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Study the Effect of Vitamin E-Selenium Compound on Tsh and Weight in Local Goat's Breeds

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Abstract: The study was carried out to investigate the effect of vitamin E-selenium on the prevention of endemic goiter in the local goat herd and regulate the estrous cycles. Serum TSH (thyroid stimulating hormone) levels were measured as an index of thyroid gland activity and their impact on the productive performance (weight) of local female goats. A total of 15 female goats aged 2-3 years and weighing 28-35 kg were randomly assigned to the productive season (during the first gestation period of 1-3 months), divided into three groups of five goats each. The negative control group (G1) received distilled water alone, the second group received 5 ml of E-Se solution, and the third group received 10 ml Se-E solution. For two weeks, the medication was administered through intramuscular injection. Weights were assessed before and after the experiment using a ground scale, and blood samples were obtained from all animals after two weeks of therapy to determine thyroid stimulating hormone (TSH) levels in the blood. For G2 and G3 animals TSH level means revealed statistically significant differences ($P<0.05$), while G3 animals significantly outperformed ($P<0.05$) where TSH level mean was 0.077±0.05 mlU/ ml compared with G1, and significant increases ($P<0.05$) in mean of body weights of G2 animals 33.6000±0.8055 kg compared with G3 and G1. This indicates to the effect of vitamin E and selenium in increasing TSH levels and controlling thyroid gland growth and activity by increasing the number of follicles and ability to store iodine. Because it dramatically increases the activity of enzymes that rely on selenium, it enhances goat health and herd productivity while reducing the incidence of abortion.

Keywords: Vitamin E–Se, TSH, Goat.

INTRODUCTION

Female goats suffer from endemic goiter, gland enlargement and hypothyroidism. These animals are exposed to the burden of pregnancy with twin or triple fetuses. The ration provided to them does not meet their nutritional needs, which exposes them to some problems related to the metabolic processes. Vitamins and minerals and their availability protects against eating disorders (Davoodi *et al*., 2022). The deficiency of mineral elements occurs slowly as a result of the body's need for these mineral elements or the decrease in the daily intake of them, or as a result of some pathological disorders that cause a lack of absorption. Researchers had found that the levels of the trace minerals selenium, vanadium, magnesium, copper, and zinc should be constant and that their deficiency affects the vital functions and may cause wasting of goats, which is a sign of many chronic diseases (Shawaf *et al*., 2021).

The main source of organic selenium is green plants. The amount of selenium in the plant depends on its concentration in soil and water, and it is found in different proportions depending on the absorption capacity of plants, and physiological conditions such as salinity and soil PH. The cumulative selenium content in soil varies, which varies depending on the geographical location. Some types of soil contain low amounts of selenium. It is found in the base soil in the form of selenite or selenite, and selenite is transported via sulfur carriers, and selenite is found in acidic soil and is bound to iron hydroxide, which makes it stable in the soil (Tsioubri *et al*., 2020) and is metabolized by plants through the sulfur absorption pathway, or

phosphate transporters for selenium inorganic selenium can be absorbed into selenocysteine and methionine, and its incorporation into proteins (Zhou, *et al*., 2018). Studies have indicated that animals benefit from organic selenium from selenomethionine , which is found in yeast, as it is absorbed into the body and stored in tissues (Yue *etal.*,2009) and despite the presence of selenium in some tissues of the body, such as skeletal muscle tissues, as it is linked to amino acids that contain sulfur (cysteine and methionine) (Tian *et al*.,2022) but that the body cannot manufacture it. As selenium works with vitamin E as an antioxidant, and they work together to raise the body's immunity. The lack of selenium in the feed and thus in the animal's body may cause hypothyroidism, weak immune system, the phenomenon of poor growth and the lack of expected weight gain from lambs and coarse wool. As for the lack of vitamin E causes white muscle disease in lambs DMD, even if selenium is provided to a unit without E. Animals often develop selenium deficiency syndrome. Its deficiency and excess cause some metabolic disorders (Barcelos *et al*.,2022). The daily needs of sheep and goats of selenium is 0.1-0.2 mg/kg of dry matter for the ration. The Norwegian Refugee Council NRC recommended to determine levels of 0.15-0.30 mg/kg of selenium supplementation in different weights of animals (pig) and the maximum level of Se was determined (of sodium selenite or yeast enriched with Se) in whole feed at 0.5mg/kg in China and EU to ensure feed safety (Cao *et al*., 2014). Studies have indicated its importance in maintaining the integrity of thyroid gland functions, which in turn affects the regularity of estrous cycles. Selenium plays a key role in the diet of sheep and goats, and its deficiency may occur due to pregnancy and childbirth. Research has also indicated on Nicastrese goats, and the secretion of their hormones is affected according to the physiological state of the body from pregnancy and lactation (Liotta *et al*., 2021). Selenium supplementation can be protective against goiter, which is involved in thyroid enlargement because it significantly improves the activity of selenium-dependent enzymes of the thyroid gland that is under the influence of the anterior pituitary gland located at the bottom of the brain after a signal from the hypothalamus to secrete TSH thyroid stimulating hormone. This hormone stimulates the entry of iodine into the thyroid gland to manufacture its hormones Bhardwaj, (2018) by converting thyroxine (T4) into the active form of free triiodothyronine (T3) (Wang *et al*., 2018). Selenium is one of the rare essential elements in animal nutrition and is responsible for several functions related to animal productivity, fertility, and prevention of abortion. No less than the importance of iodine to stimulate the thyroid gland (Kadum and Luaibi, 2017) and (Wang *et al*., 2018).

