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PHYSIOLOGICAL RESPONSE AND SEMEN QUALITY OF RABBIT BUCKS SUPPLEMENTED WITH SELENIUM AND TRIBULUS TERRESTRIS EXETRACT DURING SUMMER SEASON

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ABSTRACT: *The aim of this study was to evaluate the effects of inclusion aqueous extract of Tribulus genuses (ETT) with selenium on semen quality and physiological response of mature buck rabbits during summer season. Thirty six of mature buck rabbits and forty-eight does of Californian breed were randomly divided into six equal treatment groups (6 buck + 8 does per each). The first treatment group was fed on basal diet (unsupplied group) and served as control. The other five treatments were fed the same basal diet and orally supplied with 0.4 mg Se/L (Se), 50 mg ETT/kg BW (ETT1), 100 mg/kg BW (ETT2), 0.4 mg Se/L+ 50 mg ETT/kg BW (ETT1+Se) and 0.4 mg Se/L+100 mg ETT/kg BW (ETT2+Se), respectively.*

The results indicated that the different supplied groups had a significantly higher follicle stimulating (FSH), luteinizing (LH), testosterone, progesterone and estrogen hormones levels than the control group. The groups supplemented with of ETT and Se showed high levels of FSH, LH, FT and $E_2 17\beta$ than ~~an~~other groups. However, no significant differences were found among all supplemented groups regarding blood biochemical parameters. Administrations of ETT and Se significantly increased plasma total antioxidant capacity and immunoglobulin M levels. On the other hand, the level of malondialdehyde was significantly decreased for the treated groups compared with the control group. Also, ejaculate volume, sperm motility, sperm concentration, cell integrity, fertility rate and litter size at birth were significant increases, while reaction time, abnormal sperm and dead sperm were significantly decreased. The groups ETT1+Se and ETT2+Se recorded height rate of fertility and increase number of litter size at birth. Treated groups showed statistically heaviest final body weight, body weight gain and lowest feed conversion compared with the control group.

Conclusively*, extract Tribulus Terrestris (al-Hasakah) plant with selenium led to improve the activity of sex hormones, oxidative status and immunity, and the additives improved the quality of semen and increased*

fertility and Litter size at birth abdominal size at birth during summer condition.

Key word: *Tribulus Terrestris, semen quality, sex hormones, immune status.*

INTRODUCTION

In rabbits, the quantity and quality of semen plays an important role in the fertility and reproduction of rabbits bucks (Oseni and Lukefahr, 2014). So, optimal reproductive results are achieved with artificial insemination or natural mating primarily because the procedures aim to maximize efficiency the probability of oocytes being fertilized; while quality of semen are highly changing between buck rabbits (Tusell *et aL*.,2012). Semen evaluation must provide information on the fertilizing ability of spermatozoa. The most pertinent parameters correlated with the fertility rate are the number of spermatozoa inseminated and their motility, in spite of the use of a single attribute is not sufficiently rigorous to prognosticate the fertilizing ability of the semen (Lavara *et al.,* 2005).

Tribulus terrestris L. (TT) is a member of the Zygophyllaceae family, aqueous extract contains many compounds such as alkaloids, flavonoids oil, saponins, resins and nitrates (Abdul-Wahed, 2002). The biological properties of Tribulus extracts increased release of nitric oxide from endothelium and nerve termination it relaxes smooth muscles and increases angiogenesis converting enzyme inhibition (Sharifi *et al.,*2003). Another theory, it is believed that TT strongly affect the androgen metabolism, significantly increasing levels of testosterone or its precursors, and some studies indicate that this effect is due to the dominant component of the TT as protodioscin (Natasha *et al.,*2018). Tribulus terrestris have been extensively used as male sexual stimulants treatment of infertility, low sex drive and erectile dysfunction (Zhang and Chan, 2015). Abeer *et al.* (2012) reported that the beneficial effect of orally *T.terrestris* (150 mg / kg / day of an aqueous extract of *TT)* on testes can be attributed to antioxidant and metal chelating effect of *T. terrestris*.

Furthermore, the fruit of *Tribulus terrestris* has been used as aphrodisiac and to treated sexual dysfunction (Chhatre *et al.,* 2014), possibility to promote hormone levels of testosterone and enhance premature ejaculation (Ghosian *et al.,* 2013) and improved both sperm motility and count (Khoradmehr *et al*., 2010).

Selenium (Se) as a trace mineral is play pointedly involves in numerous biological functions like growth, immunity, antioxidant status (Murray *et al*.,

2000), production and reproductive performance, necessary component of selenoproteins (Kryukov *et al.*, 2003 and Pappas and Zoidis, 2012).
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). Selenium is essential for spermatogenesis and its deficiency results in deterioration sperm motility and morphological abnormalities in rodents (Kehr *et al*., 2009).

Therefore, the objective of this study was to evaluate the effect aqueous extract of *Tribulus terrestris* (TT) and selenium (Se) on semen quality, antioxidant capacity, blood biochemical parameters and fertility of buck rabbits.

MATERIALS AND METHODS

Housing and management:

The present study was carried out at a City of Scientific Research and Technological Applications Alexandria, Egypt, from the medal of July to the medal of October. The work aimed to study the effect of *Tribulus Terrestris* (TT) and selenium dioxide supplementations on semen quality and fertility rate of Californian buck rabbits. The ambient temperature and relative humidity were recorded daily and daily photoperiod (daylight length) was obtained from a nearby Meteorological station as shown in Table (1).

The temperature–humidity index (THI) was calculated using the equation: THI = db°C− [(0.31−0.31 (RH) (db°C−14.4)], where db °C is the dry bulb temperature and RH the relative humidity percentage/100. The obtained THI values were then classified as follows: < 27.8 = absence of heat stress, 27.8 to < 28.9 = moderated heat stress, 28.9 to < 30.0 = sever heat stress and 30 and over = very sever heat stress (Marai *et al*., 2001). Animals were kept in clean, separate wire-floor metal cages (50 cm length × 45 cm width × 40 cm high), maintained under standard laboratory conditions and kept the managerial condition, healthy, hygienic and clinically free of external and internal parasites.

Aqueous extraction of tribulus terrestris

Tribulus terrestris (TT) was collected from the local commercial in Alexandria city. Then, the dried material was ground with a blender. The powder was kept in glass bottle inside a refrigerator (20 ^{o}C) until starting the experiments. The plant powder was thoroughly mixed with boiled distilled water for 24 hours. Then, the mixture was filtered through a Whatman No.1

Table: 1: Ambient temperature (°C), relative humidity (%), temperature humidity index (THI) and photoperiod (h) during the experiment period

Parameters	Mid-July	August	September	Mid-October	Overall	SEM	P-Value
Ambient temperature(°C	31^{b}	32^{a}	31^{b}	28^{c}	**30.5**	0.4	0.001
Relative humidity (%)	76^{a}	73^{b}	76^{a}	76^{a}	**75.3**	0.08	0.001
THI	29^{b}	31^{a}	30^{b}	27^{c}	**29.3**	1.2	0.001
Photoperiod(h)	14	13	12	11	**12.5**	0.8	0.001

[a,b,c] Means within a row with different superscript letters are significantly.
THI values were then classified as follows: < 27.8 = Absence of heat stress, 27.8 to < 28.9 = Moderated heat stress, 28.9 to < 30.0 = Sever heat stress and 30 and over = Very sever heat stress (Marai *et al* ., 2001 and 2008).

filter paper and centrifuged for 15 minutes at 5000 rpm. The supernatant was collected and evaporated under reduced pressure at 37 ^{o}C (Sara *et al*., 2017).

