The addition of selenium and vitamin E to the diet and its effect on body weight, semen characteristics and testosterone in V-line breed rabbits

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ABSTRACT:

This research aims to study the effect of dietary of selenium and vitamin E on body weight and reproductive performance in rabbit. A total of 80 male rabbits at two months age and average of initial live body weight was 2.27 kg. Animals were separately housed in wire-cages. The light-dark period was controlled to be 16 h of light and 8 h of darkness. The animals were randomly assigned to the following: four experimental treatments (n=20 each): T1: Control group that fed basal diet, T2: Fed basal diet + 0.1 mg organic Se / kg diet, T3: Fed basal diet + 40 mg α-tocopherol acetate / kg diet and T4: Fed basal diet + 40 mg α-tocopherol acetate / kg diet + 0.1 mg organic Se/kg diet. The diet contains 18% protein, 2850 kcal. These measurements recorded body weight, semen collection and evaluation, ejaculate volume, mass motility, percentage of progressive sperm motility, percentage of dead sperm (%), percentage of abnormal spermatozoa (%), acrosomal damages, hypo-osmotic swelling (HOS-test) reacted spermatozoa (%), and testosterone hormone concentration. The results can summarize the changes of averages body weight that were not significant among treatment, while means of ejaculate volume, the percentage of mass motility, acrosome damages, progressive motility, and testosterone levels were significantly the highest (P<0.05). The percentage of dead sperms, percentage of abnormalities, HOS-test, was significantly the lowest in treatment group. From this study, it is recommended to add selenium and vitamin E to the diet of rabbits.

Keywords: Rabbits, Body weight, Semen characteristics, Testosterone, Reproductive performance.

INTRODUCTION

Rabbit breeding is one of the most successful investment projects, especially in recent years because rabbits are characterized by abundant production and rapid growth than other animals. Rabbits can be relied upon to fill the shortage of meat due to their rapid growth rate and short generation period (Eman 2019 and Ayyat et al. 2021). The V-line rabbit strain is a modern Spanish breed that was imported and bred in Egypt due to its high growth rate. This strain was selected in 1982 in the Department of Animal Sciences, University of Politecnica, Valencia, Spain. based on the litter size (Estany et al. 1989). In recent years, Egyptian farms have shown increasing interest in using foreign rabbits such as the V-line breed to increase rabbit meat production (Abdel-Khalek et al. 2019).

The addition of micro-mineral elements in animal diets is important for growth, reproductive and productive performance, in addition to its importance in improving the function of the immune system (Kassim et al. 2022). Some researchers reported that no effect of selenium on growth, thus, there is no effect on body weight in rabbits (Dokoupilová et al. 2007 and Marounek et al. 2009). However, other studies indicated that dietary supplementation of vitamin E organic, selenium and their combination resulted in higher body weight (Ebeid et al. 2013 and Safan 2016). These differences may be due to the type of breed used in the research or to differences in the conditions in which the research was conducted.

Vitamin E is a nutrient that helps improve sperm condition and development of the male reproductive system in mice and goats (Rao and Sharma 2001 and Hong et al. 2009), and the diameter of the seminiferous tubules in rats (Momeni et al. 2012). Moreover, previous studies had showed that vitamin E has a good influence on sperm motility and the volume of semen (Yousef et al. 2003 and Yue et al. 2010). Selenium is important as it works to increase semen (Yousef et al. 2003 and Yue et al. 2010). Selenium plays major roles for spermatogenesis and maintaining sufficient viability of spermatozoa and had ability to diminishing abnormalities of spermatozoa through direct effect on raise antioxidant status (Ebeid 2009) and its deficiency results in deterioration sperm motility and morphological abnormalities in rodents (Kehr et al. 2009). The present study aims to evaluate effect of dietary that includes organic selenium, vitamin E and their combination on body weight, physical of semen characteristics and testosterone.
MATERIALS AND METHODS

Duration and location of study:

The herein experimental work was carried out in the experimental rabbit flock maintained by the Department of Animal Production, Faculty of Agriculture, Al-Azhar University in Nasr City, Cairo, Egypt. This work started from mid of November 2020 to near the end of March 2021.

