

EVALUATION OF SEMEN QUALITY AND ITS RELATION TO MATING SYSTEM FOR SOME BREEDS OF RABBITS UNDER ENVIRONMENTAL CONDITIONS IN THE MIDDLE OF EGYPT

By

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Abstract: *This study was carried out to study the relationship between the semen quality and mating systems (natural mating and artificial insemination) of four breeds of rabbits (Californian (Cal), New Zealand White (NZW), Sinai (Sin) and Balady (Bal)). A total number of twenty bucks (5/breed) was used. Two hundred ejaculates were collected from all bucks (50/breed) during a period of ten weeks by means of an artificial vagina. Reaction time, physical and biochemical semen characteristics during the experimental were studied. The results showed that, reaction time in Bal and Sin was faster than that of Cal, and NZW. Regarding the physical characteristics, they were higher in NZW rabbits compared with Cal, Bal and Sin rabbits. Nevertheless, semen pH was higher in Cal rabbits. Sperm concentration /ml of Bal and Sin rabbits were higher than both of NZW and Cal rabbits, but live sperm (%) was higher in NZW and Cal. Effect of breed on semen characters was highly significant at $p < 0.01$. The different pictures of sperm abnormalities as affected by breed were highly significant at $p < 0.01$. Total sperm abnormalities were higher in Sin and Bal rabbits than in both of Cal and NZW rabbits. It was interesting to note from this study that all the semen biochemical characters were higher in Bal and Sin when compared with Cal and/or NZW rabbits.*

Effects of artificial insemination (AI) and natural mating (Na) on some productive and reproductive parameters were studied. One hundred and twenty females were used in AI [30 (Cal), 30 (NZW), 30 (Sin) and 30 (Bal)] as well as for Na. Number of services per conception (NSC), number of mated does (NM), number of pregnant does (NP), gestation period (GP), litter size at birth (LSB) and at weaning (LSW) were recorded. Fertility rate (FR) and mortality rate (MR) were calculated. There were no significant effects of breed on GP and (LSB). Sin and Bal had the lowest MR under natural mating (Na). Using AI decreased FR, decreased LSB, LSW and MR.

Key Words: *Rabbit; Physical Semen Characters, Chemical Semen Characters, Natural Mating, Artificial Insemination.*

INTRODUCTION

The domestic rabbit has been associated with man, for many centuries, as a source of food and fur, in addition to its benefit as an experimental subject in research. In commercial rabbit farms, Artificial Insemination (AI) is widely

employed and this diffusion has contributed to the increase in knowledge of spermatozoa metabolism and management of rabbit bucks. Many factors affect seminal traits (Boiti *et al.*, 2005) and thus it is crucial to define suitable protocols to

improve spermatozoa characteristics (Brun *et al.*, 2002 a&b). Hence, it is possible to produce more doses of semen with higher “expected” fertility and with less variability. Semen is a mixture of spermatozoa produced by testicles and seminal plasma secreted at different sites by accessories glands and by the epididymus, which are combined at the time of ejaculation. Seminal plasma also contains other particles of different size which affect the spermatozoa behavior during the transit along the female reproductive tract (Cesare Castellini, 2008). Quinteiro *et al.* (2007) declared that developed a composite index using a multivariate regression approach by entering several parameters of rabbit semen (motility, sperm abnormalities and altered acrosomes). Which better predicts the fertilizing ability and the prolificacy of semen samples. However, variation in the seminal characteristics is known to be affected by many factors (genetic strain, feeding, health status, rearing condition, season, age and collection frequency), thus contributing to the large variability in semen traits (Alvariño, 2000).

The evaluation of the reproductive capacity of the buck should be considered as a desirable practice among breeders. The semen quality characteristics represents the own potential of the male; it reflects the functional activity of the testicle. All the well-known methods that are used for the confirmation of the quality of the sperm are valued for the symptoms of the essential processes of the spermatozoa, morphological characteristics and chemical composition. The results of this information secure the supposition of the quality and the fertility of the semen. The reaction time was 14.40 seconds for mature well trained NZW (El-Sherbiny, 1987) while El-Ashry *et al.* (1995) found that in Cal rabbit, overall mean of reaction time was 43.20 seconds. Abd-El-Hakeam *et al.*, 1992 reported a significant difference in semen volume between NZW (0.58 ml) and Cal (0.47 ml)

