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Effects of Breed and Air Conditioning on some Productive and Reproductive Performance during Hot Summer Season in Rabbits

Badawi, Y. K. and T. A. El-Aasar
Animal Production Research Institute, Agric. Res. Cent., Min. of Agric., Dokki, Giza, EGYPT.
E. mail of Correspondence Author: badawi_6@hotmail.com

ABSTRACT

Two hundred and twenty weaned rabbits of New-Zealand White (NZW) as exotic breed and Baladi Black (BB) as a local breed were used in the present study. The study included two experiments, where rabbits in the first and second groups were housed in unconditioning and conditioning rabbitry, respectively. The first experiment (lasted for 35 days post weaning) was designed to evaluate growth performance of rabbits as affected by breed and conditioning of the rabbitry. The 2nd experiment was carried out to evaluate mature rabbit reproductive traits by using 30 male rabbits, 15 of each NZW and BB in each group, during pre-mature period. The experiment lasted 3 months and aimed to estimate some blood serum constitutes and body thermoregulation, as well as age and weight at first mating and some parameters indicated fertilizing ability of bucks. Results showed that, daily weight gain , feed intake, feed conversion and final body weight of rabbits were significantly ($P \leq 0.05$) better in BB and in conditioning rabbitry than those of NZW rabbits and in the control – unconditioning group, respectively. Dressing percentage, carcass weight and relative internal organs weight, as well as, blood pictures of growing rabbits were significantly ($P \leq 0.05$) higher in conditioning and BB than in unconditioning rabbitry and NZW rabbits, respectively. Conditioning rabbitry significantly ($P \leq 0.05$) improved values of each of total protein and its fractions, some enzymes indicated liver activity, some physiological aspects indicated physiological ability of body-thermoregulation. Also, conditioning rabbitry significantly ($P \leq 0.05$) improved net revenue and relative economic efficiency as compared to unconditioning group. Results of the second experiment indicated that, scrotal circumference, testicular index and mating activity, as well as, female and male sexual hormones were significantly ($P \leq 0.05$) higher in BB and in conditioning rabbitry than NZW and unconditioning rabbitry, respectively. Baladi Black rabbits showed libido; physical semen quality; conception and kindling rates; litter size and bunny weight at birth and at weaning and pre-weaning mortality rates significantly ($P \leq 0.05$) better than NZW rabbits, using natural mating or artificial insemination. Libido and physical semen quality of bucks, and fertility traits of does mated naturally or inseminated artificially were significantly ($P \leq 0.05$) improved by conditioning the rabbitry, in each breed. Using air conditioning in rabbitries showed a significant improvement in the economic efficiency of rabbit production.

Keywords: rabbits, breed, growth, carcass, productive, reproductive, fertility.

INTRODUCTION

The domestic rabbits are good alternative protein source for the human population in developing countries like Egypt (Mona Ghaly, *et al.,* 2011). Rabbit's meat consumption in Egypt is still quite low, however, with the increasing concern with healthiness of diet, rabbit meat shows high nutritional quality, with better taste and physical characteristics of meat. It contains a high amount of protein and low amounts of fat and cholesterol (Lebas *et al*, 1986 and Das and Bujarbarua, 2005), and high content of polyunsaturated fatty acids (Ouhayoun, 1992).

In Egypt, the environmental temperature is increased during the period from May to October, with slight decrease in December to March . In summer season, the surrounding temperature increased , causing negative effects on rabbits productivity and physiological status via reducing feed intake and efficiency; distress; elevation of core temperature, increasing respiration rate and depressed immune responses resulting in higher mortality rate, especially in young rabbits . These disorders are related to the inability of rabbits to eliminate excess body heat due to their un-functional sweet glands (Marai *et al*., 1991).. The endocrine system plays an integral part in the animal's response to stress (Fouad, 2005). The comfort temperature for rabbits is ranged from 15 to 25oC (Cervera and Carmona, 1998), since they are physiologically tolerant at low than high temperatures and above 35 oC they can no longer regulate their body temperature, so heat load increased to a great extent where they could not dissipate the excess heat , thus prostration may occur. It is well known that as a result of high ambient temperature reproduction suffers, while body temperature and respiration rate can be highly affected (Fayez *et al.,* 1994). To alleviate the negative impact of heat stress on rabbits performance, several managerial approaches were applied. These include early –age heat acclimation, use of some electrolytes, vitamins (A, C ,E), use of specific heat – acclimated breeds / strains of rabbits, nutritional invention, cooling of drinking water and /or air conditioned farms. The most observed consequences of heat exposure of rabbits to high environmental temperature are changes in some productive traits including reduced feed intake and feed conversion ratio . In addition , blood biochemical and hematological parameters may be influenced. These changes can be reflected in the performance of New-Zealand white rabbits under hot environmental conditions of Egypt (Okab *et al.,* 2008).

Baladi Black (BB) rabbits are considered as a local cross breed that resulted from crossing between heavy Baladi does and pure Giant Flander bucks for several generations, with the selection criteria of heavy body weight and pure black color traits of the resulted offspring. Thus, Baladi Black rabbits are characterized by their high tolerance to climatic stress and their resistance to disease (Khalil, 2002). The other objectives of selection were the improvement of carcass and meat quality traits (Moura *et al*., 2001) and feed efficiency as the most commercially important cost because post-weaning feeding accounts for around 55% to 65 % of total production cost (Armero and Blasco, 1992).

Artificial Insemination (AI) technology was extensively used in the rabbits industry in both small farms and in the wide scale rabbitries (El-Gaafary and

Marai, 1994). In addition, the application of AI help maximizing the financial profit of the rabbitry by reducing the number of pen-raised bucks and, consequently, the number of non-productive cages (Seleem and Riad, 2005). When AI is applied in a rabbitry, it is estimated that one single buck may affect the fertility and prolificacy of about one hundred does (Seleem, 2005). On the other hand , to obtain better results from AI , one should apply cyclic reliable evaluation of bucks semen to predict their fertilizing ability as this is the first vital step for enhancing fertility and productivity of rabbit breeding programs indicative of importance of the success of the AI technique. However, unfortunately, there is no individual basic parameter exists for semen evaluation that can be employed as a reliable predictor of sperm fertilizing ability. As such, finding a laboratory test, capable of consistently predicting the fertility of a semen sample would be highly desirable (Lavara *et al.*, 2005). Therefore, the main objectives of the present experiments were to evaluate growing and pre-mature rabbit performance as affected by breed and rabbitry condition.

We aimed to calculate economic efficiency for air conditioning rabbitry ; although , not all producers have the same needs in economic management, which mainly concerns those whose purpose is to make the maximum profit. There is a great deal of variation in this area. Giving advises depend on the expertise of the breeder and his economic situation.

MATERIALS AND METHODS

Animals and their managerial conditions

The field work of this study was carried out in a large commercial Industrial rabbitry, located in Sarabiom city , Ismailia Governorate, Egypt during the period from May to September. The laboratory measurements was carried out in Animal Production Research Institute, Agriculture Research Center, Dokki, Giza, Egypt. Rabbits were raised in semi-closed rabbitry with wire-netted windows on their sides for providing natural ventilation. The windows were oriented with an elevation of 2 meters from the floor. The main rabbitry was divided into two homogeneous rabbitries in all managerial conditions, except the first one were conditioning artificially using two air conditions five horsepower each, while the other was unconditioning.

Experiment I :

A total number of two hundred and twenty weaned rabbits (110 of each breed of New-Zealand White and Baladi Black) were used in the present study. The study aimed to evaluate growing and pre-mature rabbit performance as affected by breed and rabbitry condition. It included two trails in which animals in each one were divided into two equal comparable groups. The first and second groups were housed and reared in unconditioning and conditioning rabbitry, respectively. At growing (fattening) period 160 weaned rabbits, 40 of each NZW and BB in each group were used to study growth performance data (feed intake, weight gain, feed conversion, mortality rate. This experiment lasted 35 days. The experiment was designed to evaluate daily feed intake, weight gain, feed efficiency and conversion and mortality rate, dressing percentage and internal organs weight).

In the second trail (extended for 70 days), 30 male rabbits were used, 15 of each NZW and BB in each group in order to estimate some blood serum constitutes and body thermoregulation of NZW and BB rabbits as affected by rabbitry conditions. Also, age and weight at first mating and some parameters indicated fertilizing ability were recorded.