Animals housing and management:

Rabbit V-line breed was used in this study. This purebred V-line was obtained from one of the private sector companies (Doctor Rabbit Farms), Gharbia Governorate, Egypt. A total of 80 male rabbits at two months age and average of initial live body weight was 2.27 kg. All animals were healthy and clinically free of external and internal parasites. Rabbits males were raised in a semi-closed place of 160 m² (8 m width and 20 m length) with wire-netted windows opened on the eastern and western sides to receive natural ventilation. Animals were separately housed in wire-cage with standard dimension of 60 × 35 × 35 cm: long, width, and height in respectively. The design of cages was arranged in double tier batteries. The light-dark period was controlled to be 16 h of light and 8 h of darkness. The maximum and minimum values of ambient temperature and relative humidity were recorded weekly at mid-day and inside the rabbit farm building throughout the experimental periods (Table 1).

Animals feeding:

Following the National Research Council (NRC 1977) and (De Blas and Wisewan 2020) recommendations, pelleted basal diets were formulated to support nutrients’ requirements (Table 2). Granular commercial rabbit feed has been obtained from one of the private sector companies (Doctor Rabbit Farms), Gharbia Governorate, Egypt.

Experimental design:

The animals were randomly assigned to the following four experimental treatments (n=20 each):

T1: Control group that fed basal diet
T2: Fed basal diet + 0.1 mg organic Se / kg diet.
T3: Fed basal diet + 40 mg α-tocopherol acetate / kg diet.
T4: Fed basal diet + 40 mg α-tocopherol acetate / kg diet + 0.1 mg organic Se/kg diet).

Obtained of vitamin E (α-tocopherol) acetate from Adisseo company, Antony, France. Organic selenium in the form of selenomethionine produced by Saccharomyces cerevisiae (Selenized yeast inactivated) from Lallemand company, Blagnac, France.

Body Weight:

Changes in live body weight were recorded weekly individually using a digital scale before the morning feeding throughout the experimental period.

Semen collection and evaluation:

Semen samples were collected once a week for 8 successive weeks where 160 ejaculations from all treatments were randomly collected at a rate of five samples from each group and that using artificial vagina (AV). The collected semen samples were immediately assessed microscopically after removing gel clot (without any gel-mass). To measure physical semen characteristics (ejaculate volume, wave motion, progressive liner motility, sperm concentration, live and abnormal spermatozoa and total sperm output) according to El-Gaafary (1987).

Ejaculate volume:

Semen volume was determined in milliliter directly after collection using a measuring cylinder, with gradations of 0.1 mL-15 mL units attached to the artificial vagina (AV), after removal of the gel portion. (Carrillo-González and Hernández 2016). The reading was taken by direct observation of the transparent semen collection tube

Sperm concentration (<10%/mL):

The sperm concentration count using by hemocytometer were estimated according to (Khadr et al. 2015).

Mass motility:

Mass activity was scored subjectively according to the intensity of the wave motion seen in the medium by the collective activities of spermatozoa, from the absence of wave motion to very turbulent motions according to Plasson (1975) using the following scales as the guideline:

<table>
<thead>
<tr>
<th>Scales</th>
<th>Motility</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Above 80 %</td>
</tr>
<tr>
<td></td>
<td>Motile spermatozoa (Excellent)</td>
</tr>
<tr>
<td>4</td>
<td>60 to 80 %</td>
</tr>
<tr>
<td></td>
<td>Motile spermatozoa (Good)</td>
</tr>
<tr>
<td>3</td>
<td>40 to 60 %</td>
</tr>
<tr>
<td></td>
<td>Motile spermatozoa (Fair)</td>
</tr>
<tr>
<td>2</td>
<td>20 to 40 %</td>
</tr>
<tr>
<td></td>
<td>Motile spermatozoa (Oscillating)</td>
</tr>
<tr>
<td>0</td>
<td>0 to 10%</td>
</tr>
<tr>
<td></td>
<td>Motile spermatozoa (non-motile)</td>
</tr>
</tbody>
</table>
Percentage of progressive sperm motility:

The individual motility of the sperm was measured as indicated by Ajam et al (1990).