bucks. Semen colour was white in NZW and Cal rabbits (Abd-El-Ghaffar, 1992 and El-Ashry *et al.*, 1995). The density values were 2.4 in NZW.(El- Sherbiny, 1987) and 1.4 in Cal rabbit (El- Ashry *et al.*,1995). Abd-El-Hakeam *et al.* (1992) reported a significant difference in semen pH (7.89) and (7.59), in the sperm motility (60.27 %) and (66.22 %) between NZW and Cal. El- Sheikh (1991) found that, the percentage of dead sperm was 21.85% and 23.75% in Cal and NZW ,respectively. Abd-El-Hakeam *et al.* (1992) reported a non-significant difference in packed sperm volume (%) between NZW (8.86 %) and Cal (9.09 %) bucks. Abd-El-Ghaffar (1992) found a non significant difference between NZW and Cal in sperm cell concentration/ml ($355.41 \times 10^6/\text{ml}$) and ($349.06 \times 10^6/\text{ml}$), percentage of primary abnormalities (8.79 %) and (9.15%), in percentage of secondary abnormalities (8.13 %) and (8.39 %), in percentage of sperm cell abnormalities (17.81 %) and (18.59 %), in the seminal fructose (169.07 mg%) and (171.50 mg%), in the seminal total cholesterol (191.07 mg%) and (193.75 mg%),in the seminal total phospholipids (52.81 mg%) and (54.52 mg%) respectively. El-Sherbiny (1987) found that seminal plasma total calcium concentration (mg/100ml plasma) was 5.5 mg% in NZW rabbits. Del Nino Jesus *et al.* (1997) found that in Cal rabbits mean calcium was 206 p.p.m.

Artificial insemination (AI) when applied to the rabbit has been used for experimental purpose for more than 50 years. An improvement in reproductive performance through AI is only possible with very careful attention to hygiene, proper apparatus and to the execution of the insemination itself (Abd El-Ghaffar, 1992). Artificial insemination of rabbits is potentially a very valuable tool for rabbit producers. Among other reasons, it allows for a dramatic reduction in the number of males needed in the breeding herd. It has been estimated that in a large commercial herd only one buck per 500 does would be

needed to maintain normal reproduction schedules (Sinkovics, *et al.* 1983).

The most important factors which could affect the results is study the semen quality and it was very important to improve fertility rate and develop a reproductive performance (Castellini and Lattaioli, 1999). Gogol (1997) found in NZW rabbits that average FR was 80.53%. But Lavara *et al.* (2000) reported that, the average FR was 66%. However, Khalifa *et al.* (2000) did not find any significant differences in FR between NZW and Cal breeds. Khalifa *et al.* (2000) and Lavara *et al.* (2000) did not find any significant differences in NSC between NZW and Cal breeds. Abd El-Ghaffar (1992) and El-Kelawy (1997) did not find any significant differences in GP between NZW (31.2 d.) and Cal (31.5 d.) breeds. Therefore, this study was conducted to evaluate of semen quality in relation to mating system among several rabbit breeds under middle egypt environmental conditions

MATERIALS AND METHODS

This work was carried out during the period from February to May 2009. The environmental conditions in cage were presented in Table 1.

This experiment was designed to study some semen characters of four breeds of rabbits (Californian (Cal), New Zealand White (NZW), Sinai (Sin) and Balady (Bal). A total number of twenty bucks (5/breed) was used. Two hundred ejaculates were collected from all bucks (50/breed) during a period of ten weeks by means of an artificial vagina. The animals were apparently healthy. They were about 10 months old with an average body weight of 3.3, 3.5, 2.8 and 2.0 Kg for Cal, NZW, Sin and Bal breeds, respectively. Each animal was housed individually in cage.

Animals were fed *ad libitum* a commercial pelleted rabbit ration (Table 2 a&b) and the barseem is being left in the sun

every day before put to bucks. Fresh water was available via automatic watering troughs.

All bucks were trained for artificial collection of semen using artificial vagina according to Brederman *et al.* (1964). A female rabbit was used as a teaser. After three weeks of adaptation period, semen was collected.

Fifty ejaculates were obtained from each breed during a period of 10 weeks, once weekly. Reaction time (RT) was recorded from the moment of subjecting a doe to the buck until the completeness of the ejaculation.

Reaction time: was measured in seconds using a stop – watch (El-Sherbiny, 1987).

