EFFECT OF GENOTYPE AND NATURAL OR ARTIFICIAL INSEMINATION ON INDIGENOUS AND ADDAPTED RABBIT PERFORMANCE

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Abstract

A total number of 412 mature rabbits of three breeds and a line were used in this study. The experiment was designed to evaluate fertilizing ability and fertility traits using natural mating and artificial insemination. Rabbit does of each breed were divided into two comparable groups (44 in each), does of the first group of each breed were naturally mated to bucks of the same breed, the second group were divided into four sub groups (11 each) and inseminated artificially by using semen of the same breed and three other breeds (cross breeding).Results showed that, fertilizing ability of rabbit bucks such as scrotal circumference; testicular index and mating activity, libido and physical semen characteristics were significantly (P≤0.05) and in descending order as recorded by BB; Gabali; V-Line then NZW rabbit bucks. The highest values of blood plasma oestradiol 17β and progesterone were obtained from V-Line followed by BB; Gabali then NZW rabbit bucks. Whereas, BB rabbit bucks recorded the highest (P≤0.05) values of blood plasma testosterone than those of Gabali; V-Line then NZW ones. Fertility traits of rabbit does were significantly (P≤0.05) affected by breeds. Fertility traits of rabbit pure breeds does such as ovulation %; conception, kidling, litter size and bunny weight at birth and weaning, pre-weaning mortality rates were significantly (P≤0.05) better for V-Line; BB; Gabali and NZW rabbit does than those obtained by cross breeds in all parameters.

Key words: rabbit genotype, reproduction, Fertilizing abilities, semen characterestics

INTRODUCTION

The domestic rabbits have been recommended as a good alternative source of animal protein for the increasing human population in developing countries like. Rabbit meat contains a high amount of protein and low amounts of fat and cholesterol (Lebas *et al.*, 1986 and Das and Bujarbarua, 2005), a relatively high content of polyunsaturated fatty acids (Ouhayoun, 1992). Rabbits are highly dressing percentage compared to ruminants, ranging between 50 - 65% (Lebas *et al.*, 1986 and Roiron *et al*., 1992). Genetics is one of the most important factors of high impact on rabbit carcass and meat quality (Moura *et al*., 2001). Feed efficiency is one of the most commercially important traits because post-weaning feeding accounts for around 70% of total cost (Armero and Blasco, 1992). According to the FAO (2001), backyard rabbit keeping provides additional income and supplies additional protein for poor rural and urban households with low investment and labor inputs. Oyegunle *et al*. (2015) concluded that the performance of Local and New Zealand White breeds of rabbit was better when compared to other genotypes in the pure rabbit genetic group. The LAB and NZW breeds of rabbit should be considered for improved breeding, crosses between these breeds and with other rabbit breeds will improve production efficiency of rabbit breeds with less production efficiency. Therefore, the two genotypes could be considered as choice genotypes for improvement of growth of rabbits. The improvement and sustainability of rabbit production will depend on how best selection is made as regards choice of genotypes and how well the breeding program is planned. This work aimed to draw a comparative study on reproductive performance between indigenous versus

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acclimatized rabbits under Egyptian environmental conditions.

MATERIAL AND METHODS

The present work was carried out in an Industrial Rabbitry, El-Nobariah area, El-Beherah Province, Egypt. A total number of 412 mature rabbits of three breeds and a line (88 mono porous does and 15 mature bucks at 7 months of age) of New-Zealand White "NZW"; V. Line; Baladi Black "BB" and Gabali breeds) were used. Rabbit does of each breed were divided into two comparable groups (44 each), does of the first group of each breed were naturally mated to bucks of the same breed (pure breeding), while those of the second group were sub-divided into another four sub groups (11 each) and inseminated artificially by using semen of the same breed and three other breeds (cross breeding).

Fertilizing abilities of different breeds of rabbit bucks represented by (scrotal circumference; testicular index; mating activity (number of mating within 20 minutes); libido and physical semen quality) were estimated. Reproductive traits of rabbit does represented by (ovulation; conception and kindling rates; litter size at birth and at weaning; bunny weight at birth and at weaning and pre weaning mortality rates) were recorded. This experiment also evaluated the sexual hormones of rabbit bucks and does.

Semen was collected artificially by means of an artificial vagina as described by Salisbury *et al*. (1978) and Seleem (1996 and 2003). Semen samples ejaculated from each buck were evaluated individually microscopically and the ejaculates showed advanced sperm motility 70% or more were pooled of the same breed to use in artificial insemination. The rabbit does were divided into four comparable groups (11 in each). Rabbit does in each group within each breed were inseminated artificially using rabbit semen of the same breed; reciprocal breed or semen of the other breeds to make sixteen artificially inseminating groups.