Percentage of dead sperm (%):

The eosin/nigrosine staining procedure was carried out by dissolving 1.67 gm eosin and 10.0 g nigrosine in 100 mL distilled water according to Hackett and Macpherson (1965).

Percentage of abnormal spermatozoa (%):

The morphological abnormalities of spermatozoa (%) were determined in the same smear prepared for live/dead spermatozoa ratio under oil immersion using x1000 objective of a light microscope.

Acrosomal damages:

Acrosome integrity was assessed using Giemsa staining procedure (Watson 1975).

Hypo-osmotic swelling (HOS-test) reacted spermatozoa (%):

Spermatozoa with intact membranes were identified by changes in the shape of the cell, as indicated by coiled tail according to (Zeidan et al. 2008), and only those sperm having a curling tail were HOS-test positive.

Testosterone hormone concentration:

It is intended to use immunoassay for the in vitro quantitative determination of testosterone in serum and plasma. The electrochemiluminescence immunoassay “ECLIA” is intended for use on Elecsys and Cobas® immunoassay analyzers (Roch Diagnostics®, E 170 electrochemiluminescence immunoassay (ECLIA) Mannheim, Germany) according to (Wheeler 1995).

Statistical analysis:

All results were statistically analyzed by General Linear Models (GLM), one way analysis of variance, using SAS software (SAS, 2003). Following model: \( Y_{ij} = \mu + T_i + e_{ij} \) Where:

- \( Y_{ij} \) = Performance traits measured on the V-line rabbit in the treatment.
- \( \mu \) = Overall mean.
- \( T_i \) = Effect of treatments (i= 1, 2, 3 and 4).
- \( e_{ij} \) = Random error effect.

Differences among means were separated using Duncan’s multiple range Test (Duncan 1955).

RESULTS AND DISCUSSION

Effect of selenium and vitamin E on body weight:

Dada in Table (3) showed that the changes of averages initial and final body weight were nonsignificant between control group and rabbits in different treatments.

The results in the present study showed that dietary supplementation of selenium and vitamin E and a mixture had no positive effect on male rabbits’ growth. Similar results have been observed by Marounek et al. (2009) and Dorra et al. (2014) they found that body weight gain of growing rabbits did not significantly affect by selenium supplemented diets at level ranged from 0.8 to 0.1 mg/ kg diet. Similarly, in rabbits, Albuquerque et al. (2017) and Hosny et al. (2020) reported that there was no effect of interaction between the levels of supplementation of selenium and vitamin E on weight gain.

In contrast, these results conflict with results gained by Eiben et al. (2011) and Ebeid et al. (2013) who reported that vitamin E addition to diet of animals lead to higher body weight in rabbits. Also, Safan (2016), found that dietary supplementation of selenium and vitamin E and their combination had positive effect on growing rabbits.

Effect of selenium and vitamin E on physical semen characteristics:

Semen ejaculate volume (ml):

Data of the Table (4) showed that averages of ejaculate volume were 0.78, 0.79 and 0.85 ml for control, selenium and mixture of selenium with vitamin E groups respectively, compared to control group (0.66 ml). These results showed a significant (P < 0.05) improvement in the physical properties of semen, including semen volume of rabbits fed a basal diet fortified with vitamin E or selenium or both.