The semen quality parameters:

1- Some physical semen characteristics:

Ejaculate volume (V), semen density (D) and semen color (Co) were estimated according to the scale described by Zemjanis (1962), Semen pH value (pH) (Whatman pH Indicator paper; Whatman limited Maidstone, England), Mass and advanced motility (MM & AM) of semen samples were rated according to the vigor of the motility of sperms (El-Sherbiny, 1987), examination is made under the high power (x400) according to Soad *et al.* (1993), percentage of total abnormal sperms (TSA%) (El-Sherbiny, 1987), primary and secondary abnormal sperms (PSA&SSA) primary abnormalities included sperms with giant head, long head, dwarf head, narrow head, double head, long tail, double tail and protoplasmic droplets. Secondary abnormalities included tailless head, coiled tail, bent tail and cut tailed sperms and Packed sperm volume (PSV) and sperm concentration/ml and/or ejaculate (SC/ml & SC/E) (Khalifa, 1977).

2- Biochemical semen characteristics:

Initial fructose (IF) according to Mann (1948), total phospholipids (TPh)

according to Takayama *et al.* (1977), total cholesterol (TC) according to Flegg (1973), total phosphorus (Tpo) according to El-Merzabani *et al.* (1977), total calcium (Tca) according to Gindler and King (1972) and total nitrogen (TN) according to Patton and Crouch (1977).

One hundred and twenty females were chosen (30 Cal, 30 NZW, 30 Sin and 30 Bal) for natural mating (Na), and also, of artificial insemination (AI) was selfsame of number, the body weight of females ranged between 1.8 - 3.3 kg. Animals were maintained under identical nutritional and management conditions. Through, the period of experiment, each animal received a concentrate commercial diet (Pellets) *ad libitum* (Table, 2 a&b), barseem was offered daily to each animal *ad libitum* during the experimental period, fresh water was available continuously via automatic watering troughs. The female was transferred to the box of male during mating. Pregnancy was diagnosed at 10 days post-mating using palpation method. Mating was repeated again after palpation method when the female was non-pregnant. Thirty Cal females, Thirty NZW females, Thirty Sin females and Thirty Bal females were used in Artificial insemination (AI). The semen was diluted with semen extenders:

- Extender (Uzcatequi and Johnston, 1988) composed of: 2.9 g sodium citrate, 20g egg yolk, 77.1 ml distilled water, all the contents were shaken.

Five hundred I.U. penicillin G. sodium and 0.5 mg streptomycin were added to each 1 ml of each extender. Split semen fractions were diluted 1:10 with extender. The diluted semen was incubated in water bath at 40° C.

Artificially inseminated rabbits were induced to ovulate with glass rod and the insemination was after 4 hours from using the glass rod of each animal. The semen was diluted with extender in order to obtain in each inseminating dose, irrespective of its

volume, 20-25x10⁶ motile sperm cells. The does were inseminated on the second day postpartum. Pregnancy was diagnosed at 15 days post-mating using palpation.

Reproductive performance traits:

Number of services per conception (**NSC**) at a given doe was considered as the total recorded number of services of this particular doe till conception. Gestation period (**GP**) in days was calculated from date of fertile mating to delivery. Litter size at birth (**LSB**) is the number of offspring at 1st day of delivery, litter size at weaning (**LSW**) is the number of offspring at weaning was recorded for each doe. Mortality rate (**MR**) is the number of dead offspring up to weaning was recorded as percentage (%). Fertility rate (**FR**) was calculated by dividing the number of pregnant does (NP) to delivery on the number of mated does (NM) x 100.

Analysis of variance was computed using General Linear Model (GLM) procedure under software of SPSS (**SPSS, 1997**); analyses of variance were conducted as follows:

$$Y_{ij} = \mu + B_i + e_{ij}$$

Where:

Y_{ij} = observed value.

μ = overall mean.

B_i = Effect due to breed ($i = 1,2,3,4$, i.e. 1 = Californian, 2 = New Zealand White, 3 = Sinai, 4 = Balady).

e_{ij} = Random error term.

RESULTS AND DISCUSSION

Effect of breed of rabbit on reaction time, semen pH, semen density, semen color, mass motility and advanced motility are shown in Table (3). Results indicated that effect of breed on reaction time, semen pH, semen density, semen color, mass motility and advanced motility was highly significant ($p < 0.01$).

Records of reaction time per seconds in this study were 32.56, 31.51, 25.19 and 23.57 seconds for NZW, Cal, Sin

and Bal, respectively. Reaction time of Bal and Sin were faster than Cal and NZW. These results may be due to the effect of temperature on foreign breed of rabbits in the middle of Egypt.

The semen pH of Cal (7.50) was higher than of NZW (7.42), Sin (7.33) and Bal (7.35). Measurements of semen pH is of great importance because any semen extender used should be approximated to the same pH as semen or should act as a buffer against excessive acidity or alkalinity and also, it acts as an indication to the normal status of the accessory secretion and the livability of spermatozoa (Abd-El-Ghaffar, 1992 and Jean *et al.*, 2002). Generally, semen pH of bucks should be slightly alkaline.

