Egypt. Poult. Sci. Vol. (41) (II): (393-412) (2021) (2105-1166)

Egyptian Poultry Science Journal

http://www.epsj.journals.ekb.eg/

ISSN: 1110-5623 (Print) – 2090-0570 (Online)

EVALUATION OF MILK YIELD AND SEMEN QUALITY IN MATERNAL LINE OF RABBITS

Intesar M. Ali[1], M. K. Shebl [2], A. E. El-Raffa[2], A. M. Abd El-Hady[2*] and Amira. S. El-Deghadi[1]

[1]Anim.Prod. Res. Inst., Agric. Res. Center, Egypt.

[2]Poult. Prod. Dep., Fac. of Agric., Alexandria Uni. (21545), Alexandria, Egypt

Corresponding author: Ahmed M. Abd El-Hady Email: ahmed75atta@yahoo.com

Received: 27/05/2021 Accepted: 15 /06/2021

ABSTRACT: The study aims to evaluate genetically milk production of a synthetic maternal line of rabbits (V line) and semen quality of bucks. A total of 77, 70 and 70 does were used to estimate milk yield from kindling up to weaning for more than 4 parities. Twenty males of rabbits at 63 days of age were selected random and blood samples were collected to determine serum follicle-stimulating (FSH), luteinizing (LH) and testosterone hormones at the ages of 63 days and 5 and 6 months. Milk yield were 113.06, 172.87 and 211.76 g at 7^{th}, 14^{th} and 21^{st} days of age after parturition, respectively. It is noticeable that the effect of the month had no significant effect on milk yield at 7^{th} and 21^{th} days of lactation period, while it was affected significantly at 14^{th} days, and the month of December was the highest rate of milk yield in the months of the productive year. The effect of parity number more than 4^{th} on milk yield was increased significantly with the advancement and decreased for other parities. The correlations between FSH, LH and testosterone hormonal levels and rabbits sperm concentration and advance sperm motility were significantly affect at 63 days. But, the correlation between FSH and LH levels and semen volume and total sperm out percentages were significant at 63 days. It was concluded that the semen quality was associated with an increase in testosterone concentrations at 5 and 6 months. In summary, it can be observed that the evaluation of the V line rabbit as a maternal line with high milk yield during the lactation period and that high semen quality for males V line rabbits can be predicted by high levels of hormones LH, FSH and testosterone concentrations at 63 days of age.

Key words: Rabbits; Maternal line; Milk yield; Semen quality; Gonadotropin hormones; Correlation

INTRODUCTION

In the recent past rabbit rearing gained great momentum due to their high prolificacy, early sex maturity, rapid growth rate, shorter interval between generations and high feed conversion. It has been recognized and affirmed that domestic rabbits are an important animal species that can improve the socio-economic status of the rural poor, especially in developing countries (Risam *et al*., 2005).

Production efficiency of commercial rabbit farms depends on the litter size at kidding and the livability of the bunnies up to weaning (Odeyinka *et al*., 2008). Line V is a synthetic maternal line and litter size at weaning was considered as the criterion for the selection goal (El-Raffa, 2000). Thus, milk yield is one of the factors that affect the survival and weight gain of the kits. Therefore, milk yield is an important and essential factor in rabbit production (Iraqi *et al.*, 2010). The state of body condition, fertility and fetal development are certain traits closely related to the quality of lactation and this requires a great effort from the doe energy (Xiccato *et al.*, 2004).

According to the literature, it is noted that the period of nursing between 18-20 days postpartum is the highest period of milk yield, but the peak of milk yield can appear even 2-3 days earlier in cases of multiparous does and this is subject to intensive reproduction rhythms (Maertens *et al*., 2006). The development of the methodology for obtaining and examining rabbit milk for non-surgical way began with research conducted in France in the seventies of the last century (Goode & Taylor, 1974). Early litter growth and higher survival rate in rabbits requires the rabbit's intrinsic ability to provide better maternal environment and thus an appropriate milking capacity (El-Maghawry *et al.,* 1993; Iraqi, 2008). The pre-weaning growth litter in terms of litter size and litter weight is affected by the production of does milk, which is the main component apparent to maternal line after birth (Nasr, 1994; El-Raffa *et al.*, 1997).

Also, semen characteristics are very important because a single male may affect the fertility and reproduction of several females (Alvariño, 2000). On the other side, the properties of semen are very important because they largely determine the reproduction efficiency that can be obtained from one ejaculate. Commercial rabbits rearing in hot climates can be affected by buck's sexual desire, which can have a negative effect on both the load of conception and kindling. Therefore, the behavior of buck's libido behavior must be known by semen examination that has been tested for efficient use in any breeding system. Alvariño *et al*. (1996) showed that differences in semen quality characteristics between paternal lines could influence pregnancy and kindling rates. Brun *et al*. (2002) noted significant heterogeneous effects on sperms concentration and sperm motility. Habeeb *et al.* (2008) reported significant correlations between somatic semen quality and hormonal concentrations in the seminal plasma of rabbit bucks using nuclear technique. Therefore, the main objectives of this study were to evaluate milk yield and semen quality genetically of a synthetic maternal line of rabbits (V line) calculate genetic correlations among studied traits and predict the transmitting ability of individuals for semen quality of rabbit bucks.

MATERIALS AND METHODS

Data used in the present study were collected at the nucleus breeding rabbit farm of Poultry Research Center, Faculty of Agriculture, University of Alexandria, of production season at 2019-2020. All data and animals care procedures were approved by the Institutional Animal Care and Use Committee in AU-IACUC, Alexandria University, Egypt with the review report number AU08190519823.

Population of rabbits

Line V is a synthetic maternal line. It was originated in 1982 and developed at the Department of Animal Science of Universidad Polytechnic de Valencia, Valencia, Spain. In this line, Litter size at weaning was considered as the criterion for the selection goal. The method that is used to evaluate the animals is a BLUP under an animal repeatability model (Estany *et al*., 1989). A set of V Line rabbits was imported to the Poultry Research Center, Alexandria University at the end of year 1998 (El-Raffa, 2000), multiplied for five years and after that, the selection was continued under the same criterion.

Housing and feeding rabbits

Breeding stocks (bucks, does and litters) were raised in a windowed rabbitry in two separate rooms. The dimensions of each room are 20 x 7 x 3 meters length, width and high, respectively. Breeding females and males were housed individually in galvanized wire cages with standard dimensions of 60 x 50 x 35 cm for length, width and height, respectively arranged in one-tire system design allocated in rows along the rabbitry, whereas the dimensions of the growing rabbits cage were 40 × 50 × 35 cm for length, width and height, respectively. All cages of does and bucks were provided with feeders and nipple-drinkers.

On the day 28th of gestation, the cage of each doe was equipped with a metal nest box (40 × 30 × 30 cm) for kindling and nursing the progeny up to weaning at four weeks of age and were fixed outside the cages and supplied with a thin layer of wood shaving to provide a comfortable and warm nest for the kindled. All the flock was kept under the same managerial and environmental conditions.