These results obtained in the present study are agreement with Hosny et al. (2020); Enrique et al. (2022) and Mohamady (2022) where ejaculation volume showed differences among treatments (p<0.05). An increase in semen volume may be a reason for the increase in fluid seminal. In rams‘ secretion of testosterone that affects the secretory activity of the late sex glands (Bearden and Fuquay 1997). There is a contribution of some minerals, including selenium, to increasing the activity of the sexual glands following the male reproductive system, including the prostate gland and the vesicular gland (Underwood
s to a decrease in sperm
ences in total and progressive
testicular development, and selenium
Abundant sperm production also depends on
improved spermatogenesis (Behne et al. 1996).
Selenium (Brzezińska 2019) is involved in the growth and
development of testicular tissue resulting in
improvement in semen oxidative stability
(Wang and Wang 2008), possibly due to the
addition of vitamin E (Asl et al. 2018) in the
roosters’ diet.

By contrast, other studies have shown
different results (Mohamed and Abd al-
Rasheed 2017) that observed that
supplementing rations with high levels of
vitamin E did not affect both semen volume
and sperm concentration. Also, Castellini et al.
reported that supplementation of vitamin E in
the diet of rabbits did not affect both semen
volume and sperm concentration.

Sperm concentration (×10^6/mL):

Data available in Table (4) showed that the
average sperm concentration were 366.48,
474.65, 451.48 and 514.55×10^6/mL for control,
selenium, vitamin E and they’re its
combinations, respectively. The lowest values
were noticed for control group than other
treatment groups. The highest results were
recorded by the T4 group. Statistically there
were significant difference among treatment
groups except for rabbits treated with
selenium or vitamin E only, they did not differ
significantly.

In this study, the findings on (T2, T3 and
T4) treatments sperm concentration in rabbits
were like findings by (Hosny et al. 2020) and
Baker et al. (2021), in that selenium and
vitamin E increased sperm number per
ejaculate. Also, the results of this study agree
with El-Sheshawy et al. (2014); Sharaf et al.
(2019) and Mohamady (2022).

The increased concentration of sperm in
animals supplemented with both vitamin E
and selenium may be due to this, but both
vitamin E and selenium act against oxidation
from free radicals that damage sperm
(Brzezińska-Ślebodzińska et al. 1995).
Selenium is involved in the growth and
development of testicular tissue resulting in
improved spermatogenesis (Behne et al.1996).
Abundant sperm production also depends on
the availability of selenium needed for
testicular development, and selenium
deficiency leads to a decrease in sperm
concentration (Liu et al., 1982). Vitamin E and
selenium stimulates Leydig cells to
testosterone biosynthesis of testes by
stimulating the anterior pituitary hormones
secretion and increase testicular cholesterol
content (Abdel-Hasseb et al. 2004) Vitamin E
and selenium are involved in the synthesis and
production of prostaglandins (Ahmed et al.
2001), prostaglandin Fα administration has
increased the number and motility of
spermatozoa in farm animals (Haif et al. 1974).

Total and progressive motility (%):

The data in table (4) explained the
percentage of mass motility were 79.00, 76.63
and 81.88% for animals’ supplplantation with
selenium, vitamin E and their combinations,
respectively compared to control group
(72.38%). Also, the present study showed the
same trend of the progressive motility which
were 82.62, 81.12 and 85.87% for animals’
supplantation with selenium, vitamin E and
their combinations, respectively compared to
control group (78.12%). In the present study,
the differences in total and progressive motility
that were significantly (P<0.05)
affected by the treatments, are agreement with
that obtained by Mohamad and Abdul Rashid
(2017); Butt et al. (2019); Raouf and Taha
(2021); Baker et al. (2021) and Shabani et al.
(2022).

Many studies agreed with this study which
showed the importance of vitamin E and
selenium in increasing both total and
individual motility, as vitamin E plays an
important role in protecting the cell membrane
from peroxides, and from unsaturated fatty
acid peroxides (Baker et al. 2021). It has been
confirmed that vitamin E plays an important
role in providing energy for sperm motility by
improving the efficiency of mitochondria
located in the midsection of the sperm (Ener et
al. 2016).