Semen density in this study was 1.99, 1.87, 1.76 and 1.75 for NZW, Cal, Bal and Sin, Respectively (Table 3). This indicated that the semen color degree of NZW was higher (1.57) than of Cal bucks (1.24), Bal (1.04) and Sin (1.01) (Table 3). Semen color was graded from whey-watery, milky to creamy color according to the density of sperm cell concentration, thus, the quality of whey-watery color is not good. Results of semen color in NZW and Cal are in agreement with those obtained by El-Sherbiny (1987) and Abd-El-Ghaffar (1992).

Mass motility of semen was 2.90, 2.87, 2.76 and 2.73 in NZW, Cal, Bal and Sin, respectively. They were different from that reported by El-Sherbiny (1987) and Abd-El-Ghaffar (1992) who found insignificant variation in the mass motility between NZW and Cal. Advanced motility of semen in NZW was higher (68.21) than in Bal (63.21), Sin (63.11) and Cal (63.10). These findings are nearly similar to that observed by Abd-El-Hakeam *et al.* (1992). Advanced motility illustrates the degree of sperm activity and its importance for passing during the oviduct and completing

fertilization (El-Darawany and El-Sayiad, 1994 and Jean *et al.*, 2002).

Effect of breed of rabbits on semen volume, sperm-cell concentration, live sperm (%), normal sperm (%) and packed sperm volume (%) are shown in Table (3). Results indicated that effect of breed was highly significant ($p < 0.01$) on all these items.

Semen volume (ml) in this study were 0.80, 0.74, 0.65 and 0.65 for NZW, Cal, Bal and Sin, respectively. NZW and Cal results are nearly similar to that observed by El-Gaafary *et al.* (1994) and Hemid and Tharwat (1995); but, they are much higher than that recorded by Soad *et al.* (1993); El-Gaafary (1994) and Tawfeek *et al.* (1994) and lower than that recorded by Badura (1977, 1978) and Amin *et al.* (1983).

The result of sperm-cell concentration/ml for Bal (355.57×10^3) and Sin (353.53×10^3) was much higher than those for NZW (341.23×10^3) or for Cal. (340.54×10^3). While Bal and Sin had the highest sperm cell concentration value, it had the lowest semen density value and lowest color grade, this points out that the size of Bal and Sin sperm cell is smaller than the other breeds. Result in this study for NZW was in agreement with those given by Abd-El-Ghaffar (1992); but, lower than those observed by El-Sherbiny (1987) and Panella *et al.* (1994). As for Cal rabbits the result was much higher than those obtained by Afify and Markled (1994) and El-Ashry *et al.* (1995); but, lower than those given by Del Nino Jesus *et al.* (1997). Results of sperm-cell concentration/ ejaculate were 274.21, 247.24, 219.55 and 219.13 for NZW, Cal, Bal and Sin, respectively. It was higher than those mentioned by Abd-El-Hakeam *et al.* (1992); El-Gaafary (1994) and El-Gaafary *et al.* (1994); but, in agreement with those obtained by Amin *et al.* (1983) and El-Sherbiny (1987).

Results of live sperm (%) indicated that Bal and Sin had the lowest value (81.46)

and (81.19) compared with NZW (86.17) or Cal (82.20). Live sperm per ejaculate were 243.21, 213.46, 189.11 and 188.79 for NZW, Cal, Sin and Bal, respectively. These results were in agreement with those obtained by El-Sherbiny (1987) and Soed *et al.* (1993); but, were much higher than those given by Afify and Makled (1994) and Abo-Warda (1994).

Means of normal sperm (%) in Table 3 were significantly affected ($p < 0.01$) by breed of rabbits. NZW had the highest value (86.16) compared with Cal (83.81), Bal (84.99) and Sin (84.92). At the same trend, NZW had the highest normal sperm/ejaculate value (244.81) compared with Cal (215.24), Bal (193.12) and Sin (190.52).

The results indicated that, the effect of breed on packed sperm volume (%) was highly significant ($p < 0.01$) where the value in NZW was 30.47%, Cal was 30.88%, Bal (35.99) and in Sin. was 35.94%. These results are different from those obtained by Abd-El-hakeam, *et al.* (1992).