The major component in Tribulus terrestris extract (TTE) is methyl linolenate (18.56%), Also, the higher percentage of fatty acid is the heptadecanoic acid (33.56%). Meanwhile, carbohydrate and amino acid revealed the presence of inulin (5.61%) and glutamic acid (2.85%), respectively, Saponin yield is 7.38% and phenolic and flavonoid contents (11.16 and 6.076%), respectively (Nagwa *et al.*, 2018).

Selenium:

Selenium dioxide (SeO_2) used as source of Se, which reacts with water particularly hot water, to give selenious acid, a weak acid that is corrosive stable to light molecular weight is 110.97g/mol.

Experimental design:

The experiment was dune offer tow stage:

First stage: a total number of 36 un mature Californian rabbits buck (aged 4 month) with initial body weight of 2150 ±10.33g were randomly divided into six treatments (each one consisting from 6 individual replicate with one buck) to study the effect of orally supplementation of ETT with selenium (selenium dioxide used as source of Se) in buck rabbit's semen quality. During this stage, rabbit buck was administered orally via drinking water daily with tow dose of 50-100 mg/kg BW/day/rabbi and 0.4mg Se /litter drinking water for 8 weeks (from 4 -6 month, spermatogenesis period approximately). Also, the experimental dosages were continually used for bucks during the second stage.

Experimental treatments as follows:
***Group1*:** unsupplied group used as a control group (Control).
***Group2*:** supplied with 0.4 mg Se / litter/day drinking water (Se).
***Group3*:** supplied with 50 mg ETT /kg BW / day/rabbit (ETT1).
***Group4*:** supplied with 100 mg ETT /kg BW/ day/rabbit (ETT2).
***Group5*:** supplied with 50 mg ETT/kg BW/ day/rabbit + 0.4mg Se / litter/day (ETT1+Se).
***Group6*:** supplied with100 mg ETT/kg BW/day/rabbit + 0.4mg Se/ litter/day (ETT2+Se).
Second stage: the previous bucks were used for fertilize dose to study the effect of experimental supplementation agent on fertility rate and dose litter size at birth of the different treatments. These animals represented progeny of pool semen and artificial 8 does in each group *(*Lopez and Alvariño, 2000*)*. Forty-eight mature untreated does (aged 6 months) with initial body weight 3050±10.7g of witch were randomly divided into six treatments with 8 individual replicate. Only receptive females (red color of vulvae lips) were inseminated with about 40 million spermatozoa in three sequence parities. Does were artificially inseminated with the control and the other tested supplementations. Does were injected with 0.8 mg (0.2 ml) of gonadotropin-releasing hormone analogue (Buserelin, Suprefact®, Hoechst-Roussel, Germany (Receptal)) immediately at the time of insemination according to (Boussin, 1989). Does were inseminated artificially with semen extenders, which described previously. The insemination procedure was as described by (Adams, 1981).

Feed and drinking water were offered on *ad libitum* basis. All rabbits were fed the same basal diet formulated according to the nutritional requirements of the National Research Council (NRC, 1977), which ingredients and calculated chemical composition are displayed in Table 2.

Semen collection:

Semen was collected twice weekly (during the second stage) from each buck by artificial vagina using a female teaser rabbit with an interval of 3–4 days between successive ejaculation .The temperature of the inner rubber sleeve of the artificial vagina was adjusted to 41- 43^{o}C and the lubrication of the inner sleeve was performed using white Vaseline. At four month of bucks age, started the training period with artificial vagina for 2 months by collected two ejaculate per buck per week. Will the does be 8 months old, semen collection was began

Table: 2 .The composition and chemical analysis of the basal experimental diet

Ingredients	%	*Calculated analysis*			
Yellow corn	6.22	Crude protein, %			18.8
Soybean meal, 44%	22.33	Crude fiber, %			13.0
Wheat bran	23.33	Ether extract, %			3.0
Barley	15.00	Digestible energy (kcal/kg diet)			2680
Alfalfa hay	30.12	n-6 poly unsaturated FAs%			0.3
Ground limestone	1.00	n-3 poly unsaturated FAs%			1.03
Dicalcium Phosphate	1.20	*Determined analysis (g/kg)*			
Common salt	0.50	Dry matter	897.1	Crude fiber	138.5
Vit. + min. premix*	0.30	Organic matter	801.4	Ether extract	26.2
Total	100.0	Crude protein	169.8	Nitrogen-free extract	575.0
				Ash	87.9

***Each 3 kg of premix contains: Vit. A:** 12,000,000 IU; Vit. D3: 3,000,000 IU; Vit. E: 10.0 mg; Vit. K3: 3.0 mg; Vit. B1: 200 mg: Vit. B2: 5.0 mg Vit. B6: 3.0 mg: Vit. B12: 15.0 mg; Biotin: 50.0 mg; Folic acid: 1.0 mg; Nicotinic acid: 35.0 mg: Pantothenic acid: 10.0 mg; Mn: 80 g; Cu: 8.8 g; Zn: 70 g; Fe: 35 g; I: 1 g; Co: 0.15 g and Se: 0.3 g.

for semen examination. During collection period (8 weeks), two ejaculates per buck per week were collected. All ejaculates (average 560-576 samples for all treatment during semen collection period) were stored at 37 ^{o}C in a water bath until evaluation, not later than 10 minutes after collection.

Semen characteristic:

Physical semen characteristics *i.e.* reaction time (RT) determined by (Chibundu, 2005).

Ejaculate volume (Ej V, ml), determined by using graduated tube. S**permatozoa concentration (SC),** number of sperms per ml) was counted using a haemocytometer according to Smith and Mayer (1955). For evaluation of percentage of sperm advanced motility (AdM, drop of semen was examined under the low power of microscope using a hot stage at 37 ^{o}C.

Percentage of motile sperm (Sd) was estimated by a phase-contrast microscope according to Melrose and Laing (1970).

Spermatozoa concentration percentage of live and abnormal sperms (SAb) were determined after staining with eosin and nigrosine (Blom, 1950) and then calculated as a percentage out of randomly chosen 100 sperm counted, total sperms in the ejaculate (10^6 /ejaculate), number of motile sperms per ejaculate were estimated in residual semen samples.

***Rabbit libido*:**

Libido (sexual desire) was estimated by observation of the reaction time (in seconds) from the time of introducing the doe to the buck until the buck start to mount and ejaculate the first copulation.

Blood biochemical constituents:

Blood samples (from bucks) were withdrawn at morning (8.00:9.00 h) from marginal ear veins under vacuum in clean tubes without heparin for each treatment group before access feed and water. Serum was obtained by centrifugation the blood 3500 rpm for 20 minutes and stored at –20°C for later analysis. The blood biochemical parameters total plasma protein(TP), albumin(Alb) were measured by the methods Doumas *et al*. (1981), globulin(GLo) was calculated, cholesterol, aspartate aminotransferase (AST), alanine aminotransferase (ALT), triglycerides (TG) (Fasati and Prencipe, 1982), high-density lipoprotein (HDL), low-density lipoprotein (LDL) using the method of Stein (1986). Serum samples were subjected to biochemical analysis of alanine aminotransferase (ALT) and aspartate aminotransferase (AST) activities (Reitman and Frankel, 1957). All biochemical parameters were

analyzed by commercially available kit methods. GNW-Model: SM-721 Spectrophotometers, Absorbance Microplate Reader and other laboratory equipment aids were used for biochemical analysis.

