

The Giza White Rabbits



Male Giza White



Female Giza White

The Giza White Rabbits (Egypt)

M.H. Khalil¹

Department of Animal Production and Breeding, Faculty of Agriculture and Veterinary Medicine,
King Saud University, Buriedah, Qassim, P.O. Box 482, Kingdom of Saudi Arabia

SUMMARY – A description of the Egyptian local breed of rabbit, Giza, 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: Giza, description, performance, genetics.

RESUME – "Les lapins Giza White (Egypte)". Cet article présente une description de la race locale égyptienne de lapins Giza. 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 : Giza, description, performances, génétique.

1. Breed name

- (i) *Breed name synonyms:* El-Giza El Mohassan or improved Giza.
- (ii) *Strains within breed:* none.

2. General description

2.1. Population data

2.1.1. Population size and census data: 500 animals

- (i) Total number of females being used in pure-breeding: about 100 females.
- (ii) Total number of females being used in cross-breeding: about 150 females.
- (iii) Percent of females being bred pure: about 30%.
- (iv) Total number of males used for breeding: about 60 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

In 1932, a native stock of rabbits (Baladi rabbits) was bred by the Animal Breeding Department, Cairo University, Giza, Egypt, in an attempt to form a breed of uniform characteristics (El-Khishin *et al.*, 1951). These rabbits were of different colours and sizes. Colours were isolated and black and albino colours were segregating. In 1937, systematic breeding took place with the objective of obtaining an albino type of rabbit with faster rate of growth and a larger litter size which is presently known as Giza White breed. Closed breeding in albino population was performed for several years.

¹ Previous address: Department of Animal Production, Faculty of Agriculture at Moshtohor, Zagazig University, Moshtohor, Qalyoubia, Egypt.

Table 1. Herd sizes of Giza White rabbits in Governmental and Small-scale farms

	Governmental farms	Small-scale farms
Mean		
Adult animals	40	5
Young animals	200	30
Range		
Adult animals	20-80	2-10
Young animals	100-500	20-250

2.1.4. *Situation with regard to danger of extinction*

Endangered, since the total number of breeding rabbits is less than 500.

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

Albino with a soft silky fur (see photographs of adult males and females).

2.4. General-type

2.4.1. *Body parts*

Well-rounded hips and well-filled loin and ribs carrying 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 2. The top body line rises in a gradual curve from the base of the ears to the center 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 2. Body measurements (cm) in Giza White rabbits at 12 weeks of age

Trait	Mean	Range
Body length	25.0	21-28
Chest circumference	11.5	9.2-13
Loin width	4.6	4.25-4
Thigh circumference	9	7.8-12

2.4.2. *Head: convex*

2.4.3. *Eyes: pink*

2.4.4. *Ears: erect*

2.4.5. *Feet and legs: medium in length*

2.4.6. *Tail: straight*

2.5. Basic temperament (for males or females): docile

2.6. Special characteristics of the breed

Moderately adapted to hot climate and somewhat resistant to diseases.

2.7. Nest quality: pooled (not scattered)

3. Pattern

3.1. Climate

3.1.1. Elevation and topography: valley and well drained topography (not for desert conditions)

3.1.2. Favourable climate: temperature from 15°C up to 32°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 following May while Darawa (fodder maize) used in summer.

3.2.4. Housing

- (i) *Cages:* wired cages and indoor rabbitries are used. Most cages were built with wood and palm-date leaves protected from the inside with a thin wire net. Since a better environment can be found underground, a cell can be prepared with stones, bricks, clay slices or concrete (Galal and Khalil, 1994).
- (ii) *Photoperiod:* variable periods.

3.3. Common diseases and parasites

Pasteurellosis, coccidiosis, enteritis, feet and ear mites.

4. Performance

4.1. Reproduction

Figures given in Table 3 showed that Giza White rabbits are late in their sexual maturity compared to standard breeds. For more details, see cited references related to reproduction.