Effect of breed on total sperm abnormalities (%), primary abnormalities (%) and secondary abnormalities (%) are shown in Table (3). Results indicated that breed effect on these parameters were highly significant ($p < 0.01$). The results of primary sperm abnormalities (%) were 8.89, 8.80, 6.19 and 5.17 for Sin, Bal, Cal, and NZW, respectively. Results of secondary abnormalities (%) were 7.93, 7.92, 7.90 and 7.35 for Sin, Cal, Bal and NZW, respectively. Result of total sperm abnormalities (%) indicated that Sin and Bal had the highest value (16.82) and (16.70) compared with NZW (12.52) or Cal (14.11). These results are in agreement with those obtained by El-Sheikh (1991); El-Gaafary (1994); El-Gaafary *et al.* (1994); El-Kerdawy *et al.* (1998) and Ambriz *et al.* (2002).

Results in Table (4), illustrated the mean of initial fructose (mg %), total cholesterol (mg %), total phospholipids (mg %), total phosphorus (mg %), total calcium (mg %) and total nitrogen (mg %) as affected

by breed of rabbits. This indicated that the effect of breed on all chemical composition of semen plasma was highly significant ($p < 0.01$).

The present data for initial fructose (mg %) were 175.11, 175.01, 174.96 and 164.43 mg% for Cal, Bal, Sin and NZW, respectively. Similar results reported by Abd-El-Ghaffar (1992). It is known that fructose is the principal element to maintain the sperm activity. In addition, fructose is synthesized by the glandular vesicular and ampulla in rabbits under the control of testosterone hormone (Mann, 1948). The variation in initial fructose suggested that, hyper sexuality exhibiting high activity are usually accompanied by secretion of big volume of the seminal plasma containing excessive amount of fructose. Thereby, the higher content of fructose parallel to increase in the ejaculate volume can be reliable (Abd-El-Ghaffar, 1992).

The semen of Bal and Sin had the highest total cholesterol values are (199.21 and 198.21) compared with NZW (185.65) or Cal (190.32) mg %. The mean of the total cholesterol (mg %) is in agreement with that observed by Abd-El-Ghaffar (1992) and higher than those estimated by Mann and Lutwak-Mann (1981). Several studies have demonstrated that cholesterol inhibited induction of the acrosome reaction (Davis, 1980) and also inhibits fertilization (inhibits or delays capacitation) in many species including the rabbit (Davis, 1982). The influx of cholesterol also reverses capacitation of sperm: indeed, vesicles from rabbit seminal plasma containing cholesterol and liposomes containing cholesterol render capacitated sperm incapable of fertilizing eggs *in vivo* (Gerena *et al.*, 1998).

Following the same trend, results of total phospholipids (mg %) were 62.11, 61.31, 58.01 and 54.88 for Bal, Sin, Cal and NZW, respectively. They were in agreement with those obtained by Abd-El-Ghaffar (1992). The result of total phosphorus (mg

(%) was higher in Sin and Bal Semen (39.58 and 38.98) compared with NZW (30.46) or Cal. (35.20). It is nearly similar to that obtained by El-Sherbiny (1987) and lower than that estimated by El-Sharabasy (1974).

The mean of total calcium (mg %) in seminal plasma were 8.99, 8.54, 7.70 and 6.72 for Bal, Sin, Cal and NZW, respectively. Total nitrogen (mg %) were 187.12, 186.38, 170.44 and 169.15 for Bal, Sin, Cal and NZW, respectively. It was nearly similar to that obtained by El-Sherbiny (1987).

Cholesterol efflux from the plasma membrane is required for the cyclic adenosine monophosphate-dependent tyrosine phosphorylations that are correlated with sperm capacitation (Visconti *et al.*, 1999). Changes in cholesterol content, phospholipid dynamics, and protein mobility are intimately linked to capacitation (Flesch *et al.*, 2001).

The results indicated that Bal and Sin had the highest semen biochemical values but it had the lowest normal sperm and live sperm (%), this suggest that less normal live sperm number consume less minerals amount.

The results indicated that NZW is better than Bal and Sin even under the environmental conditions of this experiment, it might be suggest to conduct this experiment under the summer season to know the differences.

Table (5) referred that, means of GP (day) as affected by breed and mating way are presented, results indicated that, there was no significant. These results are in agreement with those obtained by Tawfeek and El-Hindawy (1991), El- Sayiad *et al.* (1993) and El- Kelawy (1997).

Effect of breed and AI on NSC are shown in Table (5). Sin and Bal rabbits had significantly higher NSC than NZW or Cal rabbits under IA and Na conditions, these results are in agreement with those obtained by El-Darawany and El-Sayiad (1994) and Oudah (1990) and El-Kelawy (1997). While, there was insignificant difference due to AI. The fertility due to Na condition was higher than AI conditions, this perhaps due to AI need very careful attention to hygiene.