Determination hormones, immune response and serum Antioxidant:

Bucks serum concentrations of estrogen ($E_2$17β), progesterone (P_4), free testosterone (FT), follicle stimulating hormone (FSH) and luteinizing hormone (LH) levels were determined by using enzyme-linked immunosorbent assay (ELISA) kits according to Odell and Parlow (1981).

Different types of immunoglobulins in blood serum (IgG and IgM) were determined using commercial ELISA kits (Kamiya Biomedical Company, USA). Biochemical analyses of serum total antioxidant capacity (TAC) and malonaldehyde (MAD) were determined using commercially available kits methods using spectrophotometers, (GNW-Model: SM-721) according to Ippoushi *et al*., (2005).

Statistical analysis:

Using SAS (2002), the data were statistically evaluated using Snedecor and Cochoran (1982) fully randomized design. The following model was used:

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

Where, Y_{ij}= Observations, μ = Overall mean, Tri = Effect of i^{th} treatment (i: 1-6), e_{ij}= Experimental error.

The significant means differences among groups were separated by Duncan's multiple rang test (Duncan, 1955).

RESULTS AND DISCUSSION

Temperature degrees (^oC) and relative humidity (%):

In Table 1 are shown the change of temperature during the experimental period (summer season). The mean of ambient temperature, relative humidity and THI and photoperiod during the experimental interval were 30.5, 75.3, 29.3 and 12.5h, respectively.

The data demonstrated that the ambient temperature during July, Agust, September and October are 31, 32, 31 and 28.0^{0}C with overall average 30.5. These results indicated that the rabbits exposed to sever HS during summer session. These observations are in agreement with that reported by Marai *et al*. (2001 and 2008).

Effect of ETT on physiological response:

Hormonal profile:

Table 3 illustrated that the group supplied with 50 mg ETT (ETT1) had a significantly higher FSH, LH, FT and $E_2$17β concentrations compared with control group and the other experimental groups except for the concentration of $E_2$17β for the group supplied with 0.4 mg SE/ l of water. While the group supplemented with 100 mg ETT + Se (ETT2+Se) showed the lowest levels of FSH, LH and $E_2$17β than the control and the other experimental groups. Also, the groups supplied with 100 mg ETT (ETT2) or 100 mg ETT + Se (ETT2+Se) showed the lowest levels of $E_2$17β than the control and the other experimental groups. These results are in agreement with Mohammad *et al.* (2013) who recorded that treatment with TT can increase the hormones level of FT, P4, $E_2$17β and LH. Antonio *et al*. (2000) recorded that the upswing in LH impact to a signal for testosterone to increase. Also, Kazim *et al.* (2016) recorded that highest effectiveness of *Tribulus* on Serum testosterone levels. The same result recorded by Georgiev *et al. (*1988) it was shown that TT extract administration improved LH also sperm production and testosterone levels in ram. Also, Karimi *et al*. (2012) who mentioned that dioscin is a important component of *Tribulus terrestris* that increases male sexual ability by increasing free testosterone concentration and modulating estrogen, progesterone and pregnenolone levels.

Regarding the role of Se, Table (3) showed that serum FT concentration for the group supplied with only Se was increased compare with that recorded on the control group. That result are in agreement with similar response detected by El-Sisy *et al*. (2008) and Ibrahim and Mohamed, (2018) who indicated that supplemented male Baladi goats fed a diet with selenium yeast led to improved their reproductive efficiency and increase serum testosterone compared to control group. Also, Abdel-Waretha *et al.* (2019) recorded the same result in rabbit bucks supplemented nano-selenium.

Interestingly, Gauthaman and Adaikan (2005) examined the hormonal effects by TT extracts in rabbits and they detected an increase in androgenic hormone levels and erectile dysfunction improvement.

They all illustrated that TT had aphrodisiac activity, due to its androgen rising property. Also, Nasroallah *et al.* (2013) showed that TT raising testosterone by increasing gonadotropin releasing hormone which in modify stimulates the production of LH and follicle stimulating hormone, testosterone and that reflected on raising fertility and libido.

Table 3: Effect of selenium dioxide and *Tribulus terrestris* aqueous extract and their combination on hormonal profile measured in blood plasma of Californian buck rabbits

Parameters	control	Se	ETT1	ETT2	ETT1+Se	ET T2+Se	SEM	P-Value
FSH(ng/ml)	1.02^{ab}	0.77^{c}	1.10^{a}	0.96^{b}	0.44^{d}	0.16^{e}	**0.021**	**0.001**
LH(ng/ml)	0.35^{e}	0.44^{d}	0.79^{a}	0.65^{b}	0.57^{c}	0.19^{f}	**0.323**	**0.001**
FT(ng/ml)	1.77^{d}	2.78^{c}	4.99^{a}	3.64^{b}	2.87^{c}	3.77^{b}	**0.532**	**0.001**
P_4 (ng/ml)	0.09^{c}	0.13^{c}	0.24^{b}	0.35^{a}	0.27^{b}	0.11^{c}	**0.053**	**0.001**
$E_2$17β (pg/ml	22.9^{b}	28.3^{a}	29.9^{a}	16.6^{c}	23.8^{b}	17.7^{c}	**1.235**	**0.001**

*Means ± Standard error which superscripts with different small letters (a-c) within the same row differ significantly at $P<0.05$ Se: 0.4mg/litter water Selenium dioxide, ETT1: Aqueous *extract TribulusTerrestris* 50mg/kg BW, ETT2: Aqueous *extract TribulusTerrestris* 100 mg/kg BW. ETT1+Se= Aqueous *extract TribulusTerrestris* 50 mg/kg BW+ 0.4mg/litter water Selenium dioxide. ETT+Se= Aqueous *extract TribulusTerrestris* 100 mg/kg BW+Se0.4mg/litter water Selenium dioxide. FSH: follicle stimulating hormone, LH: luteinizing hormone, FT: FreeTestosterone, P4: Progesterone,E217β: Estrogen.

Blood biochemical parameters:

Serum-biochemical blood data were summarized in Table 4. There were no significant differences in activity of AST, ALT, ALP or concentration of TP, ALb and GLO between the control and experimental groups during tested period. Furthermore, no significant changes were observed in the concentrations of creatinine compared to the control group. Also, lipid profile (TG, HDL and LDL) were not significant differences for all experimental groups compared with control group.

However, No significant changes were observed in the biological parameters alterations in components synthesized by liver like enzymes and proteins. Even the combination between ETT and Se doesn't affected or significantly changed parameters. In addition, ETT plant, which medicine had no toxic effects on kidney functions so it's likely to have a protective effect on kidney. These results are in agreement with a previous study by Abdel-Kader *et al.* (2016) who confirmed the positive effect of the plant on the kidney tissues and function. These results may be due to presence of abundant bioactive phytochemicals as glycosides, saponins, flavonoids, phytosteroids, alkaloids, glycosides, and numerous constituents in TT (Shama *et al.,* 2019). Disagreement with our results, Grigorova *et al.* (2008) and Mohsen and Mehran (2016) showed that hens serum total cholesterol tended to be lower in TT treated group relative to control birds. On the other hand, Haytham (2016) recorded that a significant decrease in total serum cholesterol, blood glucose. Also, the previous researchers indicated that the level of serum alkaline phosphatase is no difference among the hens of the all groups. However, the carnet results indicated that Se had no effect on biochemical blood parameters, while, Emara *et al*. (2019) reported that feed rabbit different source of Se (Nano-selenium and sodium selenite) led to significantly decrease TC, LDL, HLD,VLDL, triglycerides, and phospholipids. Also, El-Kholy *et al.* (2019) revealed that rabbits supplemented with different source of Se caused significant increases in total protein (TP), albumin (Alb) and globulin (Glb) but these increases were still within normal range.