Dead sperms (%):

The results in the present study Table (4)
showed that the differences of dead
spermatozoa percentage are significant among
treatment groups. The lowest percentage of
dead sperms was found in rabbits of treatment
by selenium plus vitamin E (12.20%) compared
by other treatments, while there was no
significant difference between rabbits of
treatment by only selenium or vitamin E (16.60
and 17.23% respectively). However, all
treatments were significantly compared to the
control group (20.13%).
The percentage of dead sperm in this study were consistent with archived by (Domosławska et al. 2018; Hosny et al. 2020 and Mohamady 2022). They explained that this decrease in the percentage of dead spermatozoa is due to the function of vitamin E and selenium in increasing sperm vitality and may also be due to the function of vitamin E in protecting the sperm plasma membrane from the harmful effects of unsaturated fatty acid peroxides. They also noted that selenium has a role in maintaining the integrity of sperm (Baker et al. 2021).

On the contrary, there was no difference between treatments regarding the percentage of live sperm (Enrique et al. 2022). Similarly, (Daramola et al. 2016) did not notice any effect of vitamin E and selenium in improving the quality of semen, and the reason for this may be due to the conditions of the experiment on the one hand and to the experimental animals on the other.

Abnormal Sperms (%):

The averages percentage of abnormalities sperm are shown in Table (4). These results show that treatment by selenium plus vitamin E had lower significant (p< 0.05) percentage of abnormalities (14.88%) compared to control group (18.28%), but there were no significant differences in case of comparison to treatment by only selenium (16.60%) or vitamin E (15.63%).

The percentage of abnormalities sperm in the present study are closed with those reported by (Hosny et al. 2020; Baker et al. 2021; Mohamady 2022 and Sabzian-Melei et al. 2022). Flohé (2007) indicated that selenium acts as a cofactor for the enzyme glutathione peroxidase (GSH-Px), which leads to the elimination of peroxides of unsaturated fatty acids. Therefore, selenium deficiency leads to abnormalities in the function of testicular tissues, resulting in abnormalities of spermatozoa. Selenium deficiency has been associated with decreased reproductive performance and decreased sperm quality as produces abnormal sperm shapes, structural abnormalities (Baiomy et al. 2009) in rams.

These results agree with Mahmoud et al. (2013) who reported that vitamin E has a role in reducing the rate of sperm abnormalities. Mohamady (2022) found that the lowest values of abnormal spermatozoa percentages were obtained with NZW buck rabbits fed basal diet and treated with Nano-selenium plus vitamin E when compared with the other treatment groups. These results agree with those obtained by El-Sheshawy et al. (2014) who reported that 0.10 mg selenium/kg live body weight and / or 1.35 IU vitamin E /kg Live body weight administration significantly improved semen characteristics with advance of time as indicated by decreased incidence of sperm abnormalities. The improved characteristics are more obvious for those bucks injected simultaneously with selenium and vitamin E.

Acrosome damages (%):

The results in the present investigation revealed that acrosome damages influenced significantly (P< 0.05) on rabbits which were treated by selenium coupled vitamin E (14.88%) compared to other treatments where acrosome damage was 18.73, 17.35 and 16.40% in control groups and rabbits treated by only of selenium or vitamin E, respectively (Table 4).

This study is consistent with that reported by Zhu et al. (2015) and Hosny et al. (2020) in rabbits. It found a decrease in the percentage of spermatozoa with damaged acrosomes in rabbits whose diets were supplemented with selenium. This decrease in sperm with damaged acrosomes may be since both vitamin E and selenium have a function as antioxidants, and therefore could eliminate free radicals that deform spermatozoa (Baker et al. 2021).

Hypo-osmotic swelling (HOS-test) test:

Statistically, HOS-test was significantly different among groups of treatment rabbits (Table 4). The lowest significantly percentage was obtained in control group (78.08%) than in treatment animals by selenium and by selenium plus vitamin E (81.78, and 84.83%), respectively, while no significant different between control group and rabbits treated with vitamin E (80.30%) or between of rabbits treated only with selenium or vitamin E.