Experiment II :

A total number of two hundred and twelve mature rabbits (90 does and 16 bucks of each breed of New-Zealand White and Baladi Black) were used in the present experiment. It included two parts and aimed to evaluate mature rabbit reproductivity as affected by breed and rabbitry condition. Animals in each part were divided into two equal comparable experimental groups. The first and second groups were housed and reared in unconditioning and conditioning rabbitry, respectively. The criteria of response were male and female sexual hormones and fertility traits of does mated naturally, libido and physical semen quality of bucks, and fertility traits of does, using artificial insemination of both exotic and local rabbit breeds.

Rabbits of the two experiments were fed a commercial diet covering the nutritional requirements of different physiological status of rabbits according to NRC (1977) recommendations. The ingredients and chemical composition of the pelleted ration fed to rabbits, during the experimental period was as shown in Table 1.

Maximum and minimum of air temperature (C), relative humidity (RH %) and temperature-humidity index (THI) values inside the rabbitries, during the period of experimental work are shown in Table 2.

THI was estimated according to Livestock and Heat Stress Indices, Agriculture Engineering Technology Guide, Clemson University, Clemson, Sc 29634, USA, using the following formula:

THI= db o F – (0.55 – 0.55 RH) (db o F – 58.00)

Where:

db o F= dry bulb temperature in Fahrenheit.

RH= relative humidity.

The obtained values of THI were classified as follows:-

1- less than 72 indicates absence of heat stress.
2- From 72 and less than 83 indicates moderate heat stress.
3- From 84 and less than 86 indicates severe heat stress.
4- Over 86 indicate very severe heat stress.

Data collection

Body thermoregulation was estimated for both pre-mature rabbit males individually in the morning at 8.00 a.m twice a week, during the experimental period as described by Seleem (2003). Rectal temperatures were measured by inserting a clinical thermometer in the rectum at a uniform depth of 1.5 cm for one minute. Skin temperature (between neck and lion, medial dorsal surface) was measured from one location on the body surface. The thermometer was fixed on the bare skin and on fur which was combed back into place by finger. Ear lobe (in the central area of auricle) temperature was measured by a clinical thermometer. The thermometer was placed into direct contact with the central area of the auricle.

Respiration rate was estimated by the frequency of the flank movements per minute. A hand counter was used to count the flank movement frequencies. Pulse rate was taken by putting the left hand on the left side of abdominal surface of the animal over the heart position and counting the pulse rates for one minute by a hand counter.

Fertilizing ability of rabbit bucks:

Scrotal circumference was measured as the method described by Mickelsen *et al.* (1982). Testicular index (length x width x depth) was calculated in cubic centimeters. Mating activity (number of mating/ 20 minutes) was as assessed by Amal Hekal *et al.* (2013) and Safaa Barakat et. al. (2013).

Regarding sexual hormones, blood samples were taken from the marginal ear vein of three rabbit bucks and five does per group weekly up to 4 weeks. Blood serum testosterone concentration of bucks and estradiol 172α and progesterone levels of does were determined using RIA Kits (Immunotech, A Coulter Co., France) according to the manufacturer information.

Some parameters indicated fertilizing ability of rabbit males:

Age and weight of rabbit males at first mating were recorded. Relative weights of each of pituitary gland and gonads represented by testes; epididymal and sexual accessory glands were evaluated.

Fertility traits

Natural mating was carried out by transferring each doe to the buck's cage to be mated and return back to its cage after mating. Palpation of all rabbit does was carried out 12 days post mating to determine pregnancy. Conception and kindling rates and litter size and bunny weight at birth and at weaning and pre weaning mortality rates were estimated in either natural mating or artificial insemination.

Semen collection and evaluation:

Libido (sexual desired) was evaluated as described by Seleem (2003). Each week, two ejaculates per 3 bucks were collected artificially using an artificial vagina as described by Boiti *et al.* (2005). Semen was collected early in the morning. Only ejaculates exhibiting a white color were used in the experiment, and if gel was present, it was removed with forceps. The ejaculated semen of each buck was evaluated microscopically. Semen volume was estimated using a micropipette and sperm concentration was assessed with a haemocytometer. Two aliquots from the same ejaculate were extracted for assessment of sperm motility, dead and abnormal spermatozoa and acrosome status. physical semen characteristics were done as measured by Castellini *et al.* (2006).

In the fertility traits, semen samples showed sperm-advanced progressive motility > 70% were pooled and diluted with lactose-yolk citrate extender (2.90 gm sodium citrate dehydrate + 1.25 gm lactose + 0.04 gm citric acid anhydrous + 10.00 ml egg yolk + 50000 IU sodium penicillin + 50000 µg streptomycin sulphate/ 100 ml sterilized distilled water) at 1: 4 extension rate. At the same time of insemination each female was given an intramuscular injection with 20 µg gonadotrophin-releasing hormone (Gonadoreline, Fertagyl, Intervet. Lab.) to induce ovulation immediately before insemination as described by Lopez and Alvarino (2000). Insemination technique was applied according to Eschborn (1985) using especial devises disposable a plastic curved pipette (Imporvet, S.A., Barcelona, Spain). One pipette for each doe connected to 2 ml syringe through suitable rubber tube.

Statistical analyses:

Data were statistically analyzed by ANOVA (Snedecor and Cochran 1982) using the General Linear Model Program of SAS (2001). The following linear model was used :

$$Y_{ijk} = \mu + B_i + T_j + BT_{ij} + e_{ijk}$$

Where: Y_{ijk} = Observation on ijkth breed,
μ = Overall mean;
B_i= fixed effect of ith breed (i = 1st and 2nd)
T_j = fixed effect of jth treated group (j = 1st and 2nd)
BT_{ij} = interaction effect of BxT
and e_{ijk}= random error of the model. Percentage values were transformed to Arc- Sin values before analysis. Duncan's new multiple range tests was used to test the significance of the differences among means (Duncan, 1955).

Table 1. Composition of the pelleted rations as fed to growing rabbits during the experimental period

Ingredients	%	
	Growing	Adult
Clover hay	30.00	40.50
Wheat bran	26.20	25.00
Yellow corn	-	14.00
Soybean meal (44%)	16.00	11.00
Barley grain	23.00	-
Molasses	-	3.00
Vinass	-	3.00
Bone meal	3.00	1.75
Lime stone	1.00	0.70
Sodium chloride	0.50	0.55
Vitamins & Mineral Premix *	0.30	0.35
DL-Methionine	-	0.15
Total	100.00	100.00
Calculated composition **		
CP (%)	16.72	18.00
EE (%)	2.95	3.00
CF (%)	13.07	14.00
DE (Kcal/Kg)	2490.00	2720.00

***Vitamins and minerals premix per Kilogram contains:**

Items	Amount	Items	Amount
Vit.A (IU)	10,000	Biotin (mg)	0.2
Vit.D3 (IU)	2000	Choline (mg)	1200.0
Vit.E (mg)	10000	Niacine (mg)	40.0
Vit.K (mg)	3.00	Zn. (mg)	60.0
Vit.B1 (mg)	1.00	Cu. (mg)	0.1
Vit.B2 (mg)	4.00	Mn. (mg)	62
Vit.B6 (mg)	3.00	Fe. (mg)	40.0
Vit.B12 (mg)	0.02	Folic acid (mg)	1.0
		Pantothenic acid (mg)	15.0

**** Calculated according to NRC (1977) for rabbits.**

RESULTS AND DISCUSSION

I First Experiment:

The temperature-humidity index:

(THI) estimated in Table 2 indicated that:-

Rabbits housed in conditioning rabbitry did not expose to any degree of heat stress, during the experimental period.

Rabbits housed in unconditioning rabbitry exposed to moderate; severe; and very severe heat stress, during May; June and (July; August and September), respectively.

Growth performance of growing rabbits :

Data in Table 3 represented growth performance of growing NZW and BB rabbits as affected by conditioning rabbitry. Data indicated that, daily body weight gain, feed efficiency, and final body weight of growing rabbits were significantly (P≤0.05) better in BB than in NZW. However, feed conversion ratio and daily feed intake were significantly (P≤0.05) better in NZW than in BB. Data showed that, rabbits in conditioning rabbitry had significantly (P<0.05) increase in daily body weight gain, daily feed intake, feed efficiency, and final body weight of growing rabbits were significantly (P≤0.05) better than unconditioning rabbitry. Data showed that, rabbits in conditioning rabbitry had significantly (P<0.05) increase in body weight gain, daily feed intake, feed efficiency and final body weight from weaning till marketing age compared to unconditioning rabbitry. Data in table 3 showed that BB was better in daily weight gain, feed efficiency and final body weight, in conditioning rabbitry. The improvement effects continue with housed rabbits in conditioning rabbitry until marketing age.

Marai and Habeeb (1998) reported that a depression in feed consumption in rabbits is due to impairment of appetite as a result to stimulation of the peripheral thermal receptors by the environmental temperature to transmit suppressive nerve impulses to the appetite centre in the hypothalamus that causes this phenomenon. The reduction in live body weight and daily body gain weight in unconditioning rabbitry due to heat-stress attributed to the negative effects of heat-stress on appetite and consequent decrease in feed consumption. This may lead to less protein biosyntheses and less fat deposition, leading to lower body gain.

Table 2. In door environmental temperature , relative humidity and temperature-humidity index (THI) values during the months of the experimental periods .

Month	Rabbitry condition	Temperature (0C)		Relative humidity (RH%)		Temperature-humidity index (THI)	
		Max	Min	Max	Min	Max	Min
May	Conditioning	22.5±0.9	13.1±0.6	42.0±1.9	38.8±1.7	67.9±1.4	54.9±1.0
	Unconditioning	30.4 ± 1.4	22.8 ± 1.5	70.8 ± 3.1	26.0 ± 0.6	82.1 ± 2.1	66.9 ± 1.6
June	Conditioning	23.6±0.7	14.5±0.9	35.0±1.5	35.5±2.3	68.6±1.6	58.1±1.3
	Unconditioning	31.8 ± 1.7	23.6 ± 1.8	82.1 ± 2.8	32.2 ± 1.9	84.5 ± 2.9	71.6 ± 1.8
July	Conditioning	24.5±1.3	14.3±0.7	42.2±2.1	23.0±1.5	70.4±1.9	57.9±1.1
	Unconditioning	33.8 ± 1.3	23.0 ± 1.5	86.0 ± 1.7	64.6 ± 2.1	90.0 ± 3.2	70.4 ± 2.8
August	Conditioning	25.5±0.9	20.1±0.7	45.0±2.3	33.4±1.7	71.9±1.7	64.5±1.2
	Unconditioning	34.4 ± 0.7	24.1 ± 1.1	76.1 ± 2.1	76.0 ± 1.9	89.2 ± 2.7	72.2 ± 1.6
Sept.	Conditioning	25.3±1.6	18.3±1.3	55.8±1.6	35.0±1.2	72.8±1.8	62.6±0.8
	Unconditioning	31.2 ± 1.5	23.0 ± 1.3	89.1 ± 2.8	30.0 ± 0.6	86.4 ± 3.1	67.4 ± 2.4

Table 3. Performance of growing NZW and BB rabbits as affected by rabbitry conditions (Means ± SE).

		Initial body weight (gm)	Daily weight gain (gm)	Daily feed intake(gm)	Feed efficiency	Feed conversion	Final body weight at 60 days (gm)
Breed	B1	608.7± 31.2 b	23.8± 1.2 b	96.2 ± 3.7 a	0.245 ± 0.02 b	4.18 ± 0.6 a	1321.2 ± 61.3 b
	B2	711.5± 33.6 a	27.0± 1.0 a	89.8 ± 3.9 b	0.299 ± 0.02 a	3.41 ± 0.4 b	1521.5 ± 62.8 a
Treatment	T1	657.4 ± 29.8b	30.2 ± 1.3 a	97.7 ± 4.6 a	0.311 ± 0.03 a	3.25 ± 0.5 b	1563.4 ± 66.3 a
	T2	662.8 ± 27.4a	20.6 ± 1.3 b	88.3 ± 3.7 b	0.234 ± 0.02 b	4.34 ± 0.6 a	1279.3 ± 64.2 b
Breed x Treatment	B1xT1	611.2 ± 33.8b	28.6 ± 1.9a	101.1±5.9 a	0.283 ± 0.03 b	3.53 ± 0.8 b	1469.2 ± 67.2 b
	B1xT2	606.1 ± 35.2b	18.9 ± 1.2b	91.2 ± 4.8 c	0.207 ± 0.02 d	4.83 ± 0.9 a	1173.1 ± 59.4 d
	B2xT1	703.5 ± 35.6a	31.8 ± 1.7a	94.2 ± 5.2 b	0.338 ± 0.04 a	2.96 ± 0.5 c	1657.5 ± 71.3 a
	B2xT2	719.4 ± 37.2a	22.2 ± 1.4b	85.4 ± 4.3 d	0.260 ± 0.02 c	3.85 ± 0.8 b	1385.4 ± 65.2 c

Carcass traits:

The effect of conditioning rabbitry, and breed on carcass traits was so clear, where unconditioning rabbitry caused significant (P≤0.05) increase in dressing percentage and carcass' internal organs weight including spleen; kidneys; liver; heart and lungs for growing BB and NZW rabbits (Table 4). Baladi Black growing rabbits in conditioning rabbitry recorded carcass traits significantly (P<0.05) better than those of NZW rabbits.

Pre-slaughter weight is considered to be one of the most important factor affecting carcass traits in rabbits (Ortiz et. al., 2001). Maertens and Groote, (1992) and Szendro *et al*., (1995) confirm the importance of pre-slaughter body weight on carcass traits. Other traits such as dressing percentage, spleen, kidneys, liver, heart and lungs as given in Table 4 showed breed differences (P<0.05) in the proportions of internal organs among breeds.

Table 4. Dressing percentage and internal organs weight of growing NZW and BB rabbits as affected by rabbitry conditions (Means ± SE).

		pre-slaughter weight	Carcass	Dressing (%)	Spleen (%)	kidneys (%)	liver (%)	heart (%)	Lungs (%)
Breed (B)	B1	1327.1 ± 61.2 b	854.4 ± 24.8 b	64.0 ± 2.0 b	0.07 ± 0.00 b	0.70 ± 0.01 b	2.42 ± 0.09 b	0.42 ± 0.00 b	0.51 ± 0.01 b
	B2	1515.2 ± 64.3 a	1031.7 ± 32.6 a	67.8 ± 2.3 a	0.09 ± 0.01 a	0.73 ± 0.01 a	2.70 ±0.013 a	0.43 ±0.01 a	0.53 ± 0.01 a
Treatment(T)	T1	1563.3 ± 63.7 a	1084.6 ± 30.9 a	69.3 ± 2.8 a	0.10 ± 0.02 a	0.74 ± 0.02 a	2.72 ± 0.10 a	0.43 ± 0.00 a	0.54 ± 0.01 a
	T2	1279.1 ± 58.4 b	801.7 ± 26.7 b	62.5 ± 2.2 b	0.07 ± 0.01 b	0.69 ± 0.01b	2.40 ±0.08 b	0.42 ± 0.00 b	0.50 ± 0.01 b
B x T	B1xT1	1475.3 ± 62.2 b	997.5± 27.9 b	67.6 ± 2.7b	0.08 ± 0.01 b	0.71±0.02 b	2.52 ± 0.11b	0.42± 0.01b	0.52 ±0.02 b
	B1xT2	1178.9 ± 59.1 d	711.2± 25.4d	60.3 ± 1.8d	0.06 ± 0.00b	0.68± 0.01b	2.31± 0.12b	0.41 ± 0.01c	0.49± 0.01 d
	B2xT1	1651.2 ± 68.7 a	1171.3±41.3 a	70.9 ± 2.9a	0.11± 0.01 a	0.76± 0.03 a	2.91 ± 0.23a	0.44± 0.01a	0.55± 0.01 a
	B2xT2	1379.2 ± 66.3 c	892.1± 29.8 c	64.7 ± 2.1c	0.07 ± 0.01b	0.70 ± 0.02 b	2.48 ± 0.13b	0.42 ± 0.01b	0.50± 0.01 c

Means having different superscripts are significantly different (P ≤ 0.05) B1: New-Zealand White ,B2: Baladi Black, T1:Conditioning , T2: Unconditioning

Blood picture:

Regarding blood picture, Table 5 showed that, blood pictures represented in red blood cells, white blood cells, hemoglobin and hematocrete of growing rabbits were significantly (P≤0.05) higher in conditioning and BB than in unconditioning rabbitry and NZW rabbits, respectively.