Rabbits were fed the diet *ad-libitum* until 16 weeks of age and thereafter they received a restricted quantity (130-140 g. per day) until the first mating. Bucks, non-pregnant does, and non-lactating ones were fed restricted amount of food to prevent over fatness impairing their reproductive performance. Does losing their entire litters during the lactation period were immediately returned to restricted intakes. Pregnant does after 15 days of pregnancy, lactating and growing rabbits were fed *ad-libitum***.** These diets provide 18.0% crude protein, 14.8% crude fiber, 3.2 ether extract and 2600 kcal/ kg diet.

Reproductive management

Beginning of the breading season, during September, the females were first mated at the age ranging from 135 to 150 days; breeding rabbits were divided into groups for within group mating. Each group was consisted of four does and one buck that were chosen to avoid mating between close relatives (avoiding full–sibs, half–sibs and parent–offspring mating). Each doe was transferred to the buck's cage to be mated. Does were palpated 15 days post mating to detect pregnancy and those that remained not pregnant was returned to the same buck at the next mating date. Does which were not pregnant 3 times consecutively were eliminated.

At the day 33rd of pregnancy, the birth was released by an injection of oxytocin in case of the doe that had not littered until then. During the pre-weaning period, the doe had free admission to their litters. During this period, unrestricted access for litters to food and water was allowed. The does were re-mated 10 days after kindling from the same buck.

Data collected

Milk yield

A total 77, 70 and 70 does were used for each age to estimate milk yield (g/ litter/doe) from kindling up to weaning at 7th, 14th and 21st days of age after parturition as representative days for the third week.

Body weight of pups was determined on day 7, 14 and 21 days of postpartum. It is known, that rabbit pups are nursed only for about 3 min once every 24 h. Milk yield was assessed using the weight-suckle-weight method. Just before suckling, body weight of removed pups from their mother (12 h prior suckling) by separation between the mother and then pups that allowed to suckle and immediately after suckling body weight of pups was again controlled. The difference between body weights reflected daily milk consumption (yield) according to McNitt & Lukefahr (1990).

The milk samples were collected on the following days of lactation by gently massaging the mammary glands, 2–3 mL of colostrum milk for each doe at 2nd day and at 17th day were obtained and put into a plastic probe. Directly after acquisition, the colostrum and normal milk samples were chilled (4 °C) and transported under chilled conditions to the laboratory for examination. The following measures were taken: pH and the concentration of standard chemical compounds as dry matter (total solids, ash, protein, fat, lactose, solids not fat and energy). The maximum milk yield is reached during the third week of lactation; milk yield declines gradually in the fourth week and kits start eating rations as of day 19 of lactation. So, on control days it is only necessary to allow access to the dams once per day for about 10 min. Weekly milk yields were assumed to be repeated measurements of the same trait.

Blood collection and hormones analyses

Blood sample for each buck was collected without anticoagulant tubes from the ear vein by a sterile syringe at 63, 150 and 180 days of age. A 3 ml of the blood sample was used to assess the serum hormones analysis including follicle stimulating hormone (FSH), luteinizing hormone (LH) and testosterone (ng/mL). Concentrations were measured by Radio Immunoassay (RIA) using the kits supplied by Diagnostic Products Corporation, USA.

Semen quality

Data collected for semen characteristics were available for bucks at all generations. A total number of 102 ejaculates collected from 20 bucks were evaluated for semen characteristics from 5 to 6 months. Bucks were housed in individual cages and they were accustomed to ejaculate in an artificial vagina. The semen specimens were artificially collected every biweekly from the bucks at an early age of 5 and 6 months at a rate of 5 times per buck during this period. Reaction time, the time between introducing the teaser doe to the buck and ejaculation (RT/sec), was estimated. The volume of each ejaculate was recorded nearest 0.1 ml (using a graduated collection tube) after removal of the gel mass.

The ejaculates with abnormal colors (in case of the presence of blood or urine were discarded. The samples were placed in an incubator (37°C) for a period of 10 to 15 min to prevent cold shock. For measuring motility of spermatozoa, semen was recorded on a subjective scale of 0 to 100% after viewing several microscopic fields with using phase contrast optics at 40×. Percentages of live, dead, and abnormal sperm were recorded as described by Baril *et al*. (1993). Elkomy *et al*. (2015) used a weak eosin-formalin (10% formalin) slain solution to evaluate the sperm cell concentration ($\times 10^6$/ml), by direct cell count using the improved Neubauer haemocytometer slide (Jimoh & Ewuola, 2019). Total sperm output was calculated by multiplying semen ejaculate volume and semen concentration. Total number of motile sperm was calculated by multiplying the percentage of motile sperm and total sperm output. Total motile normal sperm (TMNS) was calculated as {(the product of total sperm output × motility, %) × normal morphology sperm, %} (Correa & Zavos, 1996).

Statistical Procedure

Best Linear Unbiased Estimates (BLUE) is the method most frequently used in animal breeding for estimation of fixed effects (Weigel *et al.,* 1991). To derive BLUE of the fixed effects that Factors may associated with milk yield, least squares procedures and the type III methods described by statistical analysis system (SAS version 9.2, 2009) was used. Significance of the effects was tested at level $P \leq 0.05$ (*), $P \leq 0.01$ (**) and $P \leq 0.001$ (***) with the appropriate F statistic. Values of probability higher than 5% were considered to be not significant.

Data for milk yield were analyzed by adopting the following fixed linear model:

$$Y_{ijk} = \mu + KM_i + PO_j + b1(NBA - \bar{x}) + e_{ijk}$$

Y_{ijk} = is the observed value of the milk yield**.**

μ = is the general mean.

KM_i = fixed effect of the i^{th} month of kindling.

PO_j = fixed effect of the j^{th} parity order in which the milk yield was estimate.

b1 = linear regression coefficient of the covariance, for number born alive

e_{ijk} = the random error

Milk yield curve was obtained through the regression of milk yield on the days of production. Phenotypic correlation between gonadotropins and testosterone hormones levels at the 63 days of age studied and semen quality traits at 5 and 6 months of age and the significance of correlation coefficients obtained.

The trends of semen quality traits studied were estimated. These trends were obtained by first estimating the values of each trait. The regression of these values on FSH level at the 63 days of age was used to estimate semen quality traits at sexual maturity. Data were statistically analyzed using procedure of SAS software (2004). Significance of the difference between the means was verified by Duncan's new multiple ranges test (Duncan, 1955).

RESULTS AND DISCUSSION

Milk yield

Milk yield means during the different lactation weeks in Table 1 and Figure 1 were 113.06, 172.87 and 211.76 g at 7^{th}, 14^{th} and 21^{st} days of age after parturition, respectively. Means of averages milk yield were significantly affected with nursing week. The highest rate of milk production was observed at the age of 21 days from the start of kindling Figure (2). Milk yield was gradually increased with the age of kindling. It is noticed that milk yield was increased with increasing age from 7 and 14 to 21 days. It is noticeable that in Table (2) the effect of the month had no significant influence on milk yield at 7th and 21th days of lactation period, while it was affected significantly at 14th days of lactation period, and the month of December was the highest rate of milk yield in the months of the productive year. This explained the significance of month contribution on milk yield, where highest total milk yield was registered in December month followed by November month.