The method of work

The experiment was carried out in a special field on 15/9/2021-20/10/2021 in a special field for the local black goat breeder in Maysan Governorate / Iraq. Fifteen females aged 2-3 years and weighing 28-35 kg were selected in the first gestation period of 1-3 months. 5 animals were randomly divided into three groups (replicates). At the start of the experiment, one of the goats in the second group had an abortion. The animals were isolated for two weeks and fed standard feed based on 2% of body weight. The weights of the animals were measured and recorded with a ground scale and weighed before and after the experiment, and the average weights of the groups were calculated. According to the instructions of the producing company, the Dutch company Inter Chema, a center for veterinary services, Liquid vitamin E Selenium for Lambs Products Composition (each 1 ml contains vitamin E 50 mg + selenium 0.5 mg) *. The injection was repeated 3 times a week. The animals were divided in to three groups as following:

1. The control group (G1) only injected distilled water (D.W) via intramuscular injection, 1ml/goat/day (to prevent stress).
2. A second group (G2) injected intramuscularly, E-Se, 5 ml/goats/ day.
3. A third group (G3) injected intramuscularly, E- Se, 10 ml/goats/ day.

Blood was drawn from each animal, 10 cc from the jugular vein in the early morning and before feeding (fasting) after two weeks of treatment with selenium in plastic tubes containing (Ethylene Diamine Tetra acetic acid. EDTA) and kept at a temperature of 37 °C for about half an hour and then placed in a centrifuge 1500 rpm for 5 minutes and the plasma was separated in Eppendorf tubes and kept at -80°C until transfer to the physiology laboratory. TSH was measured using an Elecsys (ELISA) device using the immunoelectrochemical fluorescence method, using a device that measured the hormone according to the method described in the measurement kit supplied by the American company Monobind Inc., which is summarized as follows: Thyroid Stimulating Hormone (TSH) solid-phase sandwich ELISA (enzyme-linked immunosorbent assay) is designed to measure the amount of the target bound between a matched antibody

pair. A target-specific antibody has been pre-coated in the wells of the supplied microplate. Samples, standards, or controls are then added into these wells and bind to the immobilized (capture) antibody. The sandwich is formed by the addition of the second (detector) antibody, a substrate solution is added that reacts with the enzyme-antibody-target complex to produce a measurable signal. The intensity of this signal is directly proportional to the concentration of target present in the original specimen.

Statistical analysis

We used the complete random design program, CRD, and tested the significant differences between the means using the least significant difference at the RLSD rate and using the ready-made statistical program SPSS 2008. The level of significance was recorded at p < 0.05.

RESULTS

1- Effect of E-Se on TSH.

Table (1) indicates that when comparing the average values of TSH between G1 and G2 and G3 treatments, a statistically and significant difference was found at the level of significance (P<0.05) between the average values of the third treatment injected intramuscularly with 10cc or ml, selenium + vitamin E, and its average levels were higher. Compared to the second group that injected intramuscularly 5 ml of selenium and the control group, The values were (0.0 77 ± 0. 05, 0.0 58±0. 06, 0.052±0. 01) µIU/m, respectively.

2- Effect of E-Se on weight.

We found significant differences in the average living body weights between the control group and the second and third groups, as the two groups significantly outperformed the control group (P<0.05) over the control group, as indicated in Table (1), and the values amounted to (33.6000a ±0.8055, 32.1000ab±1.2151, 29.9000b±1.0376) Kg respectively.

Table (1). Effect of adding vit E-Se……., (Mean± SD). G1 control add D.W, G2 received 5ml\goat\day, G3 received 10ml/ goat\day.