Okab *et. al.,* (2008) reported that heat stress induced the reduction in RBC counts, Hb and PCV. This drop is responsive trial to reduce oxygen intake, thus reducing metabolic heat production under this hot condition. The decreases in oxygen intake are important for animals to keep heat balance. It was reported that heat stress decreases the level of ACTH, which, in turn, decreases the values of RBC counts, Hb and PCV. Calculated characteristics of erythrocytes were markedly affected by the season; MCV increased, and MCHC decreased, while MCH was not affected. The MCHC plays an important role in detecting the influence of heat stress, which decreases by the elevation of ambient temperature. A decrease in overall mean of MCHC in summer, may be due to the reduction of RBC counts (Samak *et al.* 1986). The increase in MCV and the decrease in MCHC might be due to the decrease of salt content in blood plasma during summer. The results of El-Sheiref *et al.* (2002) on rabbits drinking salty water confirm present results.

Many researchers observed the effect of genetic on hematological and biochemical status of rabbits (Cazabon *et al.,* 2000) and Meshreky *et al.* (2005). Baladi Black scored significantly higher Ht as shown in Table 5 as a result of an increase in RBCs count than NZW rabbits.

Table 5. Blood hematology of growing rabbits as influenced by rabbitry conditions (Means ± SE).

		Red blood cells (N x 106 /mm3)	White blood cells (N x 103 /mm3)	Hemoglobin (gm/ dL)	Hematocrete (%)
Breed	B1	5.81 ± 0.21 b	6.74 ± 0.82 b	10.42 ± 0.76 b	36.66 ± 1.1 b
	B2	6.21 ± 0.27 a	7.54 ± 0.94 a	11.34 ± 0.64 a	39.63 ± 1.8 a
Treatment	T1	6.47 ± 0.26 a	7.77 ± 0.74 a	12.12 ± 1.09 a	40.40 ± 2.3 a
	T2	5.55 ± 0.14 b	6.51 ± 0.80 b	9.64 ± 0.81 b	35.90 ± 1.4 b
Breed x Treatment	B1xT1	6.21 ± 0.28 b	7.36 ± 0.89 b	11.62 ± 0.82 b	39.06 ± 1.2 ab
	B1xT2	5.41 ± 0.17 c	6.11± 0.83 d	9.22 ± 0.73 d	34.26 ± 1.8 c
	B2xT1	6.72 ± 0.31a	8.17 ± 0.91 a	12.61 ± 1.12 a	41.73 ± 2.1 a
	B2xT2	5.69 ± 0.22 c	6.91± 0.83 c	10.06 ± 0.52 c	37.53 ± 1.7 b
Normal range **		5.3-6.8	5.1-9.7	9.8-14.0	34.0–43.0

2. Pre-mature rabbit's performance

Blood serum constitute

Concerning the effects of housing pre-mature rabbits in conditioning rabbitry on some blood serum constitute (Table 6). It can be explain and interpretive the improvements in total protein and its fraction (albumin, globulin, and albumin / globulin ratio) and some enzymes indicated liver function (AST and ALT) were significantly (P≤0.05) superior in BB, except for albumin / globulin ratio NZW rabbits was better than BB rabbits. Total protein , AST and ALT were better in NZW housed in unconditioning rabbitry.

Generally, serum total protein level is a general indication of immune status El-Sheikh et. al., (2011). Also, they reported that lymphatic tissues are responsible about globulin formation. Ismail *et al.* (2002) revealed that globulin can be taken as a good indicator of immunity response. As shown in table 6, the albumin level was significantly higher in BB than NZW ones. Albumin level reflects liver function (Azoz and El-Kholy, 2005), where, the liver is the site of albumin synthesis (Seleem et. al.,2007). This finding suggested that metabolic rate may be higher in BB and such results may give evidence that BB are more able to metabolize protein. The decrease in Alb/Glo ratio is a good indicator for increase of immunoglobulin Ismail *et al.* (2002). Table 6 showed that BB scored significant (P≤0.005) lower Alb/Glo ratio compared with NZW. On the other hand, enzymes profile reflect animal's health and activities (Chiericato et.al., 2000), where they accelerate animal's metabolism, growth and production. Genetic variations affect also enzymes level significantly (as shown in table 6).

The importance of increasing TP in summer may be due to the fact that TP in plasma generates a colloid osmotic pressure which controls the flow of water between blood and tissue fluids.

ALT activity was increased in unconditioning rabbitry. The AST/ ALT ratio was significantly (p<0.01) increased during summer. This ratio indicates the state of aspartate to alanine synthesis in the liver. The AST and ALT are dependent on the amino acid groups of alanine and glutamine taken up by the liver and reflect the changes in the liver metabolism associated with glucose synthesis. The increase in the activities of ALT, and AST in plasma is mainly due to the leakage of these enzymes from the liver cytosol into the blood stream, which reflects liver damage and disruption of normal liver function.

Table 6. Some blood serum constitutes of pre-mature NZW and BB rabbits as affected by rabbitry conditions (Means ± SE).

		Total protein (m gm/100ml)	Albumin (m gm/100ml)	Globulin (m gm/ 100ml)	Albumin/ globulin ratio	AST (U/ L)	ALT (U/ L)
Breed	B1	5.96 ± 0.06 b	3.94 ± 0.20 b	2.03 ± 0.02 b	1.95 ± 0.11 a	32.8 ± 1.1 b	18.7 ± 1.3 b
	B2	6.48 ± 0.08 a	4.24 ± 0.20 a	2.24 ± 0.03 a	1.89 ± 0.15 b	35.7 ± 1.6 a	21.3 ± 1.9 a
Treatment	T1	5.52 ± 0.07 b	4.58 ± 0.17 a	1.92 ± 0.01 a	1.95 ± 0.10 a	31.0 ± 1.7 b	18.3 ± 1.2 b
	T2	6.93 ± 0.10 a	3.60 ± 0.13 b	2.35 ± 0.03 b	1.89 ± 0.12 b	37.5 ± 2.2 a	21.8 ± 1.6 a
Breed x Treatment	B1xT1	5.21± 0.11 d	4.42 ± 0.24 b	1.76 ± 0.01 c	1.93 ± 0.09 a	29.9 ±1.2 c	17.1± 1.4 c
	B1xT2	6.71± 0.12 b	3.45 ± 0.18 d	2.29 ± 0.06 a	1.96 ± 0.18 a	35.6 ± 2.5 b	20.3 ± 2.0 b
	B2xT1	5.82 ± 0.12 c	4.73 ± 0.22 a	2.07 ± 0.01 b	1.96 ± 0.14 a	32.1± 1.4 bc	19.4 ± 1.9 b
	B2xT2	7.14 ± 0.15 a	3.75 ± 0.22 c	2.41 ± 0.04 a	1.81 ± 0.16 b	39.4 ± 2.3 a	23.2 ± 2.1 a
Normal range **		5.0-7.5	2.7-5.0	1.5-2.7	0.8 -2.65	20.7-42.9	12.0-25.0

Means within the same column (a & b) bearing different letter superscripts are significantly different (P ≤ 0.05) ** Normal range according to Seleem et. al. (2008). B1: New-Zealand White, B2: Baladi Black, T1: Conditioning , T2: Unconditioning

Body thermoregulation

Data presented in Table 7 showed some physiological aspects indicated physiological ability of body-thermoregulation of pre-mature BB and NZW rabbits. Housing rabbits in conditioning rabbitry significantly (P≤0.05) improved the ability of pre-mature BB and NZW rabbits to regulate their body thermoregulation represented in a decrease (P≤0.05) in temperatures of each of ear lobe, skin and rectal and rates of both respiration and pulse. Results clearly showed that, the ability of BB to body thermoregulation in both conditioning and unconditioning rabbitries were significantly (P≤0.05) better than those of NZW rabbits.

Rabbits use general body position, breathing rate and peripheral temperature, especially ears temperature, as three devices to modify heat loss. However, respiration and ear are the most important dissipation pathways. Marai and Habeeb (1994) .indicated that among 0 and 30 oC, latent heat evacuation is only controlled by altering the breathing rate.