Serum antioxidant and immunoglobulin status:

Results Table 5 indicated that there were no significant differences on TAC, MAD and IgG activity among the control and experimental groups during tested period. Furthermore, significant decreasing in IgM for treated groups supplied with ETT1+Se and ETT2+Se compare to control. Our date indicated that the combinations between ETT and Se had appositive results than supplementation of each of them individuals. These results are in agreement

Table 4: Effect of Selenium dioxide and *Tribulus Terrestris* aqueous extract and their combination on biochemical parameters measured in the blood plasma of Californian buck rabbits

Parameters	Control	Se	ETT1	ETT2	ETT1 +Se	ETT2 +Se	SEM	P-Value
TP (g/dl)	7.39	7.44	7.19	7.26	7.37	7.26	**0.123**	**0.056**
Alb(g/dl)	4.43	4.30	4.06	4.27	4.36	4.03	**0.130**	**0.085**
Glb(g/dl)	2.96	3.09	3.13	2.99	2.89	3.03	**0.155**	**0.085**
AST (U/l)	25.0	24.7	26.0	24.9	27.2	25.5	**0.625**	**0.452**
ALT(U/l)	32.3	30.7	28.7	27.3	30.4	32.7	**0.845**	**0.541**
ALP (U/l)	171	161	174	171	166	173	**4.054**	**0.689**
Cre (mg/dl)	0.99	1.07	1.10	1.08	0.96	0.98	**0.235**	**0.066**
TAC(mg/dL)	114	122	112	118	122	108	**6.541**	**0.942**
HDL(mg/dL)	12.9	12.5	12.6	11.9	12.1	12.8	**0.691**	**0.653**
LDL(mg/dL)	88.8	89.9	90.3	88.6	89.1	94.4	**2.659**	**0.084**
TG(mg/dL)	123	122	124	116	121	127	**5.46**	**0.562**
T L(mg/dl)	321	288	290	289	287	288	**12.561**	**0.452**

*Means ± Standard error which superscripts with different small letters (a-c) within the same row differ significantly at P<0.05. Se: 0.4mg/litter water Selenium dioxide, ETT1: Aqueous *extract TribulusTerrestris* 50mg/kg BW, ETT2: Aqueous *extract TribulusTerrestris* 100 mg/kg BW. ETT1+Se= Aqueous *extract TribulusTerrestris* 50 mg/kg BW+ 0.4mg/litter water Selenium dioxide. ETT+Se= Aqueous *extract TribulusTerrestris* 100 mg/kg BW+Se0.4mg/litter water Selenium dioxide. TP: Total protein, ALb: Albumin, GLb: Globulin, ALP: Alkalinephosphatase, AST: aspartate aminotransferase, ALT: alanine aminotransferase, Cre: Creatinine, TAC: Total cholesterol, LDL: low density lipoprotein, HDL: High density, lipoprotein, TG: triglyceride, TL: Total lipid.

Table 5: Effect of Selenium dioxide and *Tribulus Terrestris* aqueous extract and their combination on antioxidant and immunoglobulin status measured in the blood plasma of Californian buck rabbits

Parameters	Control	Se	ETT1	ETT2	ETT1+Se	ETT2+Se	SEM	P Value
TAC(nmol/ml)	2.04	2.49	2.17	2.55	2.38	2.82	**0.104**	**0.424**
MAD(nmol/ml)	2.27	1.97	1.69	1.97	1.88	1.76	**0.062**	**0.0558**
IgG, (mg/dl)	23.66	26.2	27.67	28.63	31.33	33.37	**1.567**	**0.2898**
IgM, (mg/dl)	3.62^{b}	4.23^{b}	4.58^{b}	4.55^{b}	5.51^{a}	5.65^{a}	**0.550**	**0.0013**

*Means ± Standard error which superscripts with different small letters (a-c) within the same row differ significantly at P<0.05. Se: 0.4mg/litter water Selenium dioxide, ETT1: Aqueous *extract TribulusTerrestris* 50mg/kg BW, ETT2: Aqueous *extract TribulusTerrestris* 100 mg/kg BW. ETT1+Se= Aqueous *extract TribulusTerrestris* 50 mg/kg BW+ 0.4mg/litter water Selenium dioxide. ETT+Se= Aqueous *extract TribulusTerrestris* 100 mg/kg BW+Se0.4mg/litter water Selenium dioxide.

TAC: Total antioxidant capacity, MAD: Malonyelaldehyed IgG: Immunoglobulin G, IgM: Immunoglobulin M.

with Emara *et al*. (2019) who recorded that the supplemented diet with nano-selenium and sodium selenite cause significantly improving on the status of the estimated antioxidants. Another study by Dokoupilová *et al*. (2007) which recorded that supplemented Se in organic or inorganic forms to provide a margin of safety of immunity against deficiency and to maintain productive performance. Same result obtained by El-Kholy *et al.* (2019) who mentioned that supplemented rabbit diet with organic or inorganic Se form increased in immunoglobulin concentrations with Se addition could be an indication of Se either in organic or inorganic form induces earlier maturation of the humeral indication of Se either in organic or inorganic form induces earlier maturation of the humoral immune responses. Also, higher serum IgG levels in rabbits supplemented with Se indicate that Se is effective in improving humeral immunity. Since, Meissonnier *et al.* (2008) demonstrated that limitation of the levels of serum immunoglobulin such as IgA, IgG and IgM are the most common methods of testing humeral immune responses. On the other hand, Dutt-Roy *et al.* (2017) observed that an in vivo study that the treatment rat with TT extracts raised the activities of TAC as catalase, superoxide dismutase and decline the malondialdehyde (MDA) level.