The effect of parity number on milk yield was not significant during 7th and 21th days after parturition but increased significantly with 14th days after parturition and the advancement of parity more than 4th parity and decreased for other parities in Table (2) and Figure (2). A linear relationship was observed between milk yield and parity order. Results indicated that parity number affected lactation milk in an ascending manner, which increased firmly during the fourth parity order. the amount of milk yield produced is greatly affected by lactation day and the litter size.

Poujardieu & Theau-Clément (1995) reported that was no effect of parity number on reproductive performance after 2nd parity. Decreased reproductive performance (litter size, litter weight and milk yield) was showed in virgin females compared with multiparous females (Pascual *et al.*, 1998; Debray *et al.*, 2003; Rebollar *et al.,* 2008). These results obtained confirm that parity number affects the energy balance of the rabbit does. In fact, feed consumption is lower in primitive females than in multiparous. Furthermore, the energy balance of does is more negative during the 1st lactation period than during the following lactation periods (Castellini *et al.,* 2006). However, we found no differences between the parties' number in daily body weight (DBW) at birth. Regardless the effect, of the parity number and the milk production were highest in the first 14 days of lactation period and lowest between 21 and 28 days of lactation period. Milk production was lower than the results observed by Al-Saef *et al*. (2008) and Rebollar *et al*. (2008). Rabbits milk yield in exotic and local rabbit lines increases gradually from the 1st week to reach its maximum at the 3rd week, then decreases thereafter (El-Sabrout *et al*., 2017).

Milk composition

Milk is secreted from the mammary gland and is a white or yellowish liquid contains dissolved lactose, whey proteins, and some minerals and consisting of a fat globules emulsion and a suspension of casein, calcium, phosphorous, all suspended in an aqueous phase. Also, milk leukocytes are part of the suspended phase (Bernabucci *et al.,* 2013). The fats in milk act as an energy source as a solvent for fat-soluble vitamins and provide essential fatty acids. Some of these components are created in the mammary gland (milk fat, lactose, caseins, alpha-lactalbumin and beta-lactoglobulin) while others enter milk via specific transportation mechanisms (Hernández-Ledesma *et al.*, 2008). In addition to the nutritional ingredients, milk may have beneficial non-nutritional functions as it contains excellent sources of bioactive compounds (Michaelidou, 2008). Lactose, a disaccharide consisting of D-glucose and D-galactose, is the main milk carbohydrate in most strains.

Lactose is the least milk versatile component. Lactose is the lowest volatility in milk depends on the close relationship between lactose synthesis and the amount of water drawn into the milk (Lin *et al*., 2016).

In addition to lactose, milk contains other carbohydrates in small amounts, including glucose, galactose and oligosaccharides. Rabbit colostrum milk has high total solids content, the major part consisting of about equal quantities of proteins and fat, with lactose present as a minor component. The mean percentages of fat, proteins, and lactose in rabbit colostrum were 17.7, 13.2, and 1.32, respectively (Bernabucci *et al*., 2013). The normal average chemical composition of rabbit milk is presented in Table (3). Due to the secondary importance of lactose content of doe rabbit milk, it has been mentioned in few scientific papers due to its low content (<2 g/100 g) especially at a later stage of the lactation period (Lebas *et al.*, 1971).

The milk pH in our study was affected by the day of lactation. The pH value increased between day 2 (6.92) and day 17, reaching the maximum value on day 17 (7.38). The gross composition of rabbit colostrum and mature milk at 17th day is given in Table (3). Moreover, in several experiments the content was calculated by difference with the other nutrients. Based on these data the colostrum total solids are higher than milk total solids at 17th day of lactation period (33.94 *vs.* 29.85 g/100 g) due to a higher protein content (13.87 *vs.* 12.45) and fat content (16.43 *vs.* 12.72). At the same time, the colostrum milk (day 2) was characterized by the lowest content of non-fat solids, which increased gradually in rabbit milk obtained on days 2 to 17 to reach the highest level of the analyzed lactation. Ash and lactose content were increased more slowly in the 17th day of the lactation period. The content of lactose was the lowest at the beginning of lactation (day 2), reaching its peak on days 17. Already at 2nd day of lactation period, the total solids, protein, fat and energy content were increased by (13.70, 11.41, 24.77 and 10.53%, respectively) compared to the average of the 17th day of lactation period (Table 3). The high values of the colostrum period may have been due to the low milk yield at this time while the low values in the 17th day of lactation period were at the peak of milk yield. The maximum protein values were measured in the colostrum and thin declined gradually with increasing lactation stage, reaching a minimum throughout the 3rd week. This may be related to its requirement for pup's growth. Levels of lactose were nearly constant during lactation. This may be because lactose is one of the main constituents concerned in maintaining constancy of the osmotic properties of milk. The concentration of ash in the milk was affected by the week of nursing period. The minimum value was in the first week followed by a gradually increase to the maximum in the 3rd week. The increase in ash content in the 3rd weeks may be due to the increase in minerals concentrations in that period.

True colostrum is consumed by the kits during primary lactation that occurs during parturition (Hudson *et al.*, 2000). The pH of milk is a common indirect indicator of mastitis (Qayyum *et al*., 2016; Kandeel *et al*., 2019). The increase of total solids in colostrum was due to the increase in proteins, specially, antibodies of globulin in early lactation period and the increase in lipid content. Milk energy was affected by weeks of lactation period.

The high values of milk energy in the period of colostrum were due to the high lipid and protein content, which about 56.19% came from lipid, 40.27% from protein and only 3.80% from lactose (Habeeb *et al*., 2020). Iraqi *et al*. (2007) observed that week of lactation significantly affected fat, total solids and ash percentage content, but its effect was non-significant on protein percentage. However, Kamar *et al*. (1985) found a negative correlation between the milk yield and its content of fat, protein and total solids in doe rabbit milk.

Correlations between serum hormonal levels and semen quality

Ages significantly affect serum FSH, LH and testosterone hormones in Table 4. The hormonal FSH and LH levels were gradually decreased with age from 63 days until the age of 5 and 6 months by (40.62 and 67.40%) and (42.52 and 58.88%), respectively compared to 63 days of age. But, testosterone level was gradually increased with age of 5 and 6 months by 22.83 and 102.31%, respectively compared to 63 days of age. All semen quality results in Table (4), which are reaction time, semen volume, advance sperm motility, total sperm out, total motility out, live sperms, dead sperms and abnormalities were at normal ranges and we did not notice any strange data or abnormal results.