It is worth noting that the HOS-test is not rigorous in predicting sperm fertility, but the test helps in identifying the percentage of mature spermatozoa. Hypo-osmotic swelling test is a simple and method that provides useful information on the functionality of plasma membranes and determine the ability of the sperm membrane to maintain equilibrium between the sperm cells and its environment (Neild et al. 2000 and Pajovic et al. 2016).

The percentages of sperms with swollen head and coiled trails in response to HOS-test are in good agreement with those observed in
white New Zealand rabbit (Daader and Seleem 2005 and Safaa et al. 2008b). It also agrees with that observed in rabbit A-line and R-line (Safaa et al. 2008a) and in V-line rabbits (Hosny et al. 2020).

Worse HOS-test results correlated with lower levels of carnitine and selenium, and vice versa (Pajovic et al. 2016). It was also mentioned that selenium and carnitine play an important role in improving fertility by improving the integrity and morphology of sperm membranes, which can be presented as a positive HOS-test. Easa et al. (2013) they concluded that the response of rabbit sperm to the hypo-osmotic swelling test was a good indicator of the reproductive capacity of rabbit males under which the sperm that shows better motility results can be used or survive as a good indicator of ability to fertilize.

**Effect of selenium and vitamin E on plasma testosterone hormone concentrations**

The values of Table (4) showed a significant sudden increase (P<0.05) in testosterone levels where it was the lowest level in the control group (1.35 ng / ml) and the highest concentration in the group which diet was added as a mixture of selenium in addition to vitamin E (5.74 ng / ml), while there was no significant difference between the group of rabbits fed only vitamin E (2.99 ng/ml) or selenium (3.67 ng/ml).

These results agreed with Majeed and Al-Khashab (2019); Hosny et al. (2020) and Mohamady (2022) as they found vitamin E and selenium supplementation significantly improved testosterone levels in the blood. Also, the result in the present study is close to similar response detected by El-Sisy et al. (2008) and Ibrahim and Mohamed (2018) in male Baladi goats, and Abdel-Wareth et al. (2019) and Mohamady (2022) in rabbit bucks.

That improvement in the level of testosterone hormone in the blood plasma of V-line rabbits fed with vitamin E and selenium as antioxidants. To protect the Leydig cells responsible to produce testosterone from oxidative stress due to oxidants (Swathy et al. 2006) confirmed that there is a high and significant correlation between selenium deficiency and low testosterone levels. And the lack of vitamin E and selenium leads to a weakening of the ability of testicular tissues to synthesize steroid hormones from cholesterol.

**CONCLUSION**

It is concluded that a diet containing supplements such as selenium and vitamin E, and in particular a mixture of them could improve the health status of rabbit bucks, leading to substantial improvements in physical of semen characteristics then subsequent improving in the reproductive performance.

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Table 1: Ambient temperature, relative humidity during the experimental treatments.

<table>
<thead>
<tr>
<th>Treatment period</th>
<th>AT (°C)</th>
<th>RH (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15th November to 30th November</td>
<td>21.7</td>
<td>65</td>
</tr>
<tr>
<td>1st December to 31st December</td>
<td>20.36</td>
<td>63</td>
</tr>
<tr>
<td>1st January to 31st January</td>
<td>21.33</td>
<td>57</td>
</tr>
<tr>
<td>1st February to 28th February</td>
<td>19.35</td>
<td>44</td>
</tr>
<tr>
<td>1st March to 24th March</td>
<td>22.5</td>
<td>61</td>
</tr>
</tbody>
</table>
Table 2: Chemical analysis of the components of the basic feed used in feeding male rabbits.