Productive performance:

In Table 6 are shown the values of final body weight, body weight gain, feed intake and feed conversion at the end of the experiment. The growth rabbit performances from all treated groups supplied with both levels of ETT with our without Se had a significantly heaviest final body weight, body weight gain and the best feed conversion comparison with the control and Se groups. However FI was not significantly change among experimental groups. The results obtained are in accordance with other study, who confirmed a significant increase of body weight in rats supplemented with different doses of TT (Gauthaman *et al.*, 2003). This effect can be explained by the androgenic role of the effective product, which perhaps stimulates the appetite. Androgens play an important role in the growth and development of reproductive tissue and in the differentiation of other tissues (Desislava *et al.*, 2019).On the other hand, Dimitrov *et al.* (1987) and Çek *et al.* (2007) both researcher illustrated an increase in body weight at the same trend Valchev *et al*. (2009) documented that the rabbit supplemented with TT extract increase in the average daily gain and improved feed efficiency as compared to the control. Finely, El-Badry *et al*. (2019) are concordant with our study results that live body weight and body weight gain and lowest feed conversion were significantly with rabbits received

Table 6: Effect of Selenium dioxide and *Tribulus Terrestris* aqueous extract and their combination on body weight feed intake and feed conversion ratio in the blood plasma of Californian buck rabbits

Parameters	Control	Se	ETT1	ETT2	ETT1 +Se	ETT2 +Se	SEM	P Value
Initial BW, g	2150	2157	2159	2153	2249	2158	18.37	0.9998
Final BW, g	3083^{c}	3220^{c}	3384^{a}	3421^{a}	3442^{a}	3428^{a}	29.37	0.0038
BWG, g	933^{c}	1062^{c}	1225^{a}	1260^{a}	1293^{a}	1260^{a}	31.63	0.0072
FI, g/ buck	5841	5111	5361	5434	5562	5466	92.95	0.1643
FCR ratio	6.32^{a}	4.81^{b}	4.39^{b}	4.32^{b}	4.34^{b}	4.35^{b}	0.168	0.0056

* Means ± Standard error which superscripts with different small letters (a-c) within the same row differ significantly at $P<0.05$. Se: 0.4mg/litter water Selenium dioxide, ETT1: Aqueous *extract TribulusTerrestris* 50mg/kg BW, ETT2: Aqueous *extract TribulusTerrestris* 100 mg/kg BW. ETT1+Se= Aqueous *extract TribulusTerrestris* 50 mg/kg BW+ 0.4mg/litter water Selenium dioxide. ETT+Se= Aqueous *extract TribulusTerrestris* 100 mg/kg BW+Se0.4mg/litter water Selenium dioxide.

nano-Se. Regarding the role of selenium on productive performance, our results are in agreement with Ebeid *et al.* (2012) who illustrated that consumed rabbits a diet supplemented with organic Se had heaviest live body weight and daily weight gain compared with control group. However, are in contrast the present results Dokoupilová *et al.* (2007) who showed that body weight gain of growing rabbits did not significantly affect by adding dietary selenium.

Semen quality:

Values for measured sperm parameters are illustrated in Table 7. There were significantly improving on rabbit semen quality (EjV, AdM, SC, CI, FR and LSB) for the all supplemented groups with different agents compared with the values recorded for control group. However, groups supplemented with ETT+ Se recorded the significantly or numerically values and completely archives the adverse effect of HS of the previous parameter. Excellent semen quality is desired for achieving adequate fertility in mammals (Dalton, 2011) inappropriate environmental cues lead to decreases in semen quality and fertility of farm animals (Rasooli *et al.,* 2010).

Exposing to heat stimulates the hypothalamo–pituitary–adrenal axis activity evoking the sympathetic system functions, which increase levels of free radicals, cortisol level and imbalances in the antioxidant-defense status (Ahmad *et al.,* 2012) causes decline the fertility by effects on ejaculate volume, sperm motility, number of motile sperm per ejaculate, sperm-cell concentration and total sperm-output of the buck rabbits (Alsaied *et al.,* 2008). The present study are in agreement with those of Kazim *et al.* (2016) who documented that supplemented rat with TT extracts showed highest total sperm motility percentage, increase in sperm counts. Oliveira *et al*. (2015) explained the mechanism of TT extract, it has been concluded that the ethanol extract of *T. terrestris* influences spermatogenesis, as shown by the clear changes in the tubular compartment of the testes, such as increases in the total tube length, tubular volume and height of the seminiferous tubules epithelium. The hexane and aqueous soluble fraction in the methanol fractions promoted changes in the intratubular compartment because they increased the nuclear volume, cytoplasmic volume and individual volume of Leydig cells in male Wistar rats. Bitzer *et al*. (2013) recommended that in vitro addition of TT extract to human sperm could affect male fertility capacity. The incubation of human semen with TT extract significantly enhanced the total sperm motility, number of progressive motile spermatozoa, and curvilinear velocity.

Regarding the role of Se on semen quality, our results agree with result obtained by Ewuola and Akinyemi (2017) who reported that buck rabbits

Table 7. Effect of Selenium dioxide and *Tribulus Terrestris* aqueous extract and their combination on semen quality and reproductive performance of Californian buck rabbits

Parameters	Control	Se	ETT1	ETT2	ETT1+Se	ETT2+ Se	SEM	P Value
RT (Sec)	6.21^{a}	4.05^{b}	3.98^{b}	3.21^{b}	3.00	2.98^{c}	**0.235**	**0.001**
Ej.(ml)	0.43^{d}	0.79^{ab}	0.82^{b}	0.71^{b}	0.85^{a}	0.83^{a}	**0.084**	**0.001**
AdM %	$62..2^{c}$	78.4^{a}	76.3^{a}	71.3^{b}	79.4^{a}	78.4^{a}	**1.365**	**0.001**
Sperm conc. x10^{6}	180^{c}	287^{ab}	298^{a}	278	300^{a}	285^{ab}	**25.233**	**0.001**
SAb %	17.8^{a}	12.8^{b}	13.0^{b}	14.2^{c}	11.9^{c}	12.1^{c}	**1.254**	**0.001**
Dead sperm %	24.1^{a}	15.9^{b}	16.3^{cb}	15.8^{cb}	13.6^{c}	13.3^{c}	**3.182**	**0.001**
Cell integrity %	50.2^{c}	73.3^{b}	74.1^{b}	73.5^{b}	78.9^{a}	81.3^{a}	**6.241**	**0.001**
Fertility rate %	55.2^{d}	72.3^{c}	76.2^{b}	77.8^{b}	81.1^{a}	81.5^{a}	**4.56**	**0.001**
L.S.B, n	5.6^{c}	7.1^{b}	7.5^{b}	8.2^{a}	8.4^{a}	9.1^{a}	**0.361**	**0.001**

*Means ± Standard error which superscripts with different small letters (a-c) within the same row differ significantly at $P<0.05$.

Se: 0.4mg/litter water Selenium dioxide, ETT1: Aqueous *extract TribulusTerrestris* 50mg/kg BW, ETT2: Aqueous *extract TribulusTerrestris* 100 mg/kg BW. ETT1+Se= Aqueous *extract TribulusTerrestris* 50 mg/kg BW+ 0.4mg/litter water Selenium dioxide. ETT+Se= Aqueous *extract TribulusTerrestris* 100 mg/kg BW+Se0.4mg/litter water Selenium dioxide. RT: Reaction time, EjV: Ejaculate volume ,AdM: advanced motility ,SAb. sperm: abnormal sperm ,L.S.B: litter size at birth .

supplemented with organic selenium increased significant volume, mass activity, progressive motility, and live sperm cells and sperm concentration, also, decline percentage dead and abnormality sperm. Another study by Nourhan *et al.* (2020) recorded that supplemented diet bucks rabbits with organic selenium had lower reaction time, higher ejaculate volumes, sperm concentration and percentages of sperm progressive motility, live sperm, sperm with integrated membranes, and total functional sperm compared to the values obtained with the control diet. Also, they indicated that, the kindling rates, litter size, and weight at birth of females mated with males fed the organic selenium diet were significantly higher than those of females mated with males fed the control diet.

Conclusively, from these results it could be concluded that extract *Tribulus terrestris* (al-Hasakah) plant with selenium led to improve the activity of sex hormones, oxidative status and immunity, and the additives improved the quality of semen and increased fertility and Litter size at birth abdominal size at birth during summer condition.