There was no significant difference for LSB in AI but was significant ($P < 0.05$) in Na. LSW was significantly ($P < 0.05$) affected by breed of rabbits in both Na conditions or AI conditions. These results are nearly similar with those obtained by Tawfeek *et al.* (1994), El-Kerdawy *et al.* (1998) and Mahmoud *et al.* (1998). But numerically, Na increased LSB or LSW. Sin rabbits showed significantly the highest MR under AI but it had the lowest value under Na conditions. On the other hand, Cal rabbits had the highest MR under Na conditions but there was the lowest value in Cal and NZW under AI conditions.

Table (1): Means of monthly temperature and relative humidity in the studied area.

Month	Temperature (C ⁰)	Relative humidity (%)
February	21.60±0.50	51.4±0.35
March	23.44±0.45	50.3±0.45
April	26.58±0.55	47.5±0.65
May	28.36±0.50	45.9±0.60

Table (2 a&b): Composition and chemical analysis of experimental pellet diet:

(a) Composition.

Ingredient	Breeding period of males	Breeding period of females
Berseem hay (%)	26	27
Wheat bran (%)	21	20
Barley grain (%)	31	30
Soybean meal (%)	11	12
Decorticated cottonseed meal (%)	3.9	4.00
Molasses (%)	3.1	3.00
Bone meal (%)	0.70	0.70
Limestone (%)	1.00	1.00
Meat meal “60% CP” (%)	1.50	1.50
Sodium chloride (%)	0.35	0.35
Mixed of vitamins and minerals (%)	0.30	0.30
DL-Methionine	0.15	0.15
Total	100	100

(b) Chemical analysis (%).

Crude protein (CP)	16.10	17.30
Ether extract (EE)	2.25	2.15
Crude fiber (CF)	11.79	11.74
Digestible energy (DE) K cal / Kg feed*	2600	2735
* Calculated		

Table (3): Some physical semen characteristics in rabbits as affected by breed of rabbit (mean ±S.E).

Classification	No	Physical semen characteristics ⁺																
		RT (sec.)	PH	D (0-3)	CO (1-3)	MM (0-5)	AM (%)	SV /ml	SC (10) ³ /ml	SC (10) ³ /E	LS (%)	LS (10) ³ /E	NS (%)	NS (10) ³ /E	PSV (%)	PSA (%)	SSA (%)	TSA (%)
Overall mean	200	28.21±0.38	7.40±0.01	1.84±0.01	1.22±0.04	2.82±0.03	64.41±0.21	0.71±0.01	347.72±2.73	240.03±3.17	82.76±0.15	208.64±2.58	84.97±0.13	210.92±2.68	33.32±0.50	7.26±0.10	7.78±0.09	15.04±0.13
Effect of breed		**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
Cal	50	31.51±0.47 ^a	7.50±0.01 ^a	1.87±0.02 ^b	1.24±0.05 ^b	2.87±0.04 ^a	63.10±0.33 ^b	0.74±0.02 ^b	340.54±4.82 ^b	247.24±4.71 ^b	82.20±0.23 ^b	213.46±3.87 ^b	83.81±0.20 ^c	215.24±3.93 ^b	30.88±0.69 ^b	6.19 ±0.10 ^b	7.92 ±0.11 ^a	14.11±0.20 ^b
NZW	50	32.56±0.97 ^a	7.42±0.01 ^b	1.99±0.03 ^a	1.57±0.10 ^a	2.90±0.05 ^a	68.21±0.36 ^a	0.80±0.02 ^a	341.23±4.67 ^b	274.21±5.92 ^a	86.17±0.27 ^a	243.21±4.82 ^a	86.16±0.27 ^a	244.81±4.91 ^a	30.47±0.95 ^b	5.17 ±0.13 ^c	7.35 ±0.15 ^b	12.52±0.08 ^c
Sin	50	25.19±0.52 ^b	7.33±0.01 ^c	1.75±0.02 ^c	1.01±0.01 ^c	2.73±0.04 ^b	63.11±0.33 ^b	0.65±0.02 ^c	353.53±4.74 ^a	219.13±3.49 ^c	81.19±0.15 ^b	189.11±2.97 ^c	84.92±0.21 ^b	190.52±2.88 ^c	35.94±0.81 ^a	8.89 ±0.13 ^a	7.93 ±0.11 ^a	16.82±0.21 ^a
Bal	50	23.57±0.63 ^c	7.35±0.01 ^c	1.76±0.02 ^c	1.04±0.02 ^c	2.76±0.05 ^b	63.21±0.33 ^b	0.65±0.02 ^c	355.57±4.64 ^a	219.55±3.35 ^c	81.46±0.19 ^b	188.79±2.77 ^c	84.99±0.20 ^b	193.12±2.97 ^c	35.99±0.81 ^a	8.80 ±0.12 ^a	7.90 ±0.13 ^a	16.70±0.22 ^a