Data from Table (5) showed that the correlations between seminal serum FSH, LH and testosterone hormonal levels at different ages 63, 150 and 180 days and physical semen quality (semen volume, sperm concentration, advanced sperm motility, total sperm out, total motility output, live sperm, dead sperm and abnormalities). The correlations between serum FSH and LH levels were significantly affected at 63 days on semen volume and total sperm out percentages, but at 5 and 6 months were not significant affects at all hormonal levels for the same traits except for total sperm out of testosterone level at 6 months. Also, the correlations between serum FSH, LH and testosterone hormonal levels and physical semen characteristics (sperm concentration and advance sperm motility) were significantly affected at 63 days and 5 months of growing rabbits, except LH with advance sperm motility at 5 months of age. The highest correlation coefficients of FSH hormone with these traits were at 63 days of age. While, the highest correlation coefficients of testosterone hormone with these traits were at 5 month of age and only testosterone level at 6 months was correlation coefficient with sperm concentration compared to FSH and LH levels at the same age. Also, in Table (6) the correlation coefficients between serum LH level at 63 days of age and testosterone level at 6 months with total motile output were significantly affected. In contrast, the correlations between serum FSH level and with semen volume (Fig. 3), sperm concentration (Fig. 4), advanced sperm motility (Fig. 5), total sperm output (Fig. 6), live sperm (Fig. 7), dead sperm (Fig. 8) and abnormalities were significantly affected at 63 days of age.

The results indicated that all the physical semen characteristics were significantly ($P<0.05$) correlations with levels of LH, FSH and testosterone hormones at 63 days of age. These enhancements were parallel to an increase in blood serum testosterone concentrations at 63 days of age. It can be observed from the results presented in Table (4) and Fig 3, 4, 5, 6, 7 and 8 that FSH level at the age of 63 days was more correlated coefficient with semen quality characteristics especially with semen volume, semen concentration and total sperm output compared to levels of LH and testosterone hormones, and it can consider a good indication of semen quality for rabbit bucks at sexual maturity.

The ranges for semen parameters obtained (Table 4) were similar to those obtained by Alvariño (2000), Al-Sobayil & Khalil (2002) and Castellini *et al.* (2003). García-Tomás *et al.* (2006) found marked differences in the overall means only for line V but not for the other semen characteristics in line R raised in Spain. It is known that libido is controlled by various factors such as sexual pheromones, nervous system, hormones, among which, the hypothalamus-pituitary-testis axis is very important (Yang *et al*., 2005). Testosterone and estradiol, act synergistically to stimulate male sexual behavior and improve the copulatory behavior (Gado *et al*., 2015). Changes in FSH and LH levels in exposed male rabbits to heat stress may be involved in such alterations in semen quality (El-Sherry *et al*., 1980). Correlation coefficients between seminal hormonal levels and physical semen characteristics in male rabbits showed that the level each of T4, T3 and testosterone had significant positive correlations with good semen characteristics (ejaculate volume, sperm motility, sperm cell concentrations, total number of sperms output and number of motile sperms per ejaculate) and had significant negative correlations with bad semen characteristics high in each of reaction time, dead sperm%, sperm abnormality% and acrosomal abnormality% (Habeeb *et al*., 2020) . Therefore, it can be used the level of any one of these hormones in detection of semen quality to predict the reproductive performance of male rabbits under different conditions and lighting regimes. From our results we found a positive correlation between the serum FSH levels at 63 days of age and semen quality characteristics in buck rabbits.

CONCLUSION

It can be concluded that the evaluation of the V line rabbit as a maternal line with high milk yield during the lactation period and that high semen quality for males V line rabbits can be predicted by high level of hormone FSH concentration at 63 days of age. By evaluating the concentration of FSH hormone at 63 days of age, it is possible to conclude that the V line rabbit as a maternal line, can be predicted to have a high milk yield of does and a high semen quality of bucks. High FSH hormone levels indicate a good semen quality of buck of V line rabbit at 63 days of age.

ACKNOWLEDGEMENTS

The authors wish to thank nucleus breeding rabbit unit of the Poultry Research Center, Poultry Department, Faculty of Agriculture, Alexandria University, Egypt for providing the experimental lines of rabbits and supervising the experiment. The authors gratefully acknowledge all team research assistants and laboratory technicians for their technical scientific researchers.

Table (1): Number of records, means and standard errors for unadjusted individual milk yield (g) of V line doe rabbits

Milk yield	Number of does	Mean ± SE
7^{th} Day	77	113.06 ± 4.93
14^{th} Day	70	172.87 ± 6.41
21^{st} Day	70	211.76 ± 10.6

Table (2): Means and standard errors for the effect of kindling month, parity number and number born alive on milk production of V line doe rabbits

KM	**7^{th} Day**		**14^{th} Day**		**21^{th} Day**	
	LSM	**SE**	**LSM**	**SE**	**LSM**	**SE**
October	115.59	6.20	145.88^{cd}	7.32	207.62	11.93
November	102.93	6.09	174.60^{b}	8.21	230.00	14.49
December	120.13	4.63	183.08^{a}	5.39	196.05	9.05
January	115.06	6.63	140.85^{d}	7.80	207.67	12.99
February	110.96	7.86	163.04^{bc}	10.84	252.90	16.51
March	102.51	6.75	162.93^{bc}	8.48	207.40	14.16
April	103.39	12.16	158.00^{c}	17.24	214.91	28.76
P-value	NS		***		NS	
PN	7^{th} Day		14^{th} Day		21^{th} Day	
	LSM	SE	LSM	SE	LSM	SE
1	91.76^{c}	5.12	175.06^{b}	6.51	213.44^{b}	10.78
2	113.19^{b}	5.00	179.91^{ab}	5.90	192.64^{c}	9.79
3	109.42^{b}	6.74	153.09^{c}	8.81	213.16^{b}	13.94
≥4	125.95^{a}	4.42	182.44^{a}	5.74	247.36^{a}	9.98
P-value	**		*		***	
NBA	7^{th} Day		14^{th} Day		21^{th} Day	
P-value	***		***		***	

[a,b,c,..] Means in the same column having different superscript letters are significantly different at P<0.05. KM, kindling month; PN, parity number; NBA, number born a live NS = Not Significant, * P ≤ 0.05, ** P ≤ 0.01, *** P ≤ 0.001

Table (3): Chemical composition as dry matter of rabbit milk depending on the lactation stage in V line rabbits

Traits	Lactation period at 2nd day	Lactation period at 17th day
pH	6.92	7.38
Moisture (g/ 100 g)	66.06	70.15
Total solids (g/ 100 g)	33.94	29.85
Ash (g/ 100 g)	1.70	2.06
Protein (g/ 100 g)	13.87	12.45
Fat (g/ 100 g)	16.43	12.72
Lactose (g/ 100 g)	1.94	2.62
Solids not fat (g/ 100 g)	17.51	17.13
Energy (MJ/ Kg)	9.34	8.45

Table (4): Means and standard errors for unadjusted individual sex hormone levels and semen quality traits in V –Line rabbits