REFERENCES

Abdel-Kader, M.S.A.; Al-Qutaym, A.S.; Bin Saeedan, A.M.; Hamad, A.M. and Alkharfy, K.M. (2016). Nephroprotective and hepatoprotective effects of Tribulus terrestris L. growing in Saudi Arabia. *J. Pharm. Pharmacogn Res*, 4(4), 144-152.

Abdel-Waretha, A.A.A.; Ahmedb, c.A.E.; Hassana, H.A.; Abd El-Sadekd, M.S.; Ghazalahf, A.A. and Lohakareg, J. (2019). Nutritional impact of nano-selenium, garlic oil, and their combination on growth and reproductive performance of male Californian rabbits. *Animal Feed Science and Technology* , 249 , 37-45

Abdul- Wahed, M.K. (2002). Investigation of the steroidal saponins of Tribulus spp. widely grown in Iraq. M.Sc. Thesis, College of Pharmacy. Baghdad University.

Abeer, U.M.; Rasha, H.K. and Yasser, A.H. (2012). Effect of Aqueous Extract of Tribulus terrestris orally administration on some Biochemical Parameters in Castrated Male Rabbits. *The Iraqi J. Vet. Med*,, 36 (2), 217-221.

Adams, C.E. (1981). Artificial insemination in the rabbit. The technique and application to practice. *J. Appl. Rabb, Res*, 4, 10-13.

Ahmad, A.; Rasheed, N.; Gupta, P.; Singh, S.; Siripurapu, KB.; Ashraf, GM.; Kumar, R.; Chand, K.; Maurya, R.; Banu, N.; Al-Sheeha, M . and Palit, G. (2012). Novel Ocimumoside A and B as anti-stress agents: modulation of brain monoamines and antioxidant systems in chronic unpredictable stress model in rats. *Phytomedicine* ,19, 639-647.

Alsaied, A.M.; Habeeb, Fatma E.I.T.; Magdy, Z.N. and Kamel M.E. (2008). Evaluation of Physical Semen Characteristics of Male Rabbits Exposed to Different Climatic Conditions and Lighting Regimes Using Nuclear Techniques. The Egyptian Society of Nuclear Sciences and Applications (ESNSA) (Egypt); 1239 p; 9 p; 9. International Conference for Nuclear Sciences and Applications; Sharm Al Sheikh (Egypt): 11-14 Feb.

Antonio, J.; Uelmen, J.; Rodriguez, R. and Earnest, C. (2000). The effects of Tribulus terrestris on body composition and exercise performance in resistance-trained males. *Int J Sport Nutr Exerc Metab*, 10(2),208-215.

Bitzer, J.; Giraldi, A. and Pfaus, J. (2013). Sexual desire and hypoactive sexual desire disorder in women. Introduction and overview. Standard operating procedure. *J. Sexual Med,* 10(1),36–49

Blom, E. (1950). A One-Minute Live-Dead Sperm Stain by Means of Eosin Nigrosin. *Fertility Sterility*, 1, 176-177.

Boussin, D. (1989). *Reproduction Et Insemination Artificielle En Cuniculture*. Association Francaise de Cuniculture, Lempdes, Paris.

Çek, Ş.; Turan, F. and Atik E. (2007). Masculinization of convict cichlid (Cichlasoma nigrofasciatum) by immersion in Tribulus terrestris extract. *Aquaculture International* ,15(2), 109-119

Chhatre, S.; Nesari, T.; Somani, G.; Kanchan, D. and Sathaye, S. (2014). Phytopharmacological overview of Tribulus terrestris. *Pharmacognosy Reviews*, 8, 45–51.

Chibundu, U.C. (2005). Response of pre-pubertal bucks to administration of estradiol β. *Project Report, Federal University of Technology*, Owerri pp,30.

Dalton, JC. (2011). Semen quality factors associated with fertility. *In Proceedings of Applied Reproductive Strategies in Beef Cattle, Institute of Agriculture and Natural Resources, 30 September–1 October, Boise, ID, USA.*

Desislava, A.; Svetlana, G.;Natasha, G.and Elena, K. (2019). Dose-dependent effect of tribulus terrestris dry extract on reproductive organs of growing male rabbits. *Maced. J. Anim. Sci*, 9 (1), 19–23.

Dimitrov, M.; Georgiev, P. and Vitanov, S. (1987). Use of Tribestan on rams with sexual disorders. *Veterinarno Meditsinski Nauki,* 24(5), 102-110.

Dokoupilová, A.; Marounek, M.; Skřivanová, V. and Březina, P. (2007). Selenium content in tissues and meat quality in rabbits fed selenium yeast. *Czech Journal of Animal Science* ,52, 165−169.

Doumas, B. (1971). Colorimetric method for albumin determination. *Clin. Chim. Acta,* 31,87-92.

Duncan, D.B. (1955). Multiple ranges and multiple F. test. *Biometrics* ,11-42.

Dutt-Roy, R.; Kayalvizhi, E.; Chandrasekhar, M. (2017). Evaluation of the antidepressant activity of *Tribulus terrestris* in diabetic depression in rat model. *Int. J. Pharm. Sci. Res*, 8,5392–5399. [Google Scholar]

Ebeid, T.;. Zeweil, H; Basyony, M. and Badry H. (2012). The impact of incorporation of organic selenium into meat on growth performance, antioxidative status, and immue response in growing rabbits. *In: Proc. Of the 10th World Rabbit Congress, September 3-6, Sharm El-Sheikh, Egypt*, pp,861-864.

Ebeid. T. A. (2009). Organic selenium enhances the antioxidative status and quality of cock semen under high ambient temperature. *British Poultry Science,* 50 (5), 641-647.

El-Badry, A.S.O.; Mahrousa, M.H.; Mosalm, G.A.G.; Ekram, S.A. and El-Aasar, T.A. (2019). Influence of ingestion of nano- selenium on growth performance, antioxidative and mutagenicity status in somatic cells of new zealand white rabbits *Egyptian Journal of Rabbit Science*, 29 (1), 1-21.

El-Kholy, K.H. ;Tag El-Deen, H.T. ; Abd-El-Lateif ,A.I. and Aml I. M. (2019). Effects of dietary selenium sources on metabolic, enzymatic and immunoglobulin serum profiles in growing rabbits. *Pak. J. Nutr*,18 (5), 430-436.

El-Sisy, G. A.; M. A. Abdel-Razek; A. A. Younis; A. M. Ghallab and M. S. S. Abdou (2008). Effect of dietary zinc or selenium supplementation on some reproductive hormone levels in male Baladi goats. *Global Vet*, 2(2), 46–50.

Emara, S.S. ;El-Zaher, H.M.; Michael . M.I. and Eid, S.Y. (2019). Comparative Effects of Nano-Selenium and Sodium Selenite Supplementation on Blood Biochemical Changes in Relation to Growth Performance of Growing New Zealand White Rabbits. *Arab J. Nucl. Sci. Appl,* 52(4), 1-14.

Ewuola, E. O. and Akinyemi, D. E. (2017). Semen Characteristics of Rabbit Bucks Orally Administered Exogenous L-Selenomethionine. *Annual Research & Review in Biology*, Page, 1-8

Fasati, P. and Prencipe, L. (1982). Determination of plasma triglycerides. *Clinical. Chem*, 28: 2077.

Gauthaman, K.; Adaikan, PG. (2005). Effect of *Tribulus terrestris* on nicotinamide adenine dinucleotide phosphate-diaphorase activity and androgen receptors in rat brain. *J. Ethnopharmacol* ,96(1-2),127-132.