Rabbits are very sensitive to heat stress since they have few functional sweat glands which means they have difficulties in eliminating excess body heat when the environmental temperature is high (Marai *et al*., 2002). The thermo-neutral zone in rabbits is around 18–21 °C (Habeeb *et al*., 1998). Exposing rabbits to elevated ambient temperature has been reported to cause disturbances in their thermoregulatory system (Marai and Habeeb, 1994; Marai *et al*., 2002). Such disturbances led to various impairments of their physiological mechanisms. Adult rabbits were better able to respond to hyperthermic conditions and to adapt themselves to conditions of decreased ventilation and evaporation, compared with young rabbits which responded more sensitively to elevate ambient temperature (Ayyat and Marai, 1997.

Table 7. Body thermoregulation of pre-mature NZW and BB rabbits as affected by rabbitry conditions (Means ± SE).

		Respiration rate (r.p.m.)	Pulse rate (p.p.m.)	Rectal temperature(C)	Skin temperature (C°)	Ear lobe temperature(C)
Breed	B1	91.2 ± 1.1 a	188.2 ± 2.9 a	38.4 ± 0.01 a	38.2 ± 0.01 a	32.3 ± 0.01 a
	B2	85.2 ± 1.2 b	183.3 ± 2.7 b	38.0 ± 0.01 b	37.8 ± 0.01 b	32.1 ± 0.01 b
Treatment	T1	86.1 ± 0.09 b	182.3 ± 1.8 b	38.1 ± 0.01 b	38.0 ± 0.01 b	32.1 ± 0.01 b
	T2	90.2 ± 1.07 a	189.2 ± 2.3 a	38.3 ± 0.01 a	38.0 ±0.00 a	32.4 ± 0.01 a
Breed x Treatment	B1xT1	89.2 ± 1.2 b	185.3 ± 2.4 b	38.3 ± 0.02 a	38.1 ± 0.02 a	32.2 ± 0.02 b
	B1xT2	93.1 ± 1.4 a	191.1 ± 2.7 a	38.4 ± 0.02 a	38.2 ± 0.02 a	32.4 ± 0.02 a
	B2xT1	83.0 ± 1.2 c	179.2 ± 2.4 c	37.9 ± 0.03 b	37.8 ± 0.02 b	31.9 ± 0.02 c
	B2xT2	87.3 ±1.2 b	187.3 ± 2.2 ab	38.1 ± 0.02 a	37.8± 0.01 b	32.3 ± 0.01 ab

Male fertilizing ability

Some parameters indicated fertilizing ability of pre-mature male rabbits such age and weight at first mating and relative weights of each of testes, epididymis, sexual accessory glands and pituitary are shown in Table 8. Such parameters were affected by breeds of rabbits and conditioning of rabbitry. Some parameters indicated pre-mature male fertilizing ability were significantly (P≤0.05) superior as recorded by BB and in conditioning rabbitry than those of NZW rabbits and in unconditioning rabbitry, respectively.

Daader *et al.* (1999) revealed that rabbit puberty delayed and age at first mating increased with increasing environmental temperature due to the decline of the body weight in heat-stressed rabbits. Such effect may be due to the negative effect of heat-stress on feed intake.

Data obtained revealed that, the improvement in growing and pre-mature rabbit performance were always (P≤0.05) better in BB and in conditioning rabbitry compared to those recorded by NZW rabbits and in unconditioning rabbitry, respectively.

Table 8. Age, body, gonads and pituitary gland weights, at first mating of pre-mature NZW and BB rabbit males as affected by rabbitry conditions (Means ± SE).

		Age at first mating (Days)	Live body weight at first mating (gm)	Relative testes weight (%)	Relative epididymis weight %	Relative sexual-accessory glands weight (%)	Relative pituitary gland weight(%)
Breed	B1	163.3 ± 8.9	2776.0 ± 56.3 b	0.183 ± 0.01 b	0.025 ± 0.00 b	0.098 ± 0.002 b	0.012 ± 0.00 b
	B2	171.9 ± 9.4	3101.3 ± 64.3 a	0.210 ± 0.01 a	0.029 ± 0.00 a	0.107 ± 0.004 a	0.013 ± 0.00 a
Treatment	T1	158.6 ± 7.9 b	2985.0 ± 66.3 a	0.212 ± 0.01 a	0.029 ± 0.00 a	0.107 ± 0.002 a	0.013 ± 0.00 a
	T2	176.6 ± 9.2 a	2892.3 ± 54.7 b	0.182 ± 0.01 b	0.024 ± 0.00 b	0.097 ± 0.002 b	0.012 ± 0.00 b
Breed x Treatment	B1xT1	154.7 ± 9.1c	2854.8 ± 54.3 b	0.192 ± 0.01 b	0.026± 0.001 bc	0.104 ± 0.003 b	0.012 ± 0.002 b
	B1xT2	171.9 ± 11.3 ab	2697.3 ± 68.2 c	0.174 ± 0.01 c	0.023± 0.001c	0.092 ± 0.007 c	0.011 ± 0.001 c
	B2xT1	162.4 ± 8.1 bc	3115.2 ± 62.9 a	0.231 ± 0.02 a	0.032± 0.001 a	0.112 ± 0.005 a	0.014 ± 0.002 a
	B2xT2	181.3 ± 10.2 a	3087.3 ± 71.3 ab	0.189 ± 0.01 bc	0.025± 0.001c	0.101 ± 0.006 b	0.012 ± 0.002 b

Means within the same column (a & b) bearing different letter superscripts are significantly different (P ≤ 0.05) B1: New-Zealand WhiteB2: Baladi Black T1: Conditioning T2: Unconditioning

II Second Experiment:

1- Reproductive traits

1.Fertilizing ability of bucks

Data presented in Table 9 represented fertilizing ability of NZW and BB rabbit bucks, as affected by conditioning rabbitry, where scrotal circumference, testicular index and mating activity were significantly (P≤0.05) better in BB and in conditioning rabbitry than those of NZW rabbits and in unconditioning rabbitry, respectively. El-Sheikh and Seleem (2015) reported that infertility and reproductive ability of male rabbits decreased during summer months due to the decrease in desire, and sexual desire decreased with increasing ambient temperature.

Data showed that, rabbits in conditioning rabbitry had significantly (P<0.05) increase in scrotal circumference , testicular index and mating activity of BB followed by NZW rabbit bucks, respectively. It is interested to note that, BB rabbit bucks are superior than NZW, in both conditioning and un conditioning rabbitries. These results indicated that, the bucks of imported rabbit breed and line (NZW) had lower fertilizing ability than the endogenous and native breeds (BB). The results are in agreement with obtained by (Ortiz and Rubio, 2001 and El-Sheikh and Seleem (2015).

Table 9. Scrotal circumference, testicular index and mating activity of NZW testosterone levels of bucks of NZW and BB rabbits (Means ± SE).

		Scrotal circumference (cm)	Testicular index (Cm3)	Mating activity (number of mating/ 20 minutes)
Breed	B1	7.25 ± 0.6 b	4.16 ± 0.3 b	4.07 ± 0.6 b
	B2	8.27 ± 0.9 a	4.85 ± 0.4 a	5.07 ± 0.6 a
Treatment	T1	8.31 ± 0.7 a	4.96 ± 0.4 a	6.88 ± 0.4 a
	T2	7.21 ± 0.4 b	4.05 ± 0.4 b	3.27 ± 0.3 b
Breed x Treatment	B1xT1	7.68 ±1.3 b	4.79 ± 0.7 ab	5.72 ± 0.5 a
	B1xT2	6.82 ± 0.9 c	3.52 ± 0.5 c	2.42 ± 0.4 c
	B2xT1	8.94 ±1.1 a	5.12 ± 0.7 a	6.03 ± 0.5 a
	B2xT2	7.59 ±1.0 b	4.57 ± 0.6 b	4.11 ± 0.6 b

2. Sexual hormones:

The effect of conditioning rabbitry, and breed used in the experiment on sexual hormones was so clear, where conditioning rabbitry caused significant (P≤0.05) increase in blood plasma oestradiol 17β and progesterone concentration of does and testosterone levels of bucks of mature BB and NZW rabbits, respectively (Table 10). El-Sheikh and Seleem (2015).

Baladi Black mature rabbits in conditioning and unconditioning rabbitries had (female and male) sexual hormones significantly (P<0.05) better than those of NZW rabbits in both rabbitries. Our results are in agreement with El-Sheikh and Seleem (2015). They reported that heat stress affects significantly seminal testosterone hormones. Also, they told that the hormonal levels decreased under hot conditions with compared to mild conditions.