Table 3. Sexual maturity in Giza White rabbits

Trait	Mean	Range
Age of buck at 1st service (months)	7.5	6.2-8.5
Age of doe at 1st mating (months)	7.8	6.5-10.0
Age of doe at 1st kindling (months)	9.5	8.0-12
Weight of buck at first service (g)	2810	2530-3290
Weight of doe at first mating (g)	2910	2620-3450

Conception rate of Giza White rabbits is relatively higher than rate recorded for standard breeds raised in Egypt (Afifi and Emara, 1986). Table 4 shows data of fertility (Khalil, 1993) and fecundity. Giza White rabbits are characterized by high ovulation rate (El-Fouly *et al.*, 1977) and moderate litter size and weight either at birth or at weaning (Afifi, 1971; Afifi and Emara, 1987). Litter weight and average weight of young at weaning for Giza White are heavier than the three strains of Baladi rabbits (Emara, 1982).

Table 4. Fertility and fecundity traits in Giza White rabbits

Trait	Mean	Range
Conception rate (%)	76	65-80
Kindling interval (days)	49	42-65
Ovulation rate	8.7	5.8-12.0
Litter size		
At birth (total born)	6.7	5.6-8.2
At 21-days	6.0	4.8-7.4
At weaning (4 weeks)	5.8	3.8-6.4
At weaning (5 weeks)	4.5	3.5-6.5
Litter weight (g)		
At birth	330	250-420
At 21 days	1380	1160-2180
At weaning (4 weeks)	1700	1540-2415
At weaning (5 weeks)	1950	1720-2615

4.2. Pre-natal mortality per litter (Table 5)

Table 5. Pre-natal mortality in Giza White rabbits

Trait	Mean	Range
Embryonic (%)	12	5-16
Stillbirths (%)	5.2	3.5-8.5

Both embryonic mortality and stillbirths in Giza White rabbits are relatively lower than that for Baladi strains (El-Fouly *et al.*, 1977).

4.3. Milk yield traits (Table 6)

The milking ability of Giza White does is low compared to exotic breeds raised in Egypt (Ibrahim, 1985; Khalil, 1994). Although Giza White breed is more adapted to the Egyptian

conditions, the low post-natal maternal ability in such a breed (due to lower milking and suckling abilities) may be the main limiting factor for the full use of such genetic potentiality on a large scale of commercial production. Components of milk for Giza White rabbits are richer than components of milk in standard breeds raised in Egypt (Ibrahim, 1985).

Table 6. Milk yield traits of Giza White does

Trait	Mean	Range
Number of teats	8.0	7-10
21-days milk yield (g)	2640	1890-3260
Peak of lactation (in days)	18.5	16-23
Peak of lactation (in g)	2380	1570-2860
Total milk yield (g)	3750	2650-4280
Fat (%)	19.5	17-23
Protein (%)	15.7	12-18
Lactose (%)	2.0	1.8-2.9

4.4. Lifetime production per doe (Table 7)

Table 7. Lifetime production of Giza White does

Trait	Mean	Range
Number of litters per year	2.8	2.2-4.2
Doe longevity (years)	4.5	4.2-6.5

With full potentiality, lifetime production of Giza White doe could be extended for four years. Therefore, Giza White rabbits have a long lifetime production compared to other breeds raised in Egypt (Afifi and Emara, 1986).

4.5. Pre-weaning food utilization per litter

Daily feed intake per litter (0-5 weeks) for Giza rabbits is 195 grams with a range of 160-225 grams (Abdella *et al.*, 1990). Accordingly, daily crude protein and starch per litter per doe during pre-weaning period are 32 and 120 grams, respectively.

4.6. Post-weaning body weights, gains and food utilization

In comparison with exotic breeds raised in Egypt, figures given in Tables 8 and 9 indicate that Giza White rabbits after weaning have the following characters: (i) moderate weights and gains in post-weaning growth period (Afifi *et al.*, 1990); (ii) moderate daily feed intake of about 80 grams during fattening period (Afifi *et al.*, 1990); and (iii) low rate of feed conversion (5.2 grams feed per gram gain).

4.7. Carcass traits and meat composition

According to criteria and terminology cited by Blasco *et al.* (1992), figures given in Table 10 indicate that Giza White rabbits are characterized by: (i) early age at slaughter (12 weeks) compared to Baladi strains; (ii) low weight of carcass compared to standard breeds raised in Egypt (El-Sayaad *et al.*, 1990); (iii) light weight of fur; and (iv) moderate moisture content along with high protein content of protein in meat (El-Sayaad *et al.*, 1990).

Table 8. Post-weaning growth traits of Giza White rabbits

Trait	Mean	Range
Body weight (g)		
Weaning (28 days)	355	230-450
Weaning (35 days)	408	240-580
Post-weaning		
6-week	560	408-780
8-week	790	510-940
10-week	1150	640-1360
12-week	1350	770-1560
Daily gain (g)		
5-8 weeks	16.0	10.0-22.0
8-12 weeks	18.0	12.0-24
12-16 weeks	13.0	11.0-16

Table 9. Post-weaning food utilization in Giza White rabbits

Trait	Mean	Range
Daily feed intake (g)		
5-6 weeks	54	52-56
6-7 weeks	68	66-84
7-8 weeks	80	78-84
8-9 weeks	88	80-103
9-10 weeks	98	91-113
Feed conversion (g intake per g gain)		
5-16 weeks	5.2	3.1-7.8

Table 10. Carcass traits and meat composition of Giza White rabbits 12 weeks old

Trait	Mean	Range
Slaughter weight (g)	1406	960-1670
Hot carcass weight (g) [†]	650	540-960
Dressing percentage	47.0	42-52
Front parts (g)	248	232-298
Hind parts (g)	235	220-305
Forequarter weight (g)	120	95-165
Hindquarter weight (g)	157	105-170
Giblet weight (g)	78	68-95
Fur weight (g)	107	90-160
Abdominal fat (%)	5.2	4.0-6.5
Moisture (%)	74	70-78
Protein (%)	19	16-24
Ether extract (%)	2.4	1.8-4.5
Ash (%)	1.4	1.2-1.6

[†]Carcass without head.

4.8. Hair and fur traits

Means and ranges for hair traits of adult Giza rabbits are presented in Table 11. Giza White rabbits are a normal-haired breed with a hair length of 30-40 mm. Giza rabbits are

characterized by a dense fur. Down-hairs of Giza are longer than those for standard breeds (e.g., Bouscat and Flemish Giant) raised in Egypt, while guard-hairs have an intermediate value (Ibrahim, 1980). Both down- and guard-hairs on hip and side regions have intermediate diameters while hairs on back region have thin diameter. Fibres have thinner medulla than that for Baladi strains, while they are similar to those of standard breeds (e.g., Bouscat and Flemish Giant).

Table 11. Hair traits characterizing fur of adult Giza White rabbits

Trait	Mean	Range
Length of down-hairs (mm)	22	21-24
Length of guard-hairs (mm)	33	31-36
Diameter of down-hairs (micron)	16	15-18
Diameter of guard-hairs (micron)	93	88-103
Hair density (per mm ²)	4990	3460-6522
Hair medullation (%)	43	39-49

5. Physiological reaction to climatic stress

Under an annual average air temperature of 23.5°C, Giza White rabbits showed average values of 39.4, 38.4, 39.1, 31.3 and 28.2°C for temperature of body, skin, abdomen, hair and ear-lobe (Table 12). It is interesting to note that New Zealand White rabbits give similar average body temperature at the same environmental air temperature (Shafie *et al.*, 1970). Physiological parameters for Giza white rabbits (Table 12) indicate also that this breed is less heat stressed than New Zealand White rabbits. References that are useful in this aspect of heat-stress parameters in Giza White rabbits are Kamar *et al.* (1975) and Hassanein (1980).

Table 12. Physiological parameters characterizing responses of adult Giza White rabbits to climatic stress (Shafie *et al.*, 1970)

Trait	Mean	Range
Hair temperature (°C)	31.3	28.1-35.1
Ear-lobe temperature (°C)	28.2	17.0-34.7
Pulse rate	235	211-265
Respiration rate	169	122-229

6. Genetic improvement

6.1. Genetic parameters

There are some papers concerning this topic. These papers include some estimates of genetic parameters for traits of economic interest or the establishment of different selection indices. Estimates of repeatability for litter traits, milk yield and reproductive intervals in Giza White rabbits are low. The estimates range from 0.02 to 0.189. Because of low repeatability for doe traits in this breed, it is very advantageous to consider several litters before selecting a doe for these traits. Therefore, culling of does for these traits based on a single production record would not be efficient from a genetic standpoint (Khalil, 1994).

Heritabilities characterizing genetic potentiality of economic traits in Giza White rabbits can be summarized as:

- (i) Estimates for litter traits are low; ranging from 0.05 to 0.27 (Khalil *et al.*, 1987b,c, 1989; Khalil, 1994).

- (ii) Estimates for lactation traits (Khalil, 1993, 1994), carcass traits (Darwish *et al.*, 1970) and hair and fur traits (Ibrahim, 1980) are moderate or slightly high. The estimates are about 0.18 for lactation traits, while they range from 0.20 to 0.29 for carcass traits and from 0.28 to 0.45 for hair traits.
- (iii) Estimates for heat stress traits (Toson, 1983) and post-weaning growth (Khalil *et al.*, 1987b; Khalil and Khalil, 1991) are moderate or high. The estimates range from 0.28 to 0.45 for body temperature, 0.20 to 0.45 for respiration rate and 0.28 to 0.65 for post-weaning body weights.

References concerning heritabilities of economic traits in Giza white rabbits are: Darwish *et al.* (1970), Mostageer *et al.* (1970), Toson (1983), Khalil *et al.* (1987a,b,c, 1989), Khalil and Soliman (1989), Khalil and Khalil (1991) and Khalil (1993, 1994).

6.2. Selection for economic traits

In the early stages of establishing Giza White population in 1938, selection was mainly based on economic breed characteristics (e.g., litter size and body weight). In 1986, Khalil *et al.* (1986) constructed a set of selection indices to improve Giza White breed using more than one trait such as litter size at weaning, mean bunny weight at weaning, pre-weaning mortality, litter size at birth and litter weight at birth.

6.3. Crossing of Giza White with other breeds

In 1947, Bouscat, Chinchillas, White Giant Flander, Grey Giant Flander and Flemish Giant stocks were introduced to the Department of Animal Breeding, Faculty of Agriculture, Cairo University, in an attempt to test their adaptability to the Egyptian conditions (El-Khishin *et al.*, 1951). In the last fifteen years, new standard breeds as New Zealand White and California were introduced to Egypt and were used in a large scale commercial production in different areas of Egypt.

The diversity that exists between standard breeds and the Giza White rabbits is likely to provide basis for selection of genetic combinations suited to a variety of environments and production systems in Egypt. Performance of Giza White rabbits and their crosses with standard breeds have not been extensively investigated in Egypt, although cross-breeding experiments of Afifi (1971), Khalil (1980), Emara (1982), and Afifi and Khalil (1989) have been carried out to improve reproductive and growth performances of these cross-breds under the local Egyptian conditions.