Gauthaman, K.; Ganesan, A. P. and Prasad, R. N., (2003). Sexual effects of puncture vine (*Tribulus terrestris*) extract (protodioscin): An evaluation using a rat model. *Journal of Alternative and Complementary Medicine*, 9, 257– 265.

Georgiev, P.; Dimitrov, M. and Vitanov, S. (1988). Effect of Tribestan (from Tribulus terrestris) on plasma testosterone and spermato-genesis in male lambs and rams. Veterinarna Sbirka, 86(3), 20–2.

Ghosian, M.M.H.; Khalili, M.; Maleki, M. and Ahmad, M.E. (2013). The Effect of oral feeding of *Tribulus terrestris* L. on sex hormone and gonadotropin levels in addicted male rats. *Int J Fertil Steril*, 7, 57–62.

Grigorova, S.; Vasileva, B.; Kashamov, V.; Sredkova, S. and Surdjiiska. (2008). Investigation of Tribulus terrestris extract on D.the biochemical parameters of eggs and blood serum in laying hens. *Archiva Zootechnica*, 11(1), 39-44.

Haytham, M. D. (2016). Evaluation of Hematological and Biochemical Activity of Ethanolic Extract of Zygophyllum simplex Linn. in Wistar Rats. *Pak. J. Biol. Sci*,19 (4), 179-184.

Ibrahim, E. M. and Mohamed, M.Y. (2018). Effect of different dietary selenium sources supplementation on nutrient digestibility, productive performance and some serum biochemical indices in sheep. *Egyptian J. Nutrition and Feeds*, 21 (1), 53-64.

Ippoushi, K.; Ito, H.; Horie, H. and Azuma, K. (2005). Mechanism of inhibition of peroxynitrite-induced oxidation and nitration by [6]-gingerol. *Planta-Medica*, 71, 563-566.

Karimi, J. H.; Malekzadeh, S.S. and Hoshmand, F. (2012). The effect of the Tribulus terrestris extract on spermatogenesis in the rat. *Journal of Jahrom University of Medical Sciences*, 9(4),8-13.

Kazim, S.; Cemal, O.; Fatih, A.; Mehmet, T. ; Hasan, G.; Nurhan, S.; Gaffari T.; Ismet, Y.; Ibrahim, H. O. and Vijaya, J. (2016). Comparative evaluation of the sexual functions and NF-κB and Nrf2 pathways of some aphrodisiac herbal extracts in male rats. *BMC Complementary and Alternative Medicine* ,16,318.

Kehr, S. ;Malinouski, M.; Finney, L.; Vogt, S.; Labunskyy, V.M.; Kasaikina, M.V.; Carison, B.A.; Zhou, Y.; Hatfield, D.L. and Gladyshev, V.N. (2009). X-Ray Fluorescence Microscopy Reveals the Role of Selenium in Spermatogenesis. *Journal of Molecular Biology*, 389, 808-818.

Khoradmehr, A.; Khalili, MA.; Ramezani, M.; Adib, M.; Vahidi, S. and Moin, MR., (2010). Effects of Herbal Drug NOFODA on Sperm Parameters of Infertile Men. *Int J Fertil Steril*, 4, 12.

Kryukov, GV.; Castellano, S.; Novoselov, SV.; Lobanov, AV.; Zehtab, O.; Guigo, R.and Gladyshev, VN. (2003). Characterization of mammalian selenoproteomes. *Science*, 300,1439-1443.

Lavara, R. Mocé, E.; Lavara, F.; Viudes de Castro, M.P. and Vicente, J.S. (2005). Do parameters of semen quality correlate with the results of on-farm inseminations in rabbits? *Theriogenology*, 64, 1130-1141.

Lopez, J. and, Alvariño, J.M.R. (2000). Effects of added caffeine on results following a rtificial insemination with fresh and refrigerated rabbit semen. *Anim. Rep. Sci.*, 58, (1-2), 147-154.

Marai, I.F.M.; Habeb, A.A.M. and Gad, A.E. (2001). Rabbits productive, reproductive and physiol ogical performance traits as affected by heat stress: a review. *Livestock Production Science* ,78, 71–90.

Marai, I.F.M.; Habeb, A.A.M. and Gad, A.E. (2008). Performance of New Zealand white and Californian male weaned rabbits in the subtropical environment of Egypt. *Animal Science Journal*, 79, 472–480.

Meissonnier, G.M.; Pinton, P.; Laffitte, J. A.; Cossalter .M and Gong Y.Y. (2008). Immunotoxicity of aflatoxin B1: Impairment of the cell-mediated response to vaccine antigen and modulation of cytokine expression. Toxicol. Applied Pharmacol, 231:142-149.

Melrose, D.R. and Laing, J.A. (1970). Fertility and infertility in domestic animals. *Small Ruminant Res*,17:128 -159.

Mohammad, H. G.; Mohsen, K.; Maryam; Mohammad, E. and Ahmad A. (2013). The Effect of Oral Feeding of Tribulus terrestris L. on Sex Hormone and Gonadotropin Levels in Addicted Male Rats .*Int. J . Of Fertili And Sterility*, 7(1): 57-62.

Mohsen, A. and Mehran, T. (2016). Effects of adding aqueous extract of Tribulus terrestris to diet on productive performance, egg quality characteristics, and blood biochemical parameters of laying hens reared under low ambient temperature (6.8 ± 3 °C) .*Int. J . Biometeorol*, 60(6): 867-71.

Murray, RK.; Granner, DK.; Mayes, PA.; Rodwell, VW. and Harper's. (2000). Biochemistry, 25th Edition, Mc Graw-Hill. *Health Profession* Division, USA;

N.R.C. (1977). *National Research Council* . Nutrient Requirements Of Domestic Animals. Nutrients requirement of rabbits. USA. National Academy of Science, Washington, D.C.

Nagwa, M. A.; Seham, S. El-Hawary; Doha, A. M.; Manal, S. A.; Dina, M. G. and Gamal, A. (2018). Phytochemical and Biological Studies of Tribulus terrestris L. Growing in Egypt. *Int. J. Pharmacol*, 14 (2),248-259.

Nasroallah, M.; Saman, H. and Zahra, M. (2013). Physiological and pharmaceutical effects of tribulus terrestris as a multipurpose and valuable medicinal plant. *Int J Adv Biol Biom Res*,1(10):1289-1295.

Natasha, F.P.; Aryele, P.Iz.; Melina, B.S.; Cristiano,C.S. ;Andreas,S.L.; Mendez,F.G.; Daniela, S. and Francielli, W.S.C. (2018). *Tribulus terrestris* Protects against Male Reproductive Damage Induced by Cyclophosphamide in Mice. *Oxidative Medicine and Cellular Longevity* Volume 2018, Article ID 5758191,1- 9 .

Nourhan, S. Hosny; Nesrein, M.H.; Amr, S.; Morsy and Zahraa, R. Abo-elezz (2020). Effects of Organic Selenium on the Physiological Response, Blood Metabolites, Redox Status, Semen Quality, and Fertility of Rabbit Bucks Kept Under Natural Heat Stress Conditions. *Front.Vet.Sci*,12 | https://doi.org/10.3389/fvets.2020.00290

Odell, WD. and Parlow, AF. (1981). Estimation of FSH test assay. *Journal Of Clinical Investigation*, 47, 25- 51.