Libido (sexual desire) was assessed in terms of reaction time in seconds that was estimated just from the time of introducing doe to the buck until the buck start to mount (Seleem *et al*., 2008). Semen was collected artificially twice a week for up to three weeks and then semen ejaculate volume (ml); sperm-cell concentration (N x 106/ ml); total -sperm output (N x 106/ejaculate); advanced sperm motility (%); dead spermatozoa (%) and sperm abnormalities (%) were estimated according to Salisbury *et al*. (1978) and Seleem (2003). Acrosomal damage was determined by using a Giemsa stain procedure as described by Watson (1975).

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. The artificial insemination was carried out as described by Adams (1981) and Daader *et al*. (2002).

Palpation of all rabbit does was carried out 10 days post mating to determine pregnancy. Three rabbit does were randomly chosen from each group 14 hours after inseminated artificially or mated naturally and scarified to record ovulation rate according to the following equation:-

Ovulation rate (%) = (No. of ovulated follicles / Total No. of follicles) *100

Hematological and biochemical traits: Blood samples were taken in less than two minutes from the marginal ear vein of four of each rabbit bucks and does within each experimental group at 12 hours after AI or natural mating. Blood samples were collected into heparinized clean centrifuge tubes. Blood plasma was separated by centrifugation at 3000 r.p.m. for 20 minutes and kept in a deep freezer at (-20°C) until biochemical analysis. Blood plasma testosterone hormone concentration of the bucks was determined (RIA Kits from Immunotech).

Animals were fed *ad libitum* a commercial diet which was covering the nutritional requirements of the growing and mature phase of rabbits according to NRC (1994) recommendations. All animals were kept under the same managerial and hygienic conditions and were raised in wired batteries with natural ventilation. Fresh tab water was automatically available all the time by stainless steel nipples in each cage.

Statistical analyses: Data were subjected to analysis of variance according to Snedecor and Cochran (1982) using the General Linear Model Program of SAS (2001). Percentage values were transformed to Arc. Sin values before being statistically analyzed. Duncan's

new multiple range tests was used to test the significance of the differences between means (Duncan, 1955). Conception and kindling rates were analyzed using the Contingency Tables according to Everitt (1977). Data were analyzed using the following linear model:

$$Yij = \mu + Bi + eij$$

Where: Yij= observation on ith breed, μ = overall mean; Bi = effect of ith genetic group (i= 1 to 4) and eij = random error.

Percentage values were transformed to Arc- Sin values to approximate normal distribution before being statistically analyzed.

RESULTS AND DISSCUION

Fertilizing ability of bucks: Least squares means and standard errors for scrotal circumference, testicular index and mating activity of four genotypes are summarized in Table (1). The differences among the genotypes were significant (P<0.05). A best (P<0.05) scrotal circumference, testicular index and mating activity were obtained by BB rabbit bucks, compared with the lowest (P<0.05) observations for the exotic NZW breed. Comparing between the two other breeds (Gabali and V-Line), the native Gabali rabbit bucks scored a significant (P<0.05) higher scrotal circumference, testicular index and mating activity than those of imported V-Line rabbits.

Data presented in Table (2) showed that, libido and physical semen characteristics represented in semen-ejaculate volume, sperm-cell concentration per ml and per ejaculate, advanced-sperm motility, dead and abnormal spermatozoa and acrosomal damages were significantly (P≤0.05) and in descending order as recorded by BB; Gabali; V-Line then NZW rabbit bucks, respectively.

Sexual hormones: The highest (P≤0.05) values of blood plasma oestradiol 17β and progesterone were obtained from V-Line followed by BB; Gabali then NZW rabbit does, respectively. Whereas, BB rabbit bucks recorded the highest (P≤0.05) values of blood plasma testosterone than those of Gabali; V-Line then NZW ones, respectively, Table (3).

Fertility traits of does: Tables (4 and 5) clearly showed that, fertility traits of rabbit does were significantly (P≤0.05) affected by breeds. Some parameters indicated fertility traits of rabbit does such percentages of each of ovulation; conception and kindling and litter size and bunny weight at birth and at weaning, in addition to pre-weaning mortality rates were significantly (P≤0.05) better as recorded by V-Line; BB; Gabali then NZW rabbit does, mated naturally or artificially inseminated. Pure breeding recorded the best fertility traits (P≤0.05) than those obtained by cross breeding in all parameters and breeds studied.

Large rabbit breeds significantly gained more than the smaller breeds (Reddy *et al*., 1977; Lebas *et al*., 1986 and Anous, 1999). These results indicated that, the bucks of imported rabbit breed and line (NZW and V-Line) had lower fertilizing ability than the endogenous and native breeds (BB and Gabali).