Table 10. Blood plasma oestradiol 17 β and progesterone concentration of does and and BB rabbit bucks as affected by rabbitry conditions (Means ± SE).

		plasma oestradiol 17β (pg/ ml)	plasma progesterone (ng/ ml)	plasma testosterone (ng/ ml)
Breed	B1	7.31 ± 0.4 b	5.57 ± 0.4 b	4.18 ± 0.7 b
	B2	8.62 ± 0.7 a	6.13 ± 0.4 a	4.99 ± 0.6 a
Treatment	T1	8.93 ± 0.5 a	6.18 ± 0.4 a	5.44 ± 0.6 a
	T2	7.00 ± 0.4 b	5.52 ± 0.4 b	3.74 ± 0.5 b
Breed x Treatment	B1xT1	8.37 ± 0.5 b	6.01 ±0.4 ab	5.12 ± 0.8 b
	B1xT2	6.25 ± 0.6 d	5.12 ±0.4 c	3.24 ± 0.6 d
	B2xT1	9.48 ± 0.5 a	6.34 ± 0.5 a	5.75 ± 0.7 a
	B2xT2	7.75 ± 0.4 c	5.92 ± 0.5 b	4.23 ± 0.7 c

Means within the same column (a & b) bearing different letter superscripts are significantly different (P ≤ 0.05) B1: New-Zealand White B2: Baladi Black T1: Conditioning T2: Unconditioning

3. Natural mating:

Regarding fertility traits of BB and NZW rabbit does, Table 11 showed that, conception and kindling rates, litter size and bunny weight at birth and at weaning and pre-weaning mortality rates of BB rabbit does mated naturally, and in conditioning rabbitry were significantly (P ≤ 0.05) better than those recorded by NZW rabbits, and in un conditioning rabbitry, respectively.

Table 11 clearly showed that, fertility traits of rabbit does were significantly affected by breeds. Some parameters indicated fertility traits of rabbit does such percentages of each of conception and kindling and litter size and bunny weight at birth and at weaning, in addition to pre-weaning mortality rates were significantly better in BB; then NZW rabbit does, mated naturally or artificially inseminated. The observed variation in litter size at birth between breeds may reflect differences in ovarian activity in terms of follicular development, ovulation rate, uterine environment and pre - implantation viability . This may be also due to the maternal effects determined by the number of mature, fertilized and established ova (Rashwan *et al*., 1995). Also, Argente *et al*., (2003) reported that the significant differences in litter size at birth may be due to high uterine capacity or greater ovulation rate. The mean value of some physical semen characteristics are significantly affected by the breed.

However, the sperm traits of some genetic strains exposed to strict protocols of rearing (light, temperature, feed) and collection frequencies has shown lower variability within and between bucks (Viudes *et al*. 1997).Brun *et al*.,(2002) observed differences in semen characteristics for males from different genetic lines and from crossbred and purebred males.

These differences could be explained by differences in maternal genetic effects and the existence of heterosis for this trait (Garcia-Tomas *et al* (2006). From this experiment it can be concluded that breed had significant effect on ejaculate volume, individual motility, concentration and total number of spermatozoa per ejaculated. Breed effects were also found significant for ejaculate volume, individual motility, concentration and total number of spermatozoa per ejaculated.

Hulit *et al*., (1994) and Cobos *et al*., (1995) found no significant differences among the reproductive performance of different breeds if the animal reached the same final weight. Many researchers observed the effect of genetic makeup on sexual hormones of different breeds of rabbits (Chiericato *et al*., 1985 and Cazabon *et al*., 2000).

Table 11. Some reproductive traits of NZW and BB rabbit does mated naturally (Meas ± SE).

		Conception rate (%)	Kindling rate (%)	Litter size at birth.	Bunny weight at birth (gm).	Litter size at weaning.	Bunny weight at weaning (gm)	Pre-weaning mortality rate (%)
Breed	B1	73.3 b	72.7 b	7.28 ± 1.3 b	44.8 ± 3.9 b	6.28 ± 0.7 b	606.8 ± 44.2 b	14.08 ± 1.6 a
	B2	77.4 a	76.4 a	8.60 ± 1.4 a	49.8 ± 4.4 a	7.91 ± 0.9 a	662.5 ± 49.2 a	8.22 ± 0.8 b
Treatment	T1	78.3 a	77.6 a	8.96 ± 1.2 a	50.8 ± 4.1 a	8.18 ± 1.0 a	667.7 ± 46.3 a	8.90 ± 1.4 b
	T2	72.4 b	71.5 b	6.92 ± 1.1 b	43.7 ± 3.2 b	6.01 ± 1.1 b	601.6 ± 39.8 b	13.40 ± 1.2 a
Breed x Treatment	B1xT1	76.4 b	75.8 b	8.54 ± 1.8 ab	48.2 ± 5.1 b	7.51 ± 1.3 bc	621.1 ± 45.3 b	12.17 ± 1.3 ab
	B1xT2	70.1 c	69.6 c	6.01 ± 1.7 c	41.3 ± 4.2 c	5.05 ± 0.9 c	592.4 ± 46.1 b	15.98 ± 2.1 a
	B2xT1	80.1 a	79.4 a	9.37 ± 2.2 a	53.4 ± 4.7 a	8.84 ± 1.2 a	714.3 ± 42.8 a	5.63 ± 0.6 c
	B2xT2	74.7 b	73.3 b	7.82 ± 1.4 b	46.1 ± 3.9 b	6.97 ± 1.1 c	610.7 ± 36.8 b	10.81 ± 0.9 b

2. Semen quality and Artificial insemination

1.Libido and semen quality:

Concerning the effects of housing mature BB and NZW rabbit bucks in conditioning rabbitry on libido and physical semen quality are presented in Table 12. It can be noticed that libido and physical semen quality were significantly (P≤0.05) superior as recorded in BB than those of NZW rabbits, and in conditioning rabbitry than in un conditioning rabbitry, respectively.

This decline in semen ejaculate volume under heat stress of summer may be due to a low sperm concentration, a decrease in the volume of seminal plasma or to hypo activity of the accessory glands and the testes due to the adverse effect of high ambient temperature, particularly, accessory gland secretion and spermatogenesis are controlled by testosterone concentration which is low in the bucks exposed to summer heat stress in this study. Motility of rabbit spermatozoa was significantly reduced with increasing ambient temperature (43.2% in winter vs. 29.3% in summer) (Daader and Seleem 1999). The temporary sterility in buck rabbits may be due to high temperature. Temperatures above 18 o C and incidence of infertility in male rabbits were found to be significantly correlated Sammoggia, (1977). In addition, reproductive ability of male rabbits was found to be decrease during July, August and September due to the decrease in desire Nalbandov (1970).

The adverse effects of the heat stress conditions on spermatogenesis processes with a consequent decrease in the number of spermatozoa may be responsible on that depression in the previous male fertility factors. Dead sperm%, sperm abnormalities% and acrosomal abnormalities% values were high in the summer season as compared with other seasons of the year Ibrahim, (1994) and Finzi *et al.,* (1995).

The adverse effects of the heat stress conditions on spermatogenesis processes may be responsible on the increased of dead sperm, sperm abnormalities and acrosomal abnormalities percentages which are of great importance in male fertility of the rabbits. In addition, exposure male rabbits to high temperature had adverse effect on epididymal function which is under the control of testosterone that is affected negatively by heat stress. Moreover, the negative effect of heat stress on appetite which decreases feed consumption may be also involved in minimal spermatogenesis and produced low quality semen under hot conditions (Habeeb *et al.,*1992).

Table 12. Libido and physical semen characteristics of NZW and BB rabbit bucks as affected by rabbitry conditions (Means ± SE).