Oliveira, NNPM.; Félix, MAR.,; Pereira, TCS.; Rocha, LGP.; Miranda, JR. and Zangeronimo, MG. (2015). Sperm quality and testicular histomorphometry of wistar rats supplemented with extract and fractions of fruit of *Tribulus terrestris L. Brazarch Biol Techn* ,58(6):891–897.

Oseni, SO.and Lukefahr, SD. (2014). Rabbit production in low-input systems in Africa: situation, knowledge and perspectives—*A review. World Rabbit Sci*, 22: 147–160.

Pappas, A.C. and Zoidis, E. (2012). *The Role of Selenium in Chicken Physiology:* New Insights. In: Chickens: Physiology, Diseases and Farming Practices,Kapur, I. and A. Mehra (Eds.). Nova Science Publishers, New York, USA., and ISBN13: 9781620810279, 167.

Rasooli, A.; Jalali, MT.; Nouri, M.; Mohammadian, B. and Barati, F. (2010). Effects of chronic heat stress on testicular structures, serum testosterone and cortisol concentrations in developing lambs. *Animal Reproduction Science* ,117: 55–59.

Reitman, S. and Frankel, S. (1957). A colorimetric determination of serum AST and ALT enzymes. *Amer. J. Clin. Path*, 28 :56-58.

Sara, K.; Mitra, B.; Atefeh, A. and Farzane, E. (2017). *Tribulus terrestris* Extract Improves Human Sperm Parameters *in vitro*. *Journal of. Evidence-Based Complementary and Alternative Medicine*, 22(3):407-412.

SAS, (2002). SAS /STAT *Guide For Personal Computer, Proprietary Software.* Version 9. SAS Institute Inc. Cary, North Carolina, USA.

Shama, I.Y.; Adam; Nesreen, A.; Ahdaf, M.A.; Ahmed, S.Y.A.; Maiada, M.; Abdallah, 1.A.A.; Anfal, M. and Sara, H. (2019). Evaluation of Toxicity and Anti-microbial Activity of *Tribulus terrestris* Fruits in Sudan. *Asian J. Biol. Sci*, 12 (2), 130-139.

Sharifi, A.M.; Darabi, R. and Akbarloo, N. (2003). Study of antihypertensive mechanism of Tribulus terrestris in 2K1C hypertensive rats: role of tissue ACE activity. *Life Sci*, 73(23): 2963-71.

Smith, J.T. and Mayer, D.T. (1955). Evaluation of sperm concentration by the hemacytometer method. Comparison of four counting fluids. *Fertility and Sterility*, 6: 271–275.

Snedecor, G.W. and W.G. Cochran (1982). *Statistical Methods*. 8th ed. Iowa State Univ., Press Ames, Iowa, USA

Stein, E.A. (1986). *Textbook Of Clinical Chemistry*, NW Tietz, ed. W.B. Saunders, Philadelphia, 879-886.

Tusell, L.; Legarra, A.; García-Tomás, M.; Rafel, O.; Ramon, J. and Piles, M. (2012). Genetic basis of semen traits and their relationship with growth rate in rabbits. *J Anim Sci*, 90: 1385–1397.

Valchev, G.; Ivanov, A.; Grigorova, S.; Kostinbrod and Zlateva, N. (2009).A study on the effect of Tribulus terrestris L. extract as a growth promoter for rabbits. *In AGRIS Since*, 45: 96-101.

Zhang, H.W. and Chan, K. (2015). *Tribulus terrestris* is an herb belonging to the *Zygophyllaceae* family, which is indigenous to the Southern Europe, Southern Asia, Australia, and Africa. *In: Side Effects of Drugs Annual*, A Worldwide Yearly Survey Of New Data In Adverse Drug Reactions. Vol. 57:595-601

الاستجابة الفسيولوجية وجودة المنى السائل لذكور الارانب لاضافة السيلينيوم ومستخلص الحسكة خلال موسم الصيف

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الهدف من هذه الدراسة هو تقييم تأثير اضلفة المستخلص المائي لنبات تريبولوس تيريستريس (الحسكة) (ETT) مع السيلينيوم على جودة السائل المنوي والاستجابة الفسيولوجية لذكور لأرانب الناضجة خلال موسم الصيف. تم تقسيم ستة وثلاثين من الأرانب الناضجة وثمانية وأربعين من اناث سلالة الكاليفورنيا بشكل عشوائي إلى ست مجموعات معاملة متساوية (٦ ذكور + ٨ اناث لكل منها). تم تغذية المجموعة الأولى على النظام الغذائي الأساسي (المجموعة غير معاملة، الضابطة) واستخدمت كمجموعة تحكم. تم تغذية المجاميع الخمسة الأخرى على نفس النظام الغذائي الأساسي وتمت المعاملات عن طريق الاضافة الى مياة الشرب بـ ٠.٤ مجم (Se) Se / L، 50 مجم ETT / كجم من وزن الجسم ((ETT1، 100 مجم / كجم من وزن الجسم ((ETT2، 0.4 مجم 50 + Se / L مجم ETT / كجم من وزن الجسم (ETT1 + Se) و ٠.٤ مجم سي / لتر + ١٠٠ مجم من ETT / كجم من وزن الجسم (ETT2 + Se) على التوالي.
أشارت النتائج إلى أن المعاملات المختلفة السابقة كان لديها مستويات أعلى بكثير من تحفيز الجريب (FSH) واللوتين (LH) والتستوستيرون والبروجسترون وهرمونات الاستروجين مقارنة بالمجموعة الضابطة. أظهرت المجموعات المكملة بـ ETT و Se مستويات عالية من FSH و LH و FT و E217β مقارنة بالمجموعات الأخرى. ومع ذلك ، لم توجد

فروق ذات دلالة إحصائية بين جميع المجموعات المكملة فيما يتعلق بمكونات الدم البيوكيميائية. ادى تناول ETT و Se إلى زيادة كبيرة في كفائة مضادات الأكسدة الكلية للبلازما ومستويات الغلوبولين المناعي M. من ناحية أخرى ، انخفض مستوى malondialdehyde بشكل معنوي في المجموعات المعاملة مقارنتا مع مجموعة التحكم. كما أن حجم قذفة السائل المنوي ، وحركة الحيوانات المنوية ، وتركيز الحيوانات المنوية ، وسلامة الخلايا ، ومعدل الخصوبة ، وعدد الخلفة عند الولادة كانت هناك فروق احصائية كبيرة ، بينما انخفض وقت الاستجابة للوثب، والحيوانات المنوية غير الطبيعية والحيوانات المنوية الميتة بشكل كبير. سجلت المجموعتان ETT1 + Se و ETT2 + Se معدل ارتفاع فى الخصوبة وزيادة عدد المواليد عند الولادة. أظهرت المجموعات المعاملة فروق احصائية فى وزن الجسم النهائى ، زيادة في معدل الزيادة فى وزن الجسم وأدنى تحويل غذائي مقارنة بمجموعة التحكم.

التوصية : أدى مستخلص نبات الحسكة (تريبولوس تيريستريس) مع السيلينيوم إلى تحسين نشاط الهرمونات الجنسية ، وحالة الأكسدة والمناعة ، كما أدت الإضافات إلى تحسين جودة السائل المنوي وزيادة الخصوبة والخلفات عند الولادة خلال فصل الصيف.