Means within a column within a classification followed by the same letter do not differ significantly from each other; otherwise, they do differ significantly at p< 0.05. ** P< 0.01
 Reaction time (RT), semen pH (PH), semen density (D), semen color (CO), mass motility (MM), advanced motility (AM), semen volume (SV), sperm-cell concentration (SC)(10)³/ml, sperm-cell concentration /ejaculate (SC (10)³/E), live sperm % (LS%), live sperm/ejaculate (LS(10)³/E) normal sperm % (NS%), normal sperm/ejaculate (NS(10)³/E) and packed sperm volume (PSV), primary sperm abnormalities % (PSA %), secondary sperm abnormalities (%) (SSA%) and total sperm abnormalities (%) (TSA %).

Table (4): Semen biochemical characters[†] in rabbits as affected by breed of rabbit (mean ± S.E).

Classification	No	IF (Mg %)	TC (Mg %)	TPh (Mg %)	Tpo (Mg %)	TCa (Mg %)	TN (Mg %)
Overall mean	200	172.10 ±1.31	193.35 ±1.76	59.08 ±0.61	36.06 ±0.45	7.99 ±0.23	178.27 ±1.08
Effect of breed		**	**	**	**	**	**
Cal	50	173.99 ±2.16 ^a	190.32 ±2.72 ^b	58.01 ±0.97 ^b	35.20 ±0.57 ^b	7.70 ±0.35 ^b	170.44 ±1.39 ^b
NZW	50	164.43 ±2.10 ^b	185.65 ±2.75 ^c	54.88 ±0.92 ^c	30.46 ±0.66 ^c	6.72 ±0.35 ^c	169.15 ±1.41 ^b
Sin	50	174.96 ±1.98 ^a	198.21 ±3.12 ^a	61.31 ±1.09 ^a	39.58 ±0.44 ^a	8.54 ±0.40 ^a	186.38 ±1.20 ^a
Bal	50	175.01 ±1.58 ^a	199.21 ±2.77 ^a	62.11 ±1.19 ^a	38.98 ±0.46 ^a	8.99 ±0.65 ^a	187.12 ±1.37 ^a

Means within a column within a classification followed by the same letter do not differ significantly from each other; otherwise, they do differ significantly at $p < 0.05$.

** $P < 0.01$.

[†]Initial fructose (IF mg %), total cholesterol (TC mg %), total phospholipids (TPh mg %), total phosphorus (Tpo mg %), total calcium (TCa mg %) and total nitrogen (TN mg %)

Table (5): Fertility rate (%) and mortality rate (%) as affected by breed and mating system in rabbits.

Mating	Breed	NM	NP	NSC	GP (Day)	FR%	LSB	LSW	MR %
AI	Cal	30	19	1.61±0.09 ^a	31.64±0.17	63.33	5.54±0.10	5.15±0.09 ^b	6.85
	NZW	30	20	1.42±0.07 ^b	31.65±0.12	66.67	5.86±0.09	5.54±0.12 ^a	5.79
	Sin	30	16	1.66±0.09 ^a	31.42±0.15	53.33	5.81±0.17	5.12±0.25 ^b	7.55
	Bal	30	15	1.69±0.09 ^a	31.40±0.14	50.00	5.80±0.19	5.11±0.25 ^b	6.99
	Mean	30	17.5	1.60±0.09	31.53±0.08	58.33	5.75±0.17	5.23±0.19	6.80
Na	Cal	30	26	1.14±0.13 ^b	31.14±0.15	86.67	6.02±0.23 ^{ab}	5.34±0.17 ^b	12.2
	NZW	30	28	1.17±0.12 ^b	31.13±0.10	93.33	6.57±0.19 ^a	5.57±0.30 ^a	10.8
	Sin	30	25	1.33±0.15 ^a	31.12±0.13	83.33	5.92±0.29 ^b	5.58±0.26 ^a	5.77
	Bal	30	26	1.31±0.15 ^a	31.11±0.12	86.67	5.93±0.28 ^b	5.59±0.25 ^a	5.34
	Mean	30	26.3	1.24±0.17	31.13±0.11	87.5	6.11±0.14	5.52±0.15	8.53

Means within a column within a classification followed by the same letter do not differ significantly from each other.