The results are in agreement with obtained by (Lebas *et al*., 1986 and Ortiz and Rubio, 2001). Contrary, as stated by (Rao *et al*., 1978 and Parigi-Bini *et al*., 1992) who found that, the differences among groups become smaller in lower body weight categories. Also, 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). The obtained results here showed that, genotype affected significantly (P≤0.005) reproductive efficiencies of both rabbit bucks and does. Mature native Gabali and BB rabbits showed significantly (P≤0.005) higher values for almost fertilizing ability traits than both imported ones (NWZ and V-Line). 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); Mona Ghaly *et al*. (2011) and El-Sheikh *et al*., (2013).

Between the native breeds, BB breed exhibits a significant (P≤0.005) higher value of some parameters indicated fertilizing ability compared with the Gabali rabbits. Within exotic breeds, also the V-line scored significantly (P<0.05) higher bucks reproductivity than NWZ rabbits. The same trends were also observed for the fertility

traits of does. These results are comparable with those recorded by Mona Ghaly *et al*., (2011) and El-Sheikh *et al*., (2013).

This finding suggested that reproductive capabilities may be higher in native rabbits and such results may give evidence that native breeds are more adapted with Egyptian environmental conditions (Meshreky *et al*., 2005; Mona Ghaly *et al*., 2011 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. Regarding results of fertility traits of V-Line rabbit does, it is interested to notice that, that line is considered maternal line.

Table 1 Effect of genotype on Scrotal circumference, testicular index and mating activity (Means ± SE)

Items	Rabbit breeds			
	NZW	V. Line	BB	Gabali
Scrotal circumference (cm)	5.59± 0.8 c	6.57± 0.7 b	7.98 ±1.1 a	7.64±1.2 a
Testicular index (Cm3)	3.52 ± 0.5 c	4.57 ± 0.6 b	5.12 ± 0.7 a	4.97 ± 0.7 b
Mating activity (number of mating/ 20 minutes)	2.42 ± 0.4 d	4.11 ± 0.6 c	6.03 ± 0.5 a	5.49 ± 0.5 b

Means within the same row (a, b, c & d) bearing different letter superscripts are significantly different (P≤0.05)

Table 2 Effect of genotype on Libido and physical semen characteristics of (Means ± SE)

Libido and physical semen characteristics.	Breeds of rabbit bucks			
	NZW	V. Line	BB	Gabali
Libido-Sexual desire - (Sec)	44.8 ± 3.9 ab	42.2 ± 4.1 a	33.5 ± 3.5 c	40.2 ± 3.8b
Semen-ejaculate volume (ml).	0.44 ± 0.04 b	0.48 ± 0.05 c	0.55 ± 0.04a	0.52 ± 0.04 a
Sperm-cell concentration (Nx106/ml)	311.2 ± 15.8 b	349.5 ± 16.9 c	394.6± 21.3 a	378.3 ± 19.6a
Total-sperm output (Nx106/ejaculate)	136.9 ± 12.2 b	167.8± 12.9 c	217.3 ± 17.2a	196.7 ± 15.6a
Advanced-sperm motility (%)	53.3 ± 3.9 bc	54.2 ± 3.8c	63.7 ± 4.5a	59.4± 3.9 b
Dead spermatozoa (%)	26.7 ± 3.4 b	24.3 ± 3.2 a	19.9 ± 1.9 d	22.2± 2.3 c
Sperm abnormalities (%)	22.4 ± 3.1bc	21.9 ± 2.6 a	16.9 ± 1.8 d	19.1 ± 2.2 c
Acrosomal damages (%)	19.3 ± 2.6ab	17.1 ± 2.2 a	13.8 ± 1.4c	15.9 ± 1.7 bc

Means within the same row (a, b, c & d) bearing different letter superscripts are significantly different (P≤0.05)

Table 3 Effect of genotype on Blood plasma hormones

Items	Rabbit breeds			
	NZW	V. Line	BB	Gabali
Blood plasma oestradiol 17β (pg/ ml)	6.75 ±0.4 d	9.37 ±0.5 a	8.48 ±0.5 b	7.25 ±0.6 c
Blood plasma progesterone (ng/ ml)	5.45 ±0.4 c	6.34 ±0.5 a	6.12 ±0.4 a	5.92 ±0.5 b
Blood plasma testosterone (ng/ ml)	3.24 ± 0.6 c	4.23 ± 0.7 b	5.72 ± 0.8 a	5.15 ± 0.7 a

Means within the same row (a, b, c & d) bearing different letter superscripts are significantly different (P≤0.05)

Table 4 Effect of rabbit does mated naturally using pure breeding (Means ± SE)