<table>
<thead>
<tr>
<th>Item</th>
<th>Ingredient (g/kg)</th>
<th>Item</th>
<th>Chemical analysis (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clover hay</td>
<td>400</td>
<td>Crude protein (CP)</td>
<td>17.00</td>
</tr>
<tr>
<td>Barley grain</td>
<td>125</td>
<td>Crude fiber (CF)</td>
<td>15.43</td>
</tr>
<tr>
<td>Wheat brain</td>
<td>145</td>
<td>Ether extract (EE)</td>
<td>2.60</td>
</tr>
<tr>
<td>Soybean meal (44% crude protein)</td>
<td>180</td>
<td>Nitrogen free extract (NFE)</td>
<td>57.10</td>
</tr>
<tr>
<td>Yellow corn</td>
<td>130</td>
<td>Ash</td>
<td>9.20</td>
</tr>
<tr>
<td>Di-calcium phosphate</td>
<td>8</td>
<td>Digestible energy (kcal/kg)</td>
<td>2490</td>
</tr>
<tr>
<td>Limestone</td>
<td>5</td>
<td>Calcium (Ca)</td>
<td>1.23</td>
</tr>
<tr>
<td>DL-Methionine</td>
<td>1</td>
<td>Total phosphorus (P)</td>
<td>0.60</td>
</tr>
<tr>
<td>Sodium chloride</td>
<td>3</td>
<td>Lysine</td>
<td>0.95</td>
</tr>
<tr>
<td>Vitamins + minerals premix</td>
<td>3</td>
<td>Methionine</td>
<td>0.46</td>
</tr>
</tbody>
</table>

\(^{1}\)The vitamin and mineral premix/kg contained Vitamin A, 6,000 IU; Vitamin D3, 900 IU; Vitamin K3, 2 mg; Vitamin B1, 2 mg; Vitamin B2, 4 mg; Vitamin B6, 2 mg; Pantothenic acid, 10 mg; Vitamin B12, 0.01 mg; Niacin, 50 mg; Folic acid, 3 mg; Biotin, 0.05 mg; Choline, 250 mg; Fe, 50 mg; Mn, 85 mg; Cu, 5 mg; Co, 0.1 mg; I, 0.2 mg; and Zn, 50 mg pre/kg feed. The total experimental period was 7 days adaptation period, and 4-month experimental period.

Table 3: Effect of organic selenium and vitamin E and their combinations on body weight in V-line male rabbits.

<table>
<thead>
<tr>
<th>Item</th>
<th>Control (T1)</th>
<th>Selenium (T2)</th>
<th>Vitamin E (T3)</th>
<th>Se + Vit. E (T4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial weight, (Kg)</td>
<td>2.27±0.04</td>
<td>2.27±0.05</td>
<td>2.27±0.04</td>
<td>2.27±0.06</td>
</tr>
<tr>
<td>Final weight, (Kg)</td>
<td>3.21±0.19</td>
<td>3.20±0.14</td>
<td>3.12±0.04</td>
<td>3.22±0.10</td>
</tr>
</tbody>
</table>

Table 4: Effect of addition to organic selenium and vitamin E and on physical of semen characteristics and testosterone hormone concentration.