		Conception rate (%)	Kindling rate (%)	Litter size at birth	Bunny weight at birth (gm)	Litter size at weaning	Bunny weight at weaning (gm)	mortality rate (%)
Breed	B1	75.4 b	74.4 b	7.76 ± 0.8 b	43.4 ± 3.2 b	6.64 ± 0.5 b	598.3 ± 32.5 b	14.70 ± 0.8 a
	B2	80.4 a	79.7 a	8.82 ± 1.1 a	47.1 ± 3.9 a	7.79 ± 1.2 a	646.7 ± 38.4 a	11.85 ± 0.5 b
Treatment	T1	81.0a	80.3 a	9.22 ± 0.9 a	48.1 ± 3.2 a	8.14 ± 0.6 a	651.9± 34.2 a	11.65 ± 0.7 b
	T2	74.8 b	73.8 b	7.34 ± 0.7 b	42.3 ± 3.1 b	6.29 ± 0.6 b	593.1 ± 31.9 b	14.90 ± 1.1 a
Breed x Treatment	B1xT1	78.3 b	77.6 b	8.81 ± 1.2 ab	46.3 ± 4.8 b	7.69 ± 1.9 b	611.5 ±39.7 b	12.58 ± 1.0 b
	B1xT2	72.5 c	71.1 c	6.71 ± 1.4 c	40.4 ± 3.8 c	5.59 ± 1.4 d	585.1 ± 36.6 b	16.82 ± 2.1 a
	B2xT1	83.6 a	83.0 a	9.62 ± 1.3 a	49.9 ± 5.2 a	8.59 ± 1.7 a	692.3 ± 40.4 a	10.71 ± 1.3 c
	B2xT2	77.1 b	76.4 b	8.02 ± 1.7 b	44.2 ± 4.1 d	6.98 ± 1.3 b	601.1 ± 37.3 b	12.98 ± 0.6 b

2. Artificial insemination:

Data presented in Table 13 indicated fertility traits of mature BB and NZW rabbit does using artificial insemination. Housing rabbits in conditioning rabbitry significantly ($P\leq0.05$) improved the fertility traits of mature rabbits inseminated artificially, represented in each of conception and kindling rates, litter size and bunny weight at birth and at weaning and pre-weaning mortality rates. The improvement in fertility traits of rabbit does inseminated artificially, were significantly ($P\leq0.05$) higher in BB rabbit does and in conditioning rabbitry, than NZW does and un conditioning rabbitry, respectively.

The obtained results here showed that, genotype affected significantly ($P\leq0.005$) reproductive efficiencies of both rabbit bucks and does. Mature native BB rabbits showed significantly ($P\leq0.005$) higher values for almost fertilizing ability traits than imported ones (NWZ). These results may be due to the high adaptation of the native rabbits to the Egyptian environmental conditions as observed by Meshreky *et al*. (2005); and El-Sheikh *et al*., (2013).

El-Sheikh *et al*. (2013) reported that, rabbit reproductivity reflect animal's health and activities. So, native rabbit breeds may be characterized by more immunity and adaptability with local conditions.

Table 13. Some reproductive traits of NZW and BB rabbit does inseminated artificially (Means ± SE).

Libido and physical semen characteristics.		Libido (Sec.)	ejaculate volume (ml.)	Sperm-cell concentration (Nx106/ml)	Total-sperm output (Nx106/ejaculate)	Advanced motility (%)	Dead spermatozoa (%)	Abnormalities (%)	Acrosomal damages (%)
Breed	B1	43.2 ± 2.6 a	0.44 ± 0.02 b	384.1 ± 22.6	170.5 ± 22.2 b	53.8 ± 2.6	26.8 ± 1.9 a	23.8 ± 2.8 a	19.1 ± 1.8 a
	B2	40.2 ± 1.8 b	0.50 ± 0.03 a	435.0 ± 27.3 a	220.1 ± 19.3 a	58.5 ± 2.7 a	23.3 ± 1.4 b	20.9 ± 2.4 b	16.6 ± 1.5 b
Treatment	T1	38.4 ± 4.2 b	0.52 ± 0.03 a	490.2 ± 41.3 a	253.6 ± 21.6 a	61.6 ± 3.8 a	21.1 ± 2.1 b	18.0 ± 1.2 b	14.9 ± 1.2 b
	T2	45.0 ± 4.9 a	0.42 ± 0.03 b	328.9 ± 34.7 b	137.0 ± 23.8 b	50.8 ± 2.8 b	29.0 ± 2.2 a	26.7 ± 1.5 a	20.8 ± 2.4 a
Breed x Treatment	B1xT1	40.2 ± 3.8 c	0.48 ± 0.03 b	458.7 ± 39.4 b	220.2 ± 19.9 b	59.4 ± 3.9 b	22.2± 2.3 c	19.1 ± 2.2 c	15.9 ± 1.7 c
	B1xT2	46.2 ± 4.1 a	0.39 ± 0.02 c	309.5 ± 18.9 d	120.7 ± 18.3 c	48.2 ± 3.8 d	31.3 ± 3.2 a	28.5 ± 2.6 a	22.3 ± 2.2 a
	B2xT1	36.5 ± 3.5 c	0.55 ± 0.05 a	521.6 ± 42.3 a	286.9 ± 28.7 a	63.7 ± 4.5 a	19.9 ± 1.9 c	16.9 ± 1.8 c	13.8 ± 1.4 d
	B2xT2	43.8 ± 3.9 b	0.44 ± 0.04 bc	348.3 ± 21.8 c	153.3 ± 15.7 c	53.3 ± 3.9 c	26.7 ± 3.4 b	24.9 ± 3.1 b	19.3 ± 2.6 b

Economic efficiency:

Prices and costs assumed are shown in Table 14. The total costs were the sum of labour, utilities, administration costs , electricity costs, mortality costs, and feed cost; divided per rabbit. The only return considered was the income from selling fattening kits. Price of one kg pellets diet was 5.35 L.E. and kg of marketing live weight 35 L.E. Electrical cost were calculated monthly as shown in table 14. It were 530 LE and 101.5 LE for T1 and T2 , respectively. The utilities costs, which included water, phone, housing cost , medication cost , care and labour cost and depreciation cost of air conditioning. Air conditioning instrument cost was 6890 LE. and its depreciation rate was (82 LE / month) calculated for 84 month .

The economic efficiency values of T1 and T2 were 1.06 and 0.94, respectively and relative economic efficiency was 113 % for T1 compared with T2 . In our present study growing rabbits housed in conditioning rabbitry was highly significant in relative to economic efficiency than rabbits housed in unconditioning rabbitry in summer season.

Table 14. Economic efficiency of ZW and BB rabbits as affected by conditioning rabbitry:

arameter	T1	T2
Electricity used (K Watt)	1000	350
Electricity Cost (LE/rabbitry)	530	101.5
Electricity Cost (LE/Kg final body weight)	3.08	0.72
Mortality %	11.65b	14.90a
Mortality cost	4.08b	5.22a
Body weight gain at marketing (kg)	1.563.4a	1.279.3b
Price of growing rabbit / Kg meat (L.E)	35	35
Total feed intake at marketing (kg)	2.931a	2.649b
Cost of feed intake (L.E.)	15.68a	14.17b
Utilities costs L.E. / rabbit	3.75a	3.0b
Total cost (L.E.)	26.59a	23.11b
Price of body weight at marketing (L.E./rabbit)	54.72a	44.78b
Net revenue (L.E.)	28.13a	21.67b
Economic efficiency	1.06a	0.94b
Relative economical efficiency (%)	113a	100b

Cost of feed = (Total feed intake × Kg feed cost) **Utilities costs (L.E.) / litter = management costs .**
Total cost = (Total feed intake × Kg feed cost) + cost of managements **The Net revenue = Price body weight -Total cost price**
Economical efficiency =Net revenue / Total cost **Relative Economical efficiency (%) = (Net revenue/ Total cost) x 100**

CONCLUSION

It could be concluded that, conditioning rabbitry, during hot summer months displayed an essential role in enhancing growth performance and carcass traits, of growing rabbits, and improving some physiological, productive and reproductive aspects of pre-mature rabbits. Also, Baladi Black rabbits housed in conditioning rabbitry had better results and characterized by reproductive performance superior than NZW rabbits. Conditioning rabbitry of growing rabbits resulted in clear improvement of net revenue and relative economic efficiency as compared to the control group.

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تأثير السلاله وتكييف الهواء على الأداء الإنتاجي والتناسلي للأرانب خلال أشهر الصيف الحارة

ياسر كامل بدوي ، طارق عبد الغفار الأعصر

معهد بحوث الإنتاج الحيوانى، مركز البحوث الزراعية، الدقى، الجيزه، مصر.