Parameters / Treatment	TSH (mIU/ml) ±SD	Body weight (kg) ±SD
Group 1 (Control)	0. 052^{b}±0. 01	29.9000^{b}±1.0376
Group 2	0.0 58^{b}±0. 06	33.6000^{a}±0.8055
Group 3	0.077^{a}±0. 05	32.1000^{ab}±1.2151
significant	*	*

a, b Means in the same row with different letters show significant differences Non.
SD=Standard deviation
* Significant

DISCUSSION

The use of intramuscular injection as alternative days injection to avoid selenium toxicity, table (1) shows the average values that obtained. Usually, the level of TSH thyroid stimulating hormone in the blood is the best indicator of the function of the thyroid gland because it regulates the growth and activity of the thyroid gland as it increases the number of its follicles and its ability to retain iodine (Davoodi *et al*., 2022) and encourages thyroglobulin degrading enzymes and the release of thyroid hormone (Wang, *et al*., 2018) when comparing the average values of TSH between the G1, G2 and G3, a statistically significant differences was found (P<0.05) between the mean values of the third group that injected 10 ml of E-Se, and its average levels were higher compared with G2 that injected with 5 ml E-Se, and G1that was injected 0 ml E-Se, and thyroid dysfunction can be explained by TSH values. These results were consistent with the findings of (Davoodi *et al*., 2022), where they found that the TSH values of goats after iodine treatment increased, noting that previous research determined normal TSH values ranging from (0.01–0.10 µIU/m).

A reading of TSH values less than normal indicates inability of the pituitary gland to increase the levels of the thyroid hormones T4 (Thyroxine) and T3 (Tetraiodothyronine-Thyroxine) and thus there is an over activity of the thyroid gland (Hyperthyroidism), which means acute thyroiditis (Wang *et al*., 2018) .When the value of the TSH hormone decreases with the stability of the T4 or T3 hormone, it means the presence of external factors (stress, lack of minerals and a diet containing a high percentage of gluten, affecting the gland, causing inflammatory and metabolic reactions) may be a type of endemic thyroid disease, which affects the regularity of estrous cycles and early death for fetuses (Kadum and Luaibi, 2017). These findings agree with what some researchers found Liotta *et al*., (2021) that changes in TSH values in Nicastrese Goats change with the effects of pregnancy, childbirth, and nutrition.

Selenium has a significant role in maintaining the functioning of the thyroid gland (Sampaio *et al*., 2021) and is no less important than iodine (Aghwan *et al*, 2015) and that adequate selenium nutrition can help protect the organism from iodine deficiency. Hypothyroidism activity due to iodine deficiency. Some scientists evaluated the relationship between goiter and selenium. Their results show that selenium supplementation can be protective to congenital goiter (Davoodi *et al*, 2022), which is involved in thyroid enlargement because it significantly improves the activity of selenium-dependent enzymes and plays a significant role in energy metabolism in cells. It is included in the synthesis of the anti-oxidant enzyme Glutathione Peroxidase, four atoms of selenium are linked with two molecules of the enzyme (GsH-PX) and acts as a companion that activates its work (Liangkang *et al*., 2020) that works to transform hydrogen peroxide resulting from the gland tissues, and the vitamin Oxidative stress and oxidative stress enter cells in it. Thyroid it is one of the necessary factors that ensures balanced levels of thyroid hormones, as vitamin E works to scavenge the waste, chelate and other free radicals, which cause oxidative damage to cells (Meshreky and Metry, 2000). Thyroid peroxidase is one of the enzymes that contain selenium and are involved in iodine metabolism, which prevents the breakdown of the epithelial cells of the thyroid gland (Bhardwaj, 2018). This means an increase in the number of receptors for thyroid-stimulating hormone (TSH) cells in the thyroid gland. Therefore, a deficiency of selenium poses a threat to the health of the thyroid gland and leads to thyroid dysfunction and enlargement of the gland. It has been proven that ruminants have the ability to convert inorganic selenium into less toxic compounds through lactic acid bacteria in the process of microbial digestion because the rumen has the ability to absorb selenomethionine well and is stored in the liver and kidneys (Lee *et al*., 2019). Selenium increases the efficiency of microbial digestion (Tian *et al*., 2022) and one of the vital functions of selenium is to maintain on the functional efficiency of the pancreas and in digesting fats containing vitamin E well and taking their course into the blood (Cao *et al*., 2014), the researchers indicated that the body uses selenium to make enzymes as a cofactor. The active part is compounds called seleno-cysteine, and these compounds enter into the synthesis of proteins and the largest concentration of selenium in the blood was found in the selenoprotein, which may contribute to selenium transport or act as an antioxidant. Selenium deficiency can affect selenium proteins that remove oxygen free radicals as a result of the production of thyroid hormones and may cause tissue fibrosis by the time. Thyroid hormones affect the rate of metabolism and protein formation, and growth and development Kadum and Luaibi, (2017). This explains the reason for the significant differences in the rates of live body weights between the G1 and G2 and G3, as did not find significant differences for G2 and G3, but the two groups outperformed significantly ($P<0.05$) on G1 as shown in table (Aghwan *et al*., 2015), as a result of the increase in the rate of food conversion because the nutritional supplement improves the growth performance and may explain the slight decrease in the weight of G3 for the activity of gland work and the increase of metabolism and energy production because selenium provides energy to nourish the muscles, without stimulating hormones storage of fat in the body. In improving the functions of blood cell receptors, transporting lipoproteins, and aspartate-aminotransferase (Barcelos *et al*., 2022) this is consistent with what was indicated by (Wang, *et al*., 2018) in his study, adding selenium and its effect on thyroid activity in mice and increasing their weight when eating the same amount of food and no toxicity when treating mice with selenium (Cao *et al*., 2014) dietary levels were used. The distinct levels of organic and inorganic selenium by feeding pregnant females of selenium on the growth performance of bred pigs, and there was no toxic effect when using treatments with different concentrations. It has been proven that vitamins and minerals play a significant role in increasing animal weight and reproductive capacity, indicating (Aghwan., *et al*., 2015) when supplementing with selenium and increasing the weight gain of goats

(Tian *et al*., 2022). Giving doses of E-Se to female goats led to a decrease in the mortality rate of newborn goats (Barcelos *et al*., 2022) and due to the different susceptibility of E-Se to solubility and the concentration of each of the two elements in a different location of the cell as they do not completely overlap, and vitamin E acts as an antioxidant, selenium is necessary for cell respiration and protects liver cells, selenium is very active and a small amount of it is very effective, and vitamin E stimulates the activity of selenium, so both are necessary, and vitamin E increases the level of estrogen secretion. In the period of sexual puberty and progesterone in pregnancy to maintain the sides and improve reproductive performance and are also essential factors for the prevention of many reproductive disorders in different animals and to improve their reproductive performance (Meshreky & Metry, 2000). The reproductive efficiency decreased in animals suffering from a deficiency of selenium (Yang, *et al*., 2019), while the administration of selenium led to an increase in the reproductive efficiency of ewes and the health status in general, as well as an increase in the weights of the lambs resulting from those ewes (Ziaei, 2015), as selenium is important in the growth and development of lambs and is important in metabolic processes and contributes to reproductive success, and its deficiency can lead to pathological effects such as placental retention, early abortion, low fertility and birth defects (Barcelos *et al*., 2022) and selenium deficiency leads to cases of weight loss and low animal productivity (Liangkang *et al* ., 2020) to lambs resulting from mothers suffering from a deficiency in selenium. When the level of selenium is less than its normal level in the diet, the lambs whose mothers obtained sufficient amounts of selenium were less weighty and less immune. Thyroxine synthesis during pregnancy (Liotta., *et al*., 2021). This is consistent with what previously found by (Pechova *et al*., 2011) as the low level of selenium in the ewes diet led to the death of the fetuses at an early age after fertilization, and this leads to an increase in the number of barrier ewes in the herd the deficiency of vitamin E and selenium led to a decrease in the weight of the ewes and their lambs at the weaning age as a result of the decrease in thyroid hormone. It was noted that giving vitamin E and selenium led to the protection of immune cells and increased their efficiency, which leads to the production of large quantities of immune bodies, which in turn led to raising the health level of the animal and gaining weight (Hasan and Mustafa, 2020) or by reducing stress on the animal.

CONCLUSIONS

The mineral elements are of importance. They are high efficiency and in low doses. Selenium has a protective effect from endemic goiter, and its deficiency is a risk factor for local goat herds. The intramuscular injection of vitamin E and selenium increased the levels of thyrotropin and improved the health status and weights of local goats by improving the immunity, decreases the mortality rate of newborn goats and health status of the animals.

RECOMMENDATIONS

1- Conducting studies on the use of mineral elements by taking samples for laboratory analysis of feed, milk, blood, and tissues to know the mineral content and its effects, enzymes, and hormones on productive, reproductive, and physiological traits.

2- And that feeding selenium with adequate vitamin E can help protect against iodine deficiency. During pregnancy, there is a strong need for it during the normal growth stages of the fetus, in order to avoid the occurrence of an enlarged thyroid gland during pregnancy.

3- Providing green fodder from pastures in the spring period that is rich in trace mineral elements and that is less expensive than adding mineral supplements.

4- Directing breeders to add mineral elements to balanced diets of goats and sheep because of their benefit in improving the health and productivity of the herd.

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