options Méditerranéennes, Series A*, 17: 35-52.
Afifi, E.A., Khalil, M.H. and Emara, M.E. (1989). Effects on maternal performance and litter preweaning traits in doe traits. *J. Anim. Breed. Genet.*, 106: 358-362.
Afifi, E.A., Khalil, M.H., Khadr, A.F. and Youssef, Y.M.K. (1993). Heterosis, maternal and direct effect for postweaning growth traits and carcass performance in rabbit crosses. *J. Anim. Breed. Genet.*, 110: 1-10.
Badawy, A.G. (1975). *Rabbit Raising*, 2nd edn. Central Administration for Agricultural Culture, Ministry of Agriculture, Egypt (in Arabic).
Blasco, A., Ouhayoun, J. and Masoero, G. (1992). Study of rabbit meat and carcass: Criteria and terminology. *Options Méditerranéennes, Series A*, 17: 105-120.
Boulos, N.Z. (1978). *Effect of feeding different sources and levels of roughages on growing rabbits*. MSc Thesis, Cairo University, Egypt.
Dora, T.M. (1979). *Body size, feed efficiency and meat production in White Baladi, Bouscat and their crossbreds*. MSc Thesis, Mansoura University, Egypt.
El-Desoki, A.E.M. (1991). *Study of the effect of some genetic and environmental factors affecting meat yield from some foreign and local breeds of rabbits and their crosses.* MSc Thesis, Faculty of Agriculture, Mansoura University, Egypt.
Emara, M.E.A. (1982). *Effect of crossbreeding on some productive traits in rabbits*. PhD Thesis, Faculty of Agriculture of Moshtohor, Zagazig University, Banha Branch, Egypt.
Galal, E.S.E. and Khalil, M.H. (1994). Development of rabbit industry in Egypt. *Options Méditerranéennes, Series Cahiers*, 8: 43-56.
Hassan, N.S. (1988). *Production of rabbits in Egypt*. MSc Thesis, Faculty of Agriculture, Cairo University, Egypt.
Hilmy, A.F. (1991). *Some productive aspects in rabbits*. MSc Thesis, Faculty of Agriculture of Moshtohor, Zagazig University, Egypt.
Ibrahim, M.K. (1980). Some hair characteristics of different native and standard rabbit breeds. *Annals of Agricultural Science, Moshtohor, Egypt*, 12: 238 (abstract).
Khalil, M.H. (1980). *Genetic and environmental studies on some productive traits in rabbits*. MSc Thesis, Faculty of Agriculture of Moshtohor, Zagazig University, Egypt.
Khalil, M.H., Afifi, E.A., Emara, M.E. and Owen, J.B. (1988). Genetic and phenotypic aspects of doe productivity in four breeds of rabbits. *J. Agr. Sci*., 110: 191-197.
Khattab, A.S. (1980). *A study of some economical characteristics and production traits on Egyptian rabbits and their crosses*. MSc Thesis, Tanta University, Egypt.
Kosba, M.A., Farghaly, M.M., Hamdy, S., El-Ezz, Z.A. and Kamel, F.N. (1985). Two-and three-way crossing effect on body weight in rabbits. *Egyptian J. Genetics*, 14(1): 27-34.
Oudah, S.M. (1990). *Studies on some rabbits breeds and their crosses*. MSc Thesis, Faculty of Agriculture, Mansoura University, Egypt.
Radwan, M.A.H., Abdella, M.M., Bakir, A.A. and El-Maghrabi, M.M. (1978). Studies on some nutritional requirements for two local breeds of rabbits during reproduction and growing periods. *Annals of Agricultural Science, Moshtohor, Egypt*, 10: 245-255.
Sallam, M.T. and Hafez, M. (1984). The effect of crossbreeding on post-weaning growth and slaughter traits for rabbits. *Annals of Agricultural Science, Moshtohor, Egypt*, 22: 91-103.
Sallam, M.T. and El-Ashmawy, S.H. (1985). Some productive trait differences and karyotypical studies in four breeds of domestic rabbits. *J. Agr. Res. Dev*., *El- Minia, Egypt*, 7(4): 1546-1560.
Shafie, M.M., Abdel-Malek, A.G., El-Issawi, H.F. and Kamar, G.A.R. (1970). Effect of environmental temperature on physiological body reactions of rabbits under subtropical conditions. *Egyptian Journal of Animal Production*, 10(1): 133-149.
Soliman, F.N.K. (1983). *Genetic and physiological studies in rabbits. The effect of crossing on rabbits performance.* MSc Thesis, Faculty of Agriculture, Alexandria University, Egypt.
Soliman, F.N.K. (1988). *Genetic and physiological studies in rabbits: Evaluation of pre- and post-weaning performance for different breeds of rabbits*. PhD Thesis, Faculty of Agriculture, Alexandria University, Egypt.
Tag El-Din, T.H. (1979). *A comparative study of reproduction, mortality and body weight in White Baladi and Bouscat rabbits and their crossbreds*. MSc Thesis, Mansoura University, Egypt.
Tag El-Din, T.H., Ibrahim, Z.M.K. and Oudah, S.M. (1992). Studies on live body weight and litter size in New Zealand White, Californian, Baladi rabbits and their crossbreds in Egypt. *Options Méditerranéennes, Series Cahiers*, 8: 67-74.
Youssef, M.K. (1992). *The productive performance of purebred and crossbred rabbits*. MSc Thesis, Faculty of Agriculture of Moshtohor, Zagazig University, Egypt.