Items	Rabbit breeds			
	NZW	V. Line	BB	Gabali
Ovulation rate (%)	80.2 ± 3.7 b	87.1 ± 4.2 a	83.9 ± 3.9 ab	85.0 ± 4.3 a
Conception rate (%).	76.4 b	80.1 a	81.2 a	80.7 a
Kindling rate (%).	75.8 b	80.8 a	81.2 a	80.7 a
Litter size at birth.	8.74 ± 1.8 a	9.18 ± 2.2 a	7.27 ± 1.7 ab	6.81 ± 1.4 b
Bunny weight at birth (gm).	45.7 ± 5.1 b	51.2 ± 4.7 a	53.0 ± 4.1 a	52.6 ± 4.7 a
Litter size at weaning.	7.68 ± 1.3 a	8.87 ± 1.2 a	6.82 ± 0.7 b	6.64 ± 0.9 b
Pre-weaning mortality rate (%)	12.13 ± 2.1 a	3.38 ± 0.6 c	6.19 ± 1.3 b	2.50 ± 0.6 d
Bunny weight at weaning (gm).	691.1 ± 45.3 bc	742.3 ± 42.8 a	6.85.4 ± 46.1 c	610.7 ± 36.8 d

Means within the same row (a, b, c & d) bearing different letter superscripts are significantly different (P≤0.05)

Table 5 Effect of rabbit does inseminated artificially using pure breeding and cross breeding (Means ± SE)

Items	Breeds of semen source	Breeds of rabbit does			
		NZW	V. Line	BB	Gabali
Kindling rate (%)	NZW	80.1	78.2	75.3	74.7
	V.Line	74.6	85.2	80.1	79.6
	BB	77.0	81.9	83.0	81.6
	Gabali	79.1	83.1	82.7	84.2
Average		77.7 c	82.1 a	80.3 b	80.0 b
Litter size at birth	NZW	8.83 ± 2.4	8.88 ± 2.3	7.86 ± 2.1	7.71 ± 1.4
	V.Line	7.85 ± 1.9	9.71 ± 2.7	7.91 ± 1.7	7.11 ± 1.7
	BB	8.12 ± 2.5	9.06 ± 2.5	8.72 ± 2.2	7.24 ± 1.2
	Gabali	6.99 ± 1.6	9.01 ± 2.4	7.93 ± 1.5	8.47 ± 1.8
Average		7.95 ±1.3 bc	9.17 ± 1.6 a	8.11± 1.4 b	7.63 ± c
Bunny weight at birth (gm)	NZW	44.2 ± 4.6	48.6 ± 4.8	46.3 ± 4.3	46.0 ± 4.1
	V.Line	46.8 ± 4.9	50.9 ± 4.7	49.7 ± 4.9	49.4 ± 4.4
	BB	43.6 ± 4.7	49.2 ± 5.2	51.6 ± 4.8	49.6 ± 5.1
	Gabali	42.5 ± 4.2	48.7 ± 4.6	49.9 ± 5.1	49.2 ± 4.4
Average		44.3 ± 3.5 b	49.4 ± 4.1 a	49.4 ± 3.9 a	48.6 ± 3.8 a
Litter weight at birth (gm)	NZW	390.3± 33.1	431.6±34.5	363.9±27.4	354.7±30.2
	V.Line	367.4± 29.6	494.2±36.3	393.1±31.2	351.2±28.9
	BB	354.1± 29.7	445.8±32.7	450.0±30.9	359.1±29.2
	Gabali	297.1±24.3	438.8±28.4	395.7±33.7	416.7±31.9
Average		352.2±18.6c	452.6±20.7a	400.7±19.2b	370.4±19.5c
Pre-weaning mortality rate (%)	NZW	11.69 ± 2.2	6.16 ± 1.7	8.12 ± 1.6	6.12 ± 1.8
	V.Line	8.14 ± 1.8	3.71 ± 1.3	6.52 ± 1.7	3.81 ± 0.9
	BB	9.12 ± 2.1	5.12 ± 1.1	6.87 ± 1.4	4.11 ± 1.4
	Gabali	7.92 ± 1.4	4.73 ± 1.4	4.12 ± 1.1	2.92 ± 0.8
Average		9.22 ± 1.7 a	4.93 ± 1.2 c	6.41 ± 1.4 b	4.24 ± 1.1 c

Means within the same row (a, b & c) bearing different letter superscripts are significantly different (P≤0.05)

CONCLUSION

The differences among the genotypes for some parameters indicated fertilizing ability of bucks and fertility traits of does were significant (P≤0.005). Endogenous BB rabbit bucks scored the highest (P≤0.005) fertilizing ability, whereas, imported V-Line rabbit does recorded the best (P≤0.005) values indicated fertility traits. Results refer to a significant superiority of pure breeding than cross breeding in reproductive capabilities.

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