NS = Not significant

* $P < 0.05$

** $P < 0.01$

[†]AI = Artificial insemination,

Na = Natural mating,

NM= Number of mated does,

NP= Number of pregnant does,

NSC= Number of services per conception,

FR % = Fertility rate.

LSB= litter size at birth, LSW= Litter size at weaning,

MR % = Mortality rate.

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المخلص العربي

العلاقة بين جودة السائل المنوي ونظم التزاوج في بعض انواع الارانب المحلية والاجنبية تحت الظروف البيئية في مصر الوسطى

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أجريت هذه الدراسة لتقدير صفات جودة السائل المنوي فى أربعة أنواع من الأرانب (الكاليفورنيا- النيوزيلندي الأبيض- السيناوى- البلدى) تحت الظروف البيئية بمصر الوسطى - استخدم فى هذه الدراسة (20 ذكر (5 من كل نوع) وقد تم جمع مائتان قذفة من كل الذكور خلال فترة التجربة باستخدام المهبل الصناعى. وايضا تم دراسة تأثير التلقيح الطبيعى والإصطناعى على بعض الصفات والقياسات التناسلية والإنتاجية كنتيجة لتأثير سلالة الأرانب. تم اختيار عدد 120 أنثى (30 كاليفورنيا و30 نيوزلندي ابيض و30 سيناوى و30 بلدى) تلقيحا صناعيا وكذلك تم ايضا إختيار عدد 120 أنثى (30 كاليفورنيا و30 نيوزلندي ابيض و30 سيناوى و30 بلدى) لإجراء التلقيح الطبيعى.

وقد تم دراسة: وقت الاستجابة للذف والخصائص الطبيعية والبيوكيميائية للسائل المنوي خلال أسابيع التجربة وبعض الصفات والقياسات التناسلية والإنتاجية وأوضحت النتائج الاتى:-

سرعة استجابة البلدى والسيناوى كانت أعلى معنويا من النيوزلندى والكاليفورنيا.-

- حموضة السائل المنوي للكاليفورنيا والنيوزيلندي الأبيض كانت أعلى من البلدى والسيناوى.
 - كثافة السائل المنوي واللون والكتلة والحركة التقدمية فى النيوزيلندي الأبيض اعلى من باقى الانواع.
 - حجم السائل المنوى اعلى فى النيوزلندى والكاليفورنيا عن البلدى والسيناوى.
 - تركيز الحيوانات المنوية/مل كانت أعلى فى البلدى والسيناوى من النيوزيلندي الأبيض والكاليفورنيا.
 - تركيز الحيوانات المنوية/قذفة كانت اعلى فى النيوزيلندي الأبيض والكاليفورنيا .
 - اختلافات عالية المعنوية فى صفات السائل المنوى وكذلك الخصائص التمييزية للحيوانات المنوية التى ترجع إلى تأثير النوع.
 - مجموع الحيوانات المنوية الشاذة كانت أعلى فى البلدى والسيناوى عن النيوزيلندى الأبيض والكاليفورنيا.
- بصفة عامة نجد أن الصفات البيوكيميائية للسائل المنوى فى البلدى والسيناوى اعلى من النيوزيلندي الأبيض والكاليفورنيا.

- تم تسجيل البيانات الخاصة بعدد مرات التلقيح لكل إخصاب وعدد الأرناب الناتجة عند الولادة والفظام وكذلك تم حساب نسبة الإخصاب والنفوق فوجد الاتى:-

- لا يوجد تأثير معنوى يرجع إلى السلالة على فترة الحمل .
- كان يوجد تأثير معنوى عند 05% لعدد مرات الاستجابة للتلقيح بين الانواع عند استخدام التلقيح الاصطناعى والطبيعى.
- لا يوجد تأثير معنوى لحجم البطن عند الميلاد بين الانواع عند استخدام التلقيح الاصطناعى .
- يوجد تأثير معنوى لحجم البطن عند الميلاد بين الانواع عند استخدام التلقيح الطبيعى.
- يوجد تأثير معنوى لحجم البطن عند الفطام بين الانواع عند استخدام التلقيح الاصطناعى والطبيعى.
- نسبة معدل الخصوبة كانت اعلى فى التلقيح الطبيعى عن التلقيح الاصطناعى.
- نسبة النفوق كانت فى التلقيح الاصطناعى اعلى فى السيناوى والبلدى عن النيوزلندى والكاليفورنيا اما فى التلقيح الطبيعى كانت اعلى فى الكاليفورنيا والنيوزلندى.

ومن النتائج السابقة لوحظ وجود علاقة بين الخصائص الطبيعية وعدد الاجنة ونسبة الخصوبة وخاصة فى أرناب النيوزلندى الابيض.