Traits	Mean ± SE	Min.	Max.
Serum hormonal levels:			
FSH at 63 days	5.49 ± 0.04	5.15	5.74
FSH at 5 months	3.26 ± 0.02	3.11	3.39
FSH at 6 months	1.79 ± 0.04	1.54	2.22
LH at 63 days	2.14 ± 0.03	1.89	2.30
LH at 5 months	1.23 ± 0.04	1.05	1.67
LH at 6 months	0.88 ± 0.02	0.71	1.12
Testosterone at 63 days	3.46 ± 0.09	2.84	4.25
Testosterone at 5 months	4.25 ± 0.09	3.76	5.15
Testosterone at 6 months	7.00 ± 0.27	4.77	8.50
Semen quality:			
Reaction time, sec	19.96 ± 0.45	16.60	24.30
Semen volume, ml	0.93 ± 0.03	0.72	1.12
Sperm concentration, 10^6/ ml	384.70 ± 2.48	364.00	405.00
Advanced sperm motility, %	74.85 ± 1.37	64.30	84.50
Total sperm output, 10^6/ ejac	365.20 ± 2.15	345.00	380.00
Total motile output, 10^6/ ejac	306.35 ± 4.38	270.00	338.00
Live sperm, %	85.8 ± 0.77	80.20	93.40
Dead sperm, %	14.21 ± 0.77	6.60	19.80
Abnormalities, %	11.89 ± 0.54	7.80	16.50

FSH, Follicle Stimulating Hormone; LH, Luteinizing Hormone

Table (5): Correlation coefficients with significance between gonadotropins and testosterone hormones levels and semen quality traits of V line rabbits at 63 days of age.

Semen Quality	FSH (IU/L)	LH (IU/L)	Testosterone (ng/ml)
Semen volume, Ml	0.61 **	0.51 *	0.36 NS
Sperm concentration, 10^6/ ml	0.79 ***	0.75 ***	0.64 **
Advanced sperm motility, %	0.73 ***	0.47 *	0.63 **
Total sperm output, 10^6/ ejac	0.45 *	0.56 **	0.34 NS
Total motile output, 10^6/ ejac	0.40 NS	0.54 *	0.33 NS
Live sperm, %	0.45 *	0.29 NS	0.43 NS
Dead sperm, %	- 0.45 *	- 0.29 NS	- 0.43 NS
Abnormalities, %	- 0.45 *	- 0.33 NS	- 0.32 NS

NS = Not Significant, * $P \leq 0.05$, ** $P \leq 0.01$, *** $P \leq 0.001$

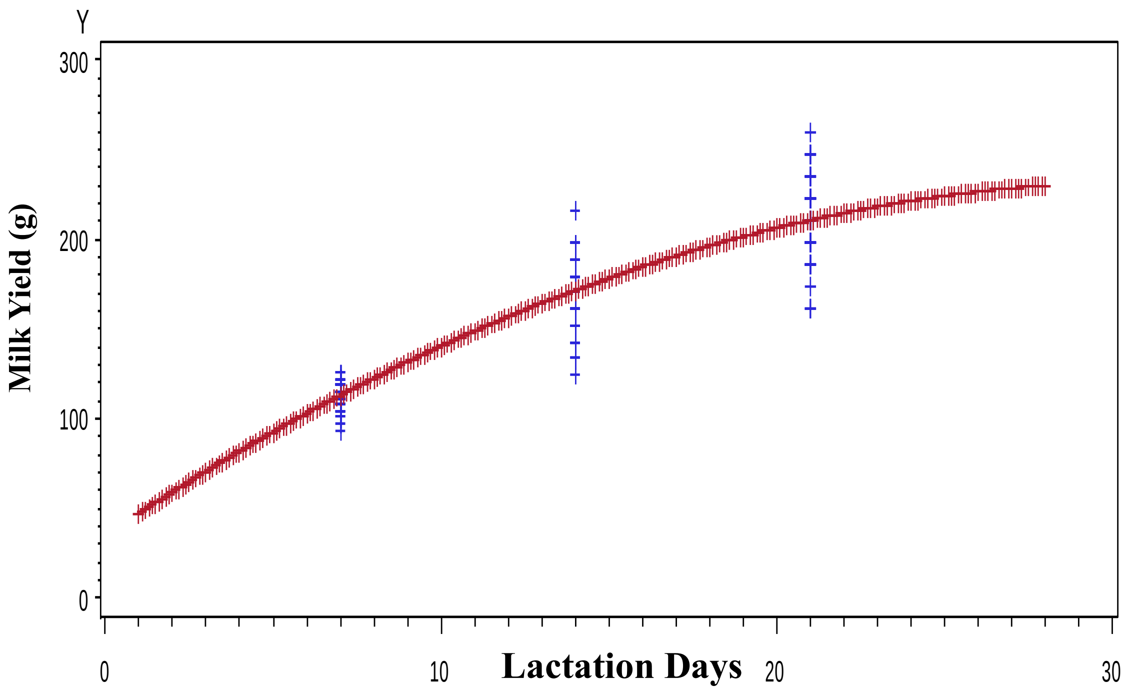

Fig. (1): Milk yield curve in the different lactation days of V line does rabbits

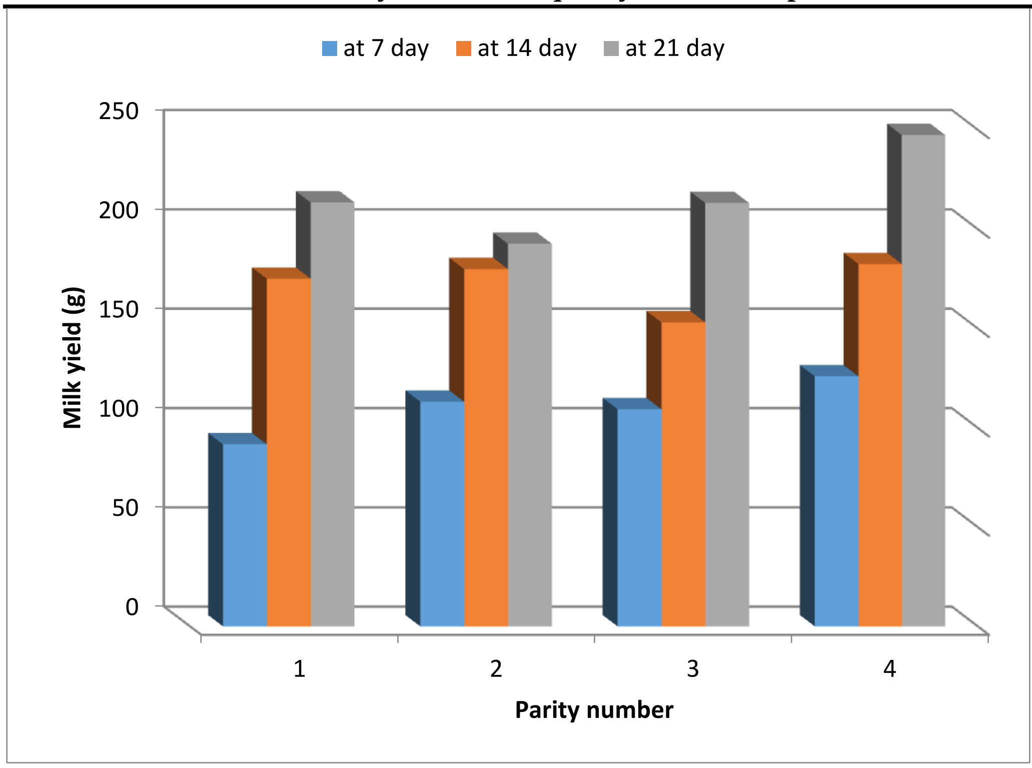

Fig. (2): Means for individual milk yield at 7, 14 and 21 days by parity number of V line does rabbits