The Egyptian literature (Afifi, 1971; Khalil, 1980; Emara, 1982; Khalil *et al.*, 1987a,b,c; Afifi and Khalil, 1989) revealed that Giza White showed, in general, lower performance than acclimatized exotic breeds (e.g., Bouscat, Chinchilla, White Giant Flander, Grey Giant Flander) for different productive traits. Findings of crossbreeding experiments in Egypt encouraged the research workers to carry out these experiments using Giza White and acclimatized exotic breeds of rabbits. These experiments were started in 1971 and continued up to 1990. These numerous studies involving Giza White breed have been reviewed by Khalil and Afifi (1994). Results of these cross-breeding experiments could be summarized as:

- (i) Cross-breeding between Giza White rabbits and exotic breeds under the Egyptian conditions was generally associated with an improvement in most economic traits (e.g., litter size and weight, mortality, litter gain, mean young weight per litter, post-weaning body weights and gains, etc.).
- (ii) Heterotic effects in litter traits of Giza White rabbits (e.g., litter size and litter weight) were more pronounced at weaning than at birth.
- (iii) Giza White is superior in pre-natal abilities while foreign breeds (e.g., New Zealand White,

Californian, Bouscat, Giant Flander, Chinchilla, etc.) are superior in post-natal maternal abilities.

- (iv) Double cross-breeds involving Giza White (i.e., cross-bred litters or rabbits produced by cross-bred dams) were superior in their performance than those of single cross-bred (i.e., cross-bred litters or rabbits produced by pure-bred dams) or purebreds. This encouraged the commercial breeders of rabbits in Egypt to use cross-bred dams (Giza White foreign breed) instead of pure ones.
- (v) Cross-bred litters and rabbits resulting from mating bucks of Giza White with does of exotic breeds (e.g., New Zealand White, Californian, Chinchilla, Bouscat, etc.) showed considerable superiority for most economic traits in cross-breeds while cross-bred litters and rabbits mothered by does of Giza White showed little superiority in most cases.

References

- Abdella, M.M., Afifi, E.A., El-Sayaad, G.A.E. and El-Madhagi, K.S.S. (1990). Effect of dietary protein level, fiber level and other factors on rabbit performance. I. Productive performance of rabbit does. *Annals of Agricultural Science, Moshtohor, Egypt*, 28(4): 2101-2112.
- Afifi, E.A. (1971). *A study of some economical and productive characters in some breeds of rabbits and their crosses*. PhD Thesis, Faculty of Agriculture, Ain-Shams University, Egypt.
- Afifi, E.A., Abdella, M.M., El-Sayaad, G.A.E. and El-Madhagi, K.S.S. (1990). Effect of dietary protein level, fiber level and other factors on rabbits performance. I. Growth traits, postweaning mortality, feed utilization and nutrients digestibility of growing rabbits. *Annals of Agricultural Science, Moshtohor, Egypt*, 28(4): 2115-2139.
- Afifi, E.A. and Emara, M.E. (1986). Conception rate and number of litter kindled by the rabbit 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. (1987). Litter size in local Egyptian and exotic breeds of rabbits and their crosses. *Journal of Applied Rabbit Research*, 10(1): 26-29.
- 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.
- Blasco, A., Ouhayoun, J. and Masoero, G. (1992). Study of rabbit meat and carcass: Criteria and terminology. *Option Méditerranéennes, Series A*, 17: 105-120.
- Darwish, H.I., Mostageer, A.M. and Ghany, M.A. (1970). Genetic and phenotypic parameters of carcass characteristics in Giza rabbits. *Egyptian Journal of Animal Production*, 10(1): 13-19.
- El-Fouly, M.A., Borady, A.A., Radwan, A.A. and Kamar, G.A.R. (1977). Seasonal variation in some reproductive traits of Bouscat and Giza White rabbits. *Egyptian Journal of Animal Production*, 17(1): 9-19.
- El-Khishin, A.F., Badreldin, A.L., Oloufa, M.M. and Kheireldin, M.A. (1951). *Growth development and litter size in two breeds of rabbits*. Bulletin No. 2, Faculty of Agriculture, Cairo University, Egypt.
- El-Sayaad, G.A.E., Afifi, E.A., Abdella, M.M. and El-Madhagi, K.S.S. (1990). Effect of dietary protein level, fiber level, breed and other factors on rabbit performance. III. Carcass traits, meat composition and blood components of growing rabbits. *Annals of Agricultural Science, Moshtohor, Egypt*, 28(4): 2141-2165.
- Emara, M.E.A. (1982). *Effect of crossbreeding on some productive traits in rabbits*. PhD Thesis, Faculty of Agriculture at 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.
- Hassanein, A.M. (1980). *Reproductivity of rabbits under different heat conditions*. MSc Thesis, Faculty of Agriculture, Cairo University, Egypt.
- Ibrahim, F.A. (1985). *Studies on some factors affecting reproduction performance, milk production and preweaning mortality in rabbits*. MSc Thesis, Faculty of Agriculture, Cairo 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).
- Kamar, G.A.R., Shafie, M.M. and Abdel-Malek, E.G. (1975). The ear lobes of rabbits as a site of body temperature regulation. *Egyptian Journal of Animal Production*, 15(1): 57-66.