أستخدم فى هذه الدراسة ٢٢٠ أرنب (١١٠ من كل من سلالة النيوزيلندى البيضاء، وسلالة البلدى الأسود). إشتملت الدراسة على تجربتين، تم تقسيم الأرانب فى كل تجربة إلى مجموعتين تجريبيتين، وتم إسكان المجموعة التجريبية الأولى والثانية فى مزرعة أرانب غير مكيفة ومكيفة الهواء، على الترتيب.التجربة الأولى :صممت التجربة الأولى لدراسة تأثير تكييف بيئة المزرعة على معدلات الأداء الإنتاجية للأرانب النامية، واستمرت التجربة ٣٥ يوم (من الفطام على عمر ٣٠ يوم وحتى عمر التسويق على ٦٥ يوم)، وقارنت التجربة أيضاً معدلات الأداء الإنتاجية للأرانب النامية من سلالة النيوزيلاندى البيضاء كسلالة أجنبية متأقلمة مع الظروف المصرية، مع معدلات أداء ارانب البلدى الأسود كسلالة محلية. واستخدم فى هذه التجربة ١٦٠ أرنب مفطوم حديثاً (٤٠ من كل من سلالة النيوزيلندى البيضاء، والبلدى الأسود، فى كل مجموعة من المجموعتين التجريبيتين). بينما أستخدم فى التجربة الثانية عدد ٦٠ من ذكور الأرانب البالغة (قبل عمر النضج الجنسى، ١٥ من كل من سلالة النيوزيلندى البيضاء، وسلالة البلدى الأسود، فى كل مجموعة من المجموعتين التجريبيتين)، أستهدفت التجربة تقييم قيم كل من بعض مكونات الدم، ومقدرة الجسم على تنظيم درجة حرارته، العمر والوزن عند أول تلقيحه، بالإضافة إلى بعض المقاييس الدالة على المقدرة الإخصابية لذكور سلالتى أرانب النيوزيلندى البيضاء والبلدى الأسود البالغة تحت ظروف الإسكان فى العنبر المكيف أو الغير مكيف، وقد إستمرت التجربة فترة ٣ أشهر. أوضحت النتائج أن قيم كل من زيادة وزن الجسم اليومية، كمية الغذاء اليومى المأكول، كفاءة الغذاء ومعدل تحويله، ووزن الجسم فى نهاية فترة تسمين الأرانب النامية كانت أفضل معنويا عند مستوى ٥% والمسجلة لأرانب النيوزيلندي البيضاء ، والعنبر المكيف عن تلك المسجله للأرانب البلدى الأسود ، والعنبر الغير مكيف، على الترتيب.كانت قيم كل من نسبة التصافى، وزن الذبيحة، والوزن النسبى للأعضاء الداخلية، بالإضافة إلى صورة الدم للأرانب النامية أعلى معنوياً (عند مستوى ٥%) فى العنبر المكيف والمسجلة لسلالة أرانب النيوزيلندى البيضاء ، مقارنة عن تلك المسجلة فى العنبر الغير مكيف، ولسلالة البلدى الأسود ، على الترتيب.أدى تكييف عنبر الأرانب إلى تحسين معنوى (عند مستوى ٥%) فى قيم كل من البروتين الكلى ومفرداته، بعض الإنزيمات الدالة على نشاط الكبد، بعض المقاييس الفسيولوجية الدالة على مقدرة الجسم غلى تنظيم درجة حرارته، بالإضافة إلى عمر ووزن كل من الجسم والغدة النخامية وبعض الأنسجة الجنسية الداخلية عند أول تلقيحة للأرانب البالغة، وكانت تلك المقاييس المسجلة بواسطة سلالة أرانب النيوزيلندى البيضاء أفضل معنوياً (عند مستوى ٥%) عن تلك المسجله بواسطة أرانب البلدى الأسود. كانت معدلات التحسن فى كل الصفات المدروسه فى معدلات أداء أرانب النيوزيلندى البيضاء النامية والبالغة وفى العنبر المكيف دائماً أفضل معنوياً (عند مستوى ٥%) عن تلك المسجلة لسلالة أرانب البلدى الأسود ، والعنبر الغير مكيف، على الترتيب. وقد تم عمل دراسة للكفاءة الإقتصادية لإستخدام التكييف في عنابر الأرانب فاوضحت النتائج أن تكييف العنابر أدى إلى تحسن ملحوظ في الكفاءة الإقتصادية لإنتاج الأرانب .التجربة الثانية :الهدف من البحث هو دراسة تأثير تكييف بيئة عنبر الأرانب الداخلى على مقدرة الذكور الإخصابية، ومعدلات خصوبة إناث سلالتين من الأرانب (النيوزيلندى البيضاء كسلاله أجنبية متأقلمة مع الظروف المصرية، والبلدى الأسود كسلالة محلية).أستخدم فى هذه الدراسة ٢٢٠ أرنب ناضج جنسياً (٩٠ أنثى، و٢٠ ذكر من كل من سلالة النيوزيلندى البيضاء، وسلالة البلدى الأسود). إستمرت الدراسة خمسة أشهر، وإشتملت الدراسة على تجربتين. وقسمت الأرانب فى كل تجربة إلى مجموعتين تجريبيتين، المجموعة الأولى تم إسكانها فى عنبر أرانب مكيف، والمجموعة الثانية فى عنبر غير مكيف.صممت التجربة الأولى لدراسة تأثير تكييف بيئة الداخلية لعنبر الأرانب على بعض المقاييس الدالة على المقدرة الإخصابية للذكور، مستوى الهرمونات الجنسية الذكرية والأنثوية، ومعدلات خصوبة الإناث الملقحة طبيعياً، فى كلا السلالتين. واستخدم فى هذه التجربة ٣٠ أنثى و ٥ ذكور من كل من سلالة النيوزيلندى البيضاء، والبلدى الأسود، فى كل مجموعة من المجموعتين التجريبيتين. بينما أستخدم فى التجربة الثانية عدد 15 أنثى و ٣ ذكور من كل من سلالة النيوزيلندى البيضاء، وسلالة البلدى الأسود، فى كل مجموعة من المجموعتين التجريبيتين، صممت التجربة لتقييم الرغبة الجنسية، جودة السائل المنوى للذكور، ومعدلات خصوبة الإناث الملقحة إصطناعياً فى كلا السلالتين.أوضحت النتائج أن بعض المقاييس الدالة على المقدرة الإخصابية للذكور متمثلة فى محيط كيس الصفن، الدليل الخصوى، والنشاط التزاوجى، وأيضاً مستويات الهرمونات الجنسية الذكرية والأنثوية (الإستراديول، والبروجسترون، والتستسترون) كانت أفضل معنويا (عند مستوى ٥%) والمسجلة لأرانب البلدى الأسود، والعنبر المكيف عن تلك المسجلة لأرانب النيوزيلندى البيضاء، والعنبر الغير مكيف، على الترتيب.سجلت أرانب البلدى الأسود رغبة جنسية وجودة سائل منوى طبيعية، معدلات حمل وولادات و عدد خلفات ووزن المولود عند الميلاد وعند الفطام، ومعدلات نفوق قبل الفطام أفضل معنوياً (عند مستوى ٥%) عن تلك المسجلة بواسطة سلالة الأرانب النيوزيلندى البيضاء، فى كلتا حالتى التزاوج الطبيعى والتلقيح الإصطناعى. تحسنت الرغبة الجنسية وجودة السائل المنوى الطبيعية للذكور، ومعدلات خصوبة الإناث الناتجة عن التزاوج الطبيعى أو التلقيح الإصطناعى معنوياً (عند مستوى ٥%) بتكييف عنبر الأرانب، فى كلا السلالتين .من هذه الدراسة يمكن إستنتاج أن تكييف عنبر الأرانب خلال أشهر الصيف الحارة أدى إلى تحسين معدلات أداء النمو، وصفات الذبيحة، خلال فترة النمو والتسمين، وكذلك أدى إلى تحسين كل من وظائف الكبد، مقدرة الجسم على تنظيم درجة حرارته، العمر والوزن عند أول تلقيحه، ووزن الغدة النخامية والأنسجة الجنسية الداخلية للأرانب البالغة وقبل غمر النضج الجنسى. كما تحسنت المقدرة الإخصابية للذكور، ومعدلات خصوبة الإناث. تميزت أرانب البلدى الأسود بمعدلات أداء تناسلى متفوقة عن سلالة أرانب النيوزيلندى البيضاء. وهذا ربما يفسر أن أن سلالة أرانب البلدى الأسود أكثر تأقلماً وأفضل في معدلات الأداء التناسلي مع الظروف البيئية المصرية عن سلالة أرانب النيوزيلندى البيضاء. هذا بالإضافة لحدوث تحسن ملحوظ في الكفاءة الإقتصادية لإنتاج الأرانب .