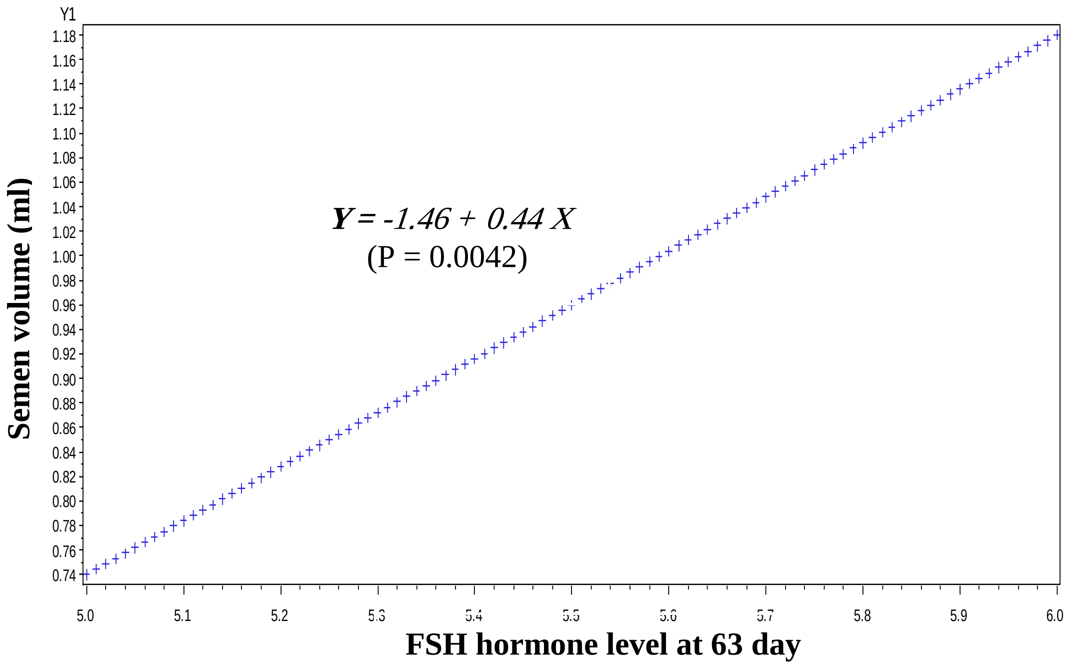

Fig. (3): Trend of semen volume at 6 months on FSH level at 63 day of age in V line rabbit bucks

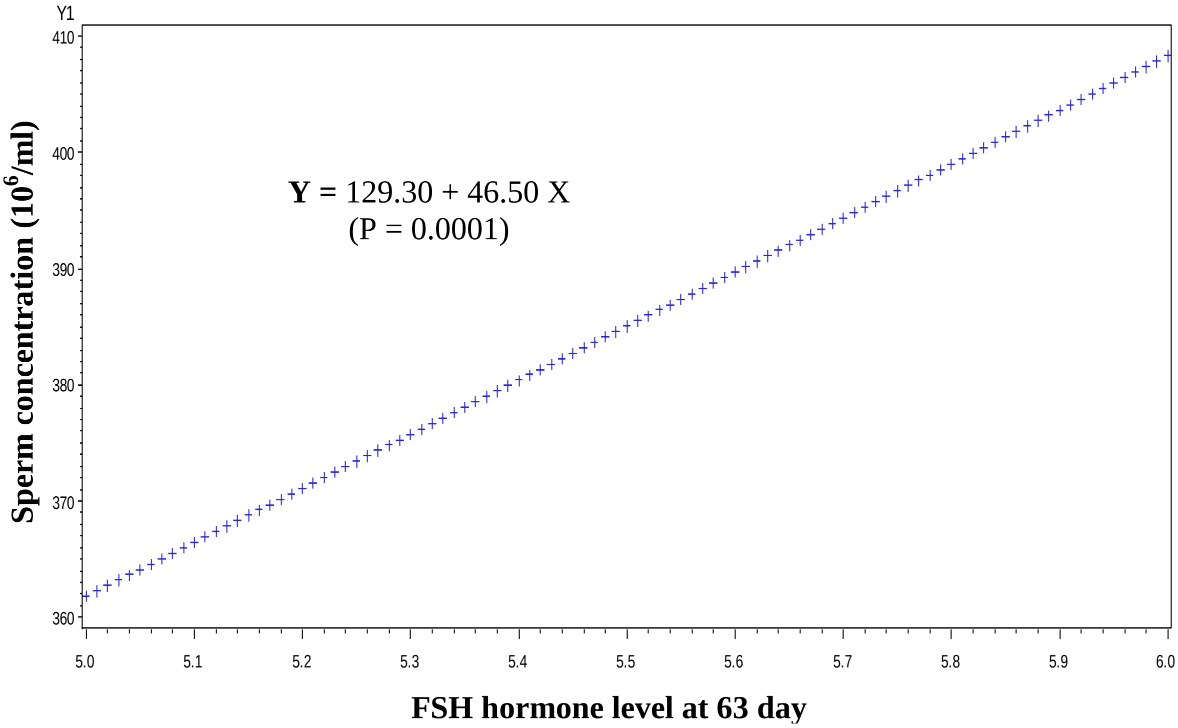

Fig. (4): Trend of sperm concentration at 6 months on FSH level at 63 day of age in V line rabbit bucks

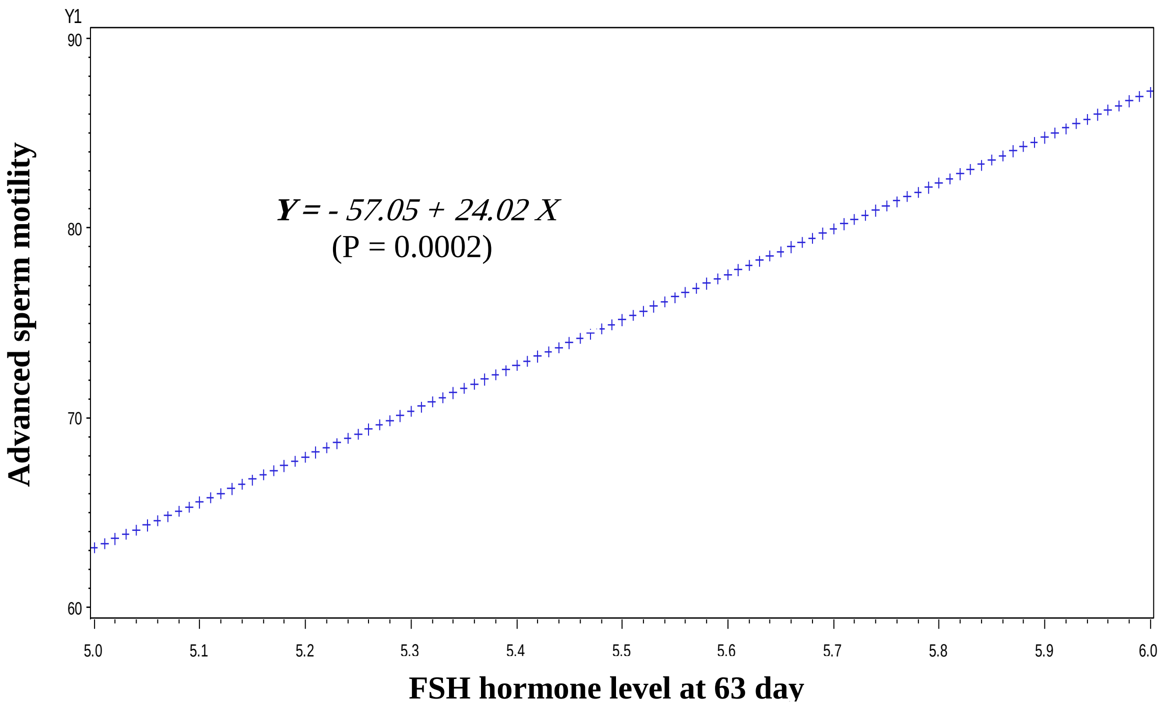

Fig. (5): Trend of advanced sperm motility at 6 months on FSH level at 63 day of age in V line rabbit bucks

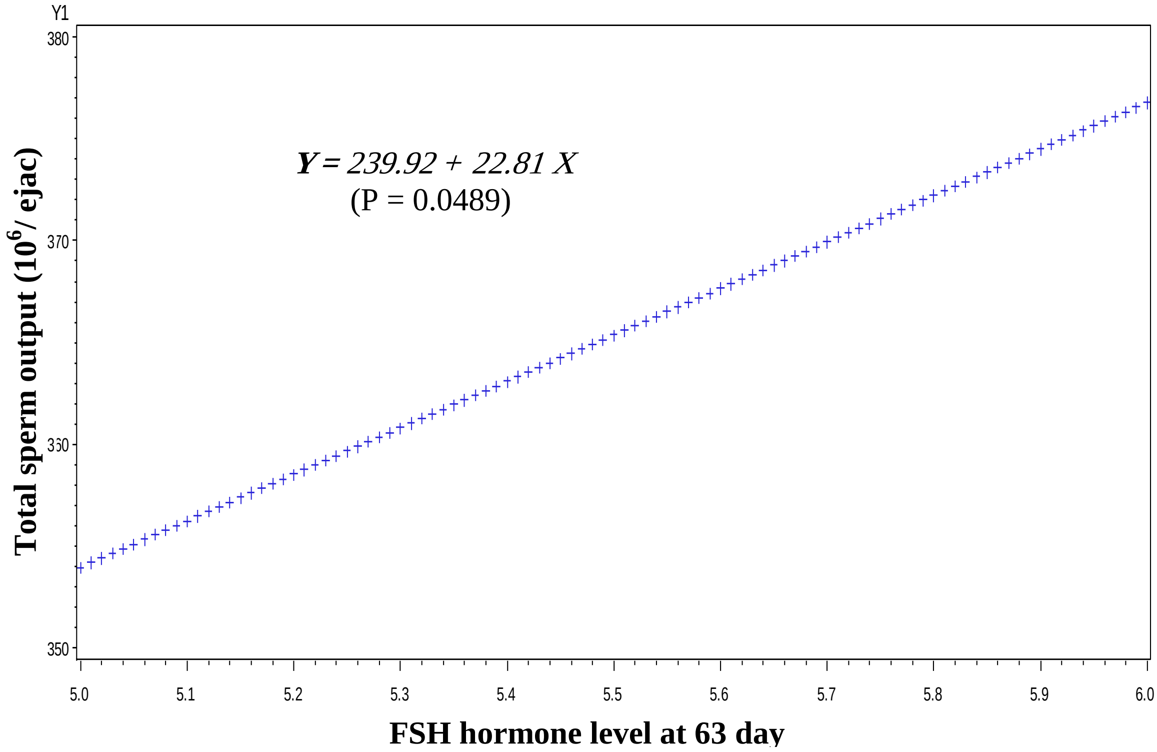

Fig. (6): Trend of total sperm output at 6 months on FSH level at 63 day of age in V line rabbit bucks

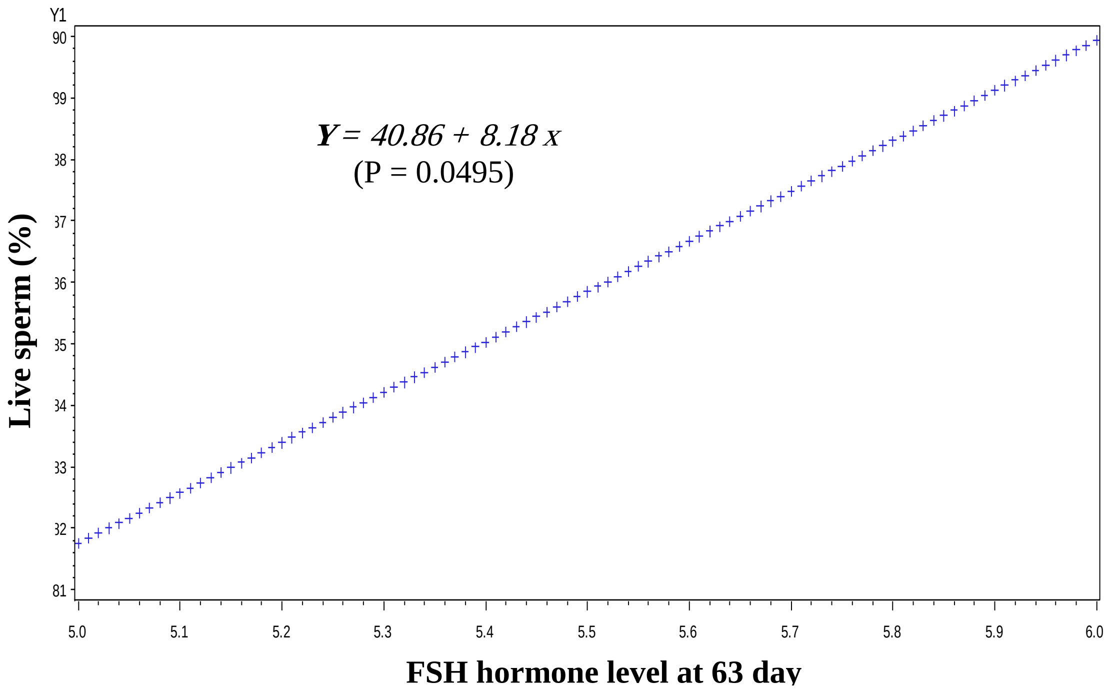

Fig. (7): Trend of live sperm at 6 months on FSH level at 63 day of age in V line rabbit bucks