- Khalil, M.H. (1980). *Genetic and environmental studies on some productive traits in rabbits*. MSc Thesis, Faculty of Agriculture at Moshtohor, Zagazig University, Egypt.
- Khalil, M.H. (1993). Genetic evaluation of the lactational performance in Giza White rabbits and its relation with preweaning litter traits. *Egyptian Journal of Rabbit Science*, 3(1): 113-127.
- Khalil, M.H. (1994). Lactational performance of Giza White rabbit and its relation with preweaning litter traits. *Anim. Prod.*, 59: 141-145.
- Khalil, M.H. and Afifi, E.A. (1994). Evaluation of performance of two-way crossing of rabbits raised in hot climates. *Options Méditerranéennes, Series Cahiers*, 8: 71-94.
- Khalil, M.H., Afifi, E.A. and Emara, M.E. (1987a). Possibility of early direct and indirect selection for doe litter performance of Bauscat and Giza White rabbits. *Journal of Applied Rabbit Research*, 10(2): 88-93.
- Khalil, M.H., Afifi, E.A. and Kadry, A.E.H. (1989). Genetic analysis of weight of doe rabbits during gestation and its phenotypic relationship with reproductive efficiency at kindling. *Journal of Applied Rabbit Research*, 12(1): 45-51.
- Khalil, M.H., Afifi, E.A. and Owen, J.B. (1987b). A genetic analysis of body weight traits in young Bauscat and Giza White rabbits. *Anim. Prod.*, 45: 135-144.
- Khalil, M.H. and Khalil, H.H. (1991). Genetic and phenotypic parameters for weaning and preweaning body weights and gain in Bouscat and Giza White rabbits. *Journal of Applied Rabbit Research*, 14: 44-51.
- Khalil, M.H., Owen, J.B. and Afifi, E.A. (1986). A review of phenotypic and genetic parameters associated with meat production traits in rabbits. *Animal Breeding Abstracts*, 54(4): 752-749.
- Khalil, M.H., Owen, J.B. and Afifi, E.A. (1987c). A genetic analysis of litter traits in Bauscat and Giza White rabbits. *Anim. Prod.*, 45: 123-134.
- Khalil, M.H. and Soliman, A.M. (1989). Genetic analysis for some reproductive traits in female rabbits. *Journal of Applied Rabbit Research*, 12(3): 205-208.
- Mostageer, A., Ghany, M.A. and Darwish, H.I. (1970). Genetic and phenotypic parameters for the improvement of body weight in Giza rabbits. *Egyptian Journal of Animal Production*, 10(1): 65-72.
- Shafie, M.M., Abdel-Malek, E.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.
- Toson, M.A. (1983). *Genetic differences of heat tolerance and their effects on some productive traits in rabbits*. MSc Thesis, Faculty of Agriculture at Moshtohor, Zagazig University, Egypt.