<table>
<thead>
<tr>
<th>Items</th>
<th>Control (T1)</th>
<th>Selenium (T2)</th>
<th>Vitamin E (T3)</th>
<th>Selenium + Vit. E (T4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ejaculate V. (ml)</td>
<td>0.66±0.10(^{a})</td>
<td>0.78±0.02(^{b})</td>
<td>0.79±0.01(^{b})</td>
<td>0.85±0.01(^{a})</td>
</tr>
<tr>
<td>Sperm Conc. ((×10^{6}/mL))</td>
<td>366.46 ± 9.23(^{c})</td>
<td>474.65 ± 11.25(^{b})</td>
<td>451.46 ± 10.05(^{b})</td>
<td>514.55 ± 9.55(^{a})</td>
</tr>
<tr>
<td>Total Motility (%)</td>
<td>72.38 ± 1.03(^{c})</td>
<td>79.00 ± 1.09(^{b})</td>
<td>76.63 ± 1.36(^{ab})</td>
<td>81.88 ± 1.05(^{a})</td>
</tr>
<tr>
<td>Progressive Motilty (%)</td>
<td>78.12 ± 1.05(^{c})</td>
<td>82.62 ± 1.07(^{b})</td>
<td>81.12 ± 1.22(^{bc})</td>
<td>85.87 ± 1.17(^{c})</td>
</tr>
<tr>
<td>Dead Sperms (%)</td>
<td>20.13 ± 0.34(^{c})</td>
<td>16.60 ± 0.94(^{b})</td>
<td>17.23 ± 0.43(^{b})</td>
<td>12.20 ± 0.72(^{a})</td>
</tr>
<tr>
<td>Abnormal Sperms (%)</td>
<td>18.28 ± 0.68(^{b})</td>
<td>16.60 ± 0.61(^{ab})</td>
<td>15.63 ± 0.52(^{a})</td>
<td>14.88 ± 0.63(^{a})</td>
</tr>
<tr>
<td>Acrosome Damages (%)</td>
<td>18.73 ± 0.53(^{c})</td>
<td>17.35 ± 0.53(^{bc})</td>
<td>16.40 ± 0.57(^{ab})</td>
<td>14.88 ± 0.58(^{a})</td>
</tr>
<tr>
<td>HOS-test (%)</td>
<td>78.08 ± 0.91(^{c})</td>
<td>81.78 ± 1.34(^{b})</td>
<td>80.30 ± 1.09(^{bc})</td>
<td>84.83 ± 0.83(^{a})</td>
</tr>
<tr>
<td>Testosterone H. (ng/mL)</td>
<td>1.35 ± 0.39(^{c})</td>
<td>3.67 ± 0.49(^{b})</td>
<td>2.99 ± 0.41(^{b})</td>
<td>5.74 ± 0.55(^{a})</td>
</tr>
</tbody>
</table>

\(^{a, b, c}\) Means with the different superscripts in the same raw, differ significantly \((P<0.05)\).
الملخص المرجعي

يفيد البحث إلى دراسة تأثير إضافة المكملات الغذائية من السيلينيوم وفيتامين هـ على وزن الجسم والإنتاج النسائي في الرإنب. تم تقسيم عدد الرأب الذكور المستخدمة 80 ذكر في عمر شهرين وكان متوسط وزن الجسم الحي في بداية التجربة 2.27 كجم. تم إيواء الحيوانات بشكل منفصل في أقفاص سلوكية. تم تقسيم الحيوانات بشكل عشوائي إلى ما يلي: أربع معاملات (ن=20 لكل منها): المعاملة الأولية: مجموعة التحكم التي تتغذى على نظام الغذائي الساسي، المعاملة الثانية: تتغذى على النظام الغذائي الساسي + 8.6 مجم سيلينيوم عضوي / كجم علف، المعاملة الثالثة: تتغذى على النظام الغذائي الساسي + 8.6 مجم من فيتامين هـ، والمعاملة الرابعة (المعاملة): عبارة عن خليط ما بين المعاملة الثانية والثالثة. تحتوي الفتامين الأساسي على 0.15 حمض سيلينيوم عضوي / كجم علف، المعاملة التالية (المعاملة): تحتوي على الفيتامين الأساسي + 40 مجم من فيتامين هـ وجمعياً لجميع المعاملات: عبر عن خليط ما بين المعاملة الثانية والثالثة. تحتوي الفتامين الأساسي على 18/9 بروتين و2850 طاقة. تم تسجيل وزن الجسم، عينات السائل الموللي، حركة الكلية للحيوانات الموللي، النسبة المولية للحيوانات الموللي، النسبة المولية للحيوانات الموللي الميتة (HOS-test)، وتركيز هرمون التستوستيرون. متوسطت وزن الجسم لم يكن معنويًا ما بين المعاملات. تأثرت نتائج الدراسة في مجموعات الرأب الذين أعبروا من الاختلاف في النتيجات بين الرأب. النتائج: النمو الموللي، وتركيز هرمون التستوستيرون. متوسطت وزن الجسم لم يكن معنويًا ما بين المعاملات. تأثرت نتائج الدراسة في مجموعات الرأب الذين أعبروا من الاختلاف في النتيجات بين الرأب.