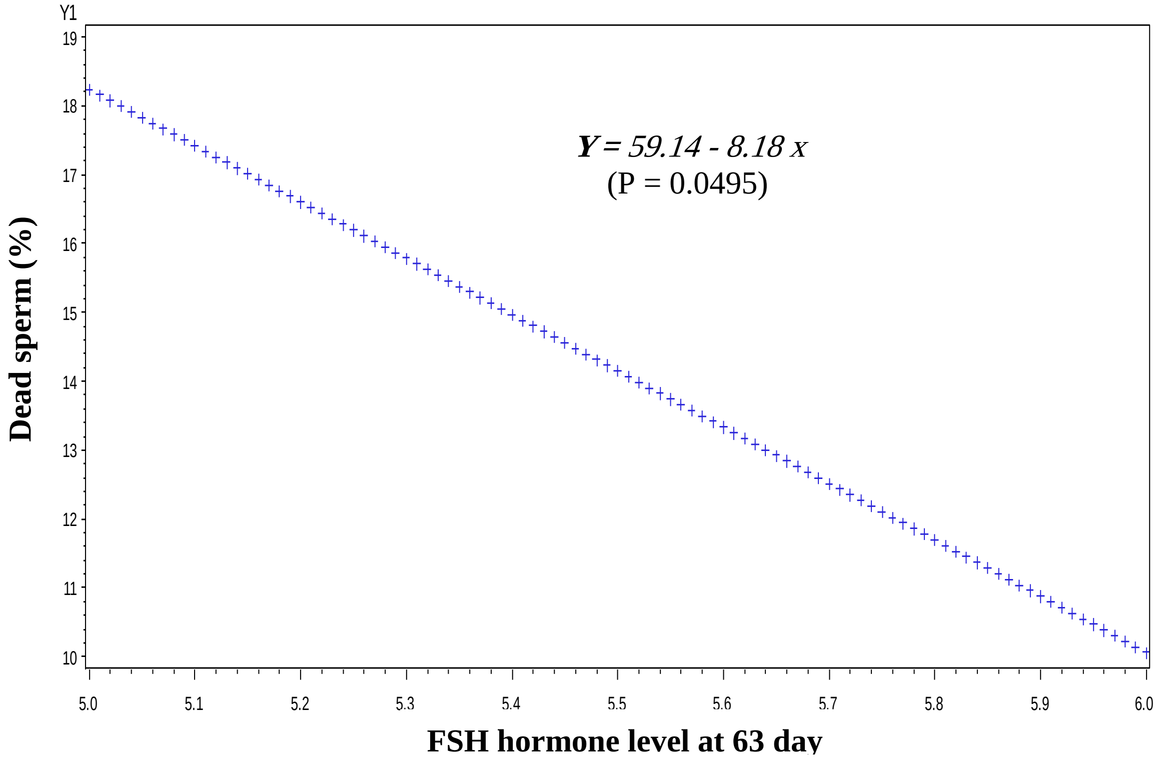

Fig. (8): Trend of dead sperm at 6 months on FSH level at 63 day of age in V line rabbit bucks

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الملخص العربي

تقييم إنتاج اللبن وجودة السائل المنوى لخط أرانب أموي

أنتصار محمود علي[١]، مصطفي شبل[٢]، علاء الرفه[٢]، أحمد محمد عبد الهادي[٢]،
أميرة سليمان الدغيدى[١]
[١] معهد بحوث الإنتاج الحيواني، مركز البحوث الزراعية، القاهرة، مصر
[٢] قسم إنتاج الدواجن، كلية الزراعة، جامعة الأسكندرية، الأسكندرية (٢١٥٤٥)، مصر

الملخص: الهدف من هذه الدراسة هو تقييم إنتاج اللبن وراثيا لخط ارانب أموي (V line) وكذلك جودة السائل المنوي لذكور نفس السلالة. تم إستخدام عدد ٧٧ و ٧٠ و ٧٠ من الأمهات لتقدير إنتاج اللبن المقدر من تاريخ الولادة وحتى عمر الفطام وذلك فى أيام اليوم ٧ و١٤ و٢١ من العمر بعد الولادة، على التوالي لأكثر من ٤ بطون. تم اختيار ٢٠ ذكرًا من أرانب خط V عمر ٦٣ يومًا وتم جمع عينات دم لتحديد تركيزات هرمونات LH و FSH وهرمون التستوستيرون في الدم، وعند عمر ٥ و ٦ أشهر تم أخذ عينات دم أخرى من نفس الذكور لتقدير نفس الهرمونات وجمعت عينات سائل منوي لتقييم جودة السائل المنوي للذكور.

لوحظ أن إنتاج اللبن خلال أسابيع الرضاعة المختلفة كانت ١١٣.٠٦ و ١٧٢.٨٧ و ٢١١.٧٦ جرام وذلك في اليوم ٧و ١٤و ٢١ بعد الولادة على التوالي. يُلاحظ أن تأثير شهر الرضاعة لم يكن له تأثير معنوي على إنتاج اللبن في اليومين الـ ٧و ٢١ من فترة الرضاعة ، بينما تأثر بشكل معنوي في اليوم ١٤ من فترة الرضاعة ، وكان شهر ديسمبر أعلى معدل للإنتاج اللبن في شهور السنة الإنتاجية. إن معامل الارتباط بين مستويات الهرمونات في سيرم الدم FSH و LH وهرمون التستوستيرون وبين تركيز الحيوانات المنوية وحركة الحيوانات المنوية المتقدمة كان تاثيرة معنوياً عند ٦٣ يوم. لكن العلاقة بين مستويات FSH و LH في سيرم الدم أثرت بشكل كبير عند ٦٣ يومًا على حجم السائل المنوي ونسب خروج الحيوانات المنوية. في المقابل ، فإن العلاقة بين مستوي هرمون FSH وحجم السائل المنوى والحيوانات المنوية الحية والحيوانات المنوية الميتة ونسب الحيوانات المنوية غير الطبيعية قد تأثرت بشكل كبير عند عمر ٦٣ يومًا. لوحظ أن مجموعة الذكور ذات التركيزات المرتفعة من تركيزات هرمونات LH و FSH وهرمون التستوستيرون عند عمر ٦٣ يومًا ارتبطت بزيادة في تركيزات هرمون التستوستيرون عند ٥ و ٦ أشهر ونوعية السائل المنوي. باختصار، يمكن ملاحظة أن تقييم الأرنب خط V كخط أموي ذو إنتاجية عالية من اللبن خلال فترة الرضاعة وأن جودة السائل المنوي لذكور خط V يمكن التنبؤ بها بمستويات عالية من الهرمونات LH و FSH وتركيزات التستوستيرون عند عمر ٦٣ يومًا.

الكلمات الدالة: أرانب - خط أموي - إنتاج اللبن - جودة السائل المنوى - الهرمونات الجنسية - معامل الارتباط