

Effect L-Arginine Acid Injection on Sex Cells in Shami Goats

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Abstract

This study was conducted with the aim of showing the effect of injecting L-Arginine acid on characteristics of spermatogonia, for Period 15/7/2021 until 15/10/2021 in the animal farm/ Ruminant hall of Animal Production Department /College of Agriculture / University of Diyala. This study include 12 male of Shami goat aged (1.5-2) years, with an average weight (37-40) kg, were divided randomly to four equal groups (3/ male / group): the first was a control group (without injection) (T1), while the second (T2), third (T3) and fourth (T4) groups were injected intramuscular with L-Arginine Acid in concentration 125, 250 and 375 mg /48 hour. The animals were slaughtered after the end of the experiment. The number of spermatogonia cells, Sertoli cells and the number of Leydig cells, germ cell layer, seminiferous tubule diameter and Seminiferous lumen of the tubule were measured. The results showed that the injection of L-Arginine Acid led to highly significant increase ($p < 0.01$) in the number of Sertoli cells, Leydig cells, inside the seminiferous tubule, as T4 and T3 were superior on T1 and T2,, T2 were superior on T1. There was also highly significant effect ($p < 0.01$) for injection in the number of Leydig cells, spermatogonia cells. So T3 and T4 were superior on T1 and T2, and T2 was superior on T1. The number of Spermatogonia cells also outperformed the T3 and T4 transaction on T1 and T2 transaction, T2 were superior on T1 and there were no significant differences between T3 and T4.

The results showed that the was a significant effect ($P < 0.05$) for Aspartic acid injection in the thickness of germ layer, as T4 was superior on rest treatments, while T3 was superior on T1 and T2. There was also highly significant effect ($p < 0.01$) for injection in the seminiferous tubule diameter, as T4 and T3 was superior on T1 and T2 and T2 was superior on T1. in the thickness of the seminiferous tubule lumen, T4 was superior on T2 and T1, no significant differences were observed between the T1 and T2 with the T3, no between the T3 and T4.

Keywords: Sex Cells – L-Arginine Acid - Shami Goat.

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INTRODUCTION

Livestock is the mainstay of the agricultural economy in Iraq, and goats support it because of its economic importance in food security, as it provides the consumer with milk and red meat in addition to hair, as well as multiple twins, as the percentage of twins is about 75% (Mavrogenis and others, 2006) Goats are also distinguished by their ability to convert rough feed materials of low nutritional value into proteins of high nutritional value (Mlambo and Mapiye, 2015). The Shami goat is spread in the Arab countries, Cyprus and Greece, and its origin is due to Syria, as it is called the Goat shami or the Damascus goat (Alkass, 1993) Reproduction in goats is affected by several environmental factors (lighting, temperature, humidity) and hormonal factors (Musa and Ibrahim, 2015). It is clear from this that goats are a seasonal reproductive animal, meaning that light has a direct effect on the reproductive cycle and its efficiency (Bakar et al, 2011) as the Shami goat enters a period of sexual inactivity). During the summer, with the increase in the number of daylight hours, which leads to a decrease in the secretion of the hormone melatonin, which is secreted by the pineal gland (Ahmed et al, 2016) This is reflected in the level of

reproductive hormones (GnRH, SSH and ICSH), testosterone secreted from the testicles, semen characteristics and testicular tissue, and thus delays the process of female insemination and delays the productive period (Darbandi et al., 2018). Melatonin stimulates the hypothalamus to secrete GnRh, which in turn affects the pituitary gland to secrete hormones. SSH and ICSH increase with their concentrations, which raise the reproductive efficiency of male goats. The benefit of the process of regulating the reproductive cycle comes by improving the vitality of the semen by increasing the volume and concentration of the ejaculate, as well as the live sperms, intact, the plasma membrane, with a high fertilization ability to ensure the process of pollination, and the fact that the Shami goats are seasonal breeding affected by the length of the photoperiod. In Iraq (Talak, 2019) Therefore, many studies have been conducted on it to improve the quantity and quality of semen by using hormonal treatments such as eCG (Al-Mahdawi 2019), Kisspeptin, GnRH and hCG (Al-Amri, 2015) and hCG (Khalil, 2021) or using amino acids such as tryptophan (Mahdi, 2021) and citric acid. Aspartic (Al-Dulaimi, 2022). L-Arginine is an amino acid that is present in the tissues of the male reproductive system and the composition of sperms

(Jenkinson et al., 1996) It has an important role in the multiplication and differentiation of sex cells and works to increase the secretion of testosterone by Leydig cells by the effect of secretion of ICSH from the pituitary and GnRH from the hypothalamus Which leads to improved reproductive performance (Sidney et al., 2004) Also, arginine raises the level of SSH hormone, which is important in the development of Sertoli cells and spermatogenic cells, since there is no study that indicates the role of the amino acid L-Arginine in improving reproductive performance and semen characteristics in Shami goats during the period of low reproductive efficiency. This study shows the effect of the study of injecting different levels of the amino acid L-Arginine on the fertility of Shami goats and histological changes.

MATERIALS AND METHODS

This study was conducted in the form of the College of Agriculture / University of Diyala, 12 sexually mature Shami goats were used in this experiment, their ages ranged between (1.5-2) years and weights ranged between (37-40) kg. For the purpose of studying the effect of amino acid injection on some characteristics of semen in Shami goats in the summer, the animals were injected with acid and semen collected from male goats by using the artificial vagina of sheep and goats for once a month from each animal in the presence of a female in estrus injected with estradiol By (2.5) mg 36 hours before the collection process. The animals were divided into 12 male Shami goats with four treatments:-

The first treatment, T1: the control treatment.

The second treatment T2: injection of L-Aarginine acid at a dose of 125 mg

The third treatment T3: injection of L-Aarginine acid at a dose of 250 mg

Fourth treatment T4: injection of L-Aarginine acid at a dose of 375 mg

The Mass motility of the sperms was assessed as reported by Blom (1946), and the individual motility was estimated as reported by Chemineau et al. (1991), the sperm concentration was calculated using an erythrocyte counting chip and prepared a dilution solution of 0.9% Sodium chloride and 0.01% mercury chloride and 2 g/l eosin dye (dissolved in water) to distinguish sperm under the microscope, so the dilution ratio was 1:200, and the live and Dead spermatozoa were calculated based on what was stated by Chemineau et al., (1991), the abnormal sperm were calculated. According to the method of Chemineau et al., (1991). The statistical program CRD was used in the statistical analysis of the experiment data according to a design

$$Y_{ijk} = \mu + a_i + e_{ijk}$$

Y_{ijk} = View value k of the transaction.

μ = general mean of the experiment

a_i = main effect of the L-Aarginine acid

e_{ijk} = the value of the experimental error of observation, which is distributed normally and randomly independently with mean equal to zero and variance σ^2 .

Significant differences between means were compared using Duncan's polynomial test (Duncan, 1955).

RESULTS AND DISCUSSION

The effect of L-Arginine amino acid injection on sex cells in the testes of male Shami bucks

Table 1 showed there were significant differences ($p < 0.01$) for injection of Arginine acid on the number of Sertoli cells inside the seminiferous tubule, as T4 and T3 were superior on T1 and T2, and T2 on T1 (42.33±1.45, 44.00±1.52, 31.00±1.00, 36.66±0.88) respectively, and there were no significant differences between T3 and T4. There was also significant effect ($p < 0.01$) for injection in the number of Leydig cells, so T3 and T4 were superior on T1 and T2 (35.66 ± 1.20, 33.00 ± 1.15, 20.33 ± 1.45, 27.33 ± 1.45), respectively, and T2 was superior on T1 and there were no significant differences between T3 and T4. The number of Spermatogonia cells also superior the T3 and T4 transaction on T1 and T2, and T2 on T1 (92.66±1.45, 94.33±2.33, 77.33±1.45, 85.00±1.15) respectively, and there were no significant differences between T3 and T4.

Table 1: The effect of L- Arginine amino acid injection on sex cells in the testes of male Shami bucks (mean± SE)

Treatment	Sertoli cells	Leydig cells	Spermatogonia
T ₁	31.00±1.00 b	20.33±1.45 c	77.33±1.45 c
T ₂	36.66±0.88 b	27.33±1.45 b	85.00±1.15 b
T ₃	44.00±1.52 a	33.00±1.15 a	94.33±2.33 a
T ₄	42.33±1.45 a	35.66±1.20 a	92.66±1.45 a

Different letters in column indicate significant differences (a, b, c: $P \leq 0.05$).

The moral superiority in Leydig and Sertoli cells and spermatogenic cells may be attributed to the effect of arginine injection into the hypothalamus and stimulating it on the secretion of GnRH, which affects the pituitary gland, and then the secretion of SSH hormone, which has an active role in the maturation and preparation of Sertoli cells, as well as the secretion of ICSH, which acts on Leydig cells. And their numbers increased (Aziz et al., 2015) in mice, or as a result of the transformation of the embryo through the enzyme arginase to nitric oxide (NO) and polyamines that are important in the multiplication and differentiation of Sertoli and Leydig cells (Thomas and Thomas, 2001).

The effect of L-Arginine amino acid injection on sex cells in the testes of male Shami bucks

Table 2 showed there were significant differences ($p < 0.01$) for Arginine acid injection in the thickness of germ layer, as T4 and T3 was superior on T2 and T1, while T2 was superior on T1 and there were no significant differences between T3 and T4 (78.63 ± 0.69 , 76.86 ± 2.14 , 66.00 ± 3.05 and 48.06 ± 4.32) respectively. Also T4 and T3 was superior on T1 and T2 in the seminiferous tubule diameter (199.83 ± 0.69 , 197.76 ± 2.14 , 157.23 ± 4.32 and 182.53 ± 3.05) respectively, T2 was superior on T1 and there were no significant differences between T3 and T4. as T4 was superior on T1 and T2 in the thickness of the seminiferous tubule lumen, no significant differences were observed between the T1 and T2 with the T3, no between the T3 and T4. (41.90 ± 1.70 , 38.90 ± 1.53 , 55.80 ± 4.95 and 51.10 ± 5.16) respectively.

Table 2: The effect of L-Arginine amino acid injection on sex cells in the testes of male Shami bucks (mean \pm SE)

Treatment	Germ cell layer	Seminiferous tubule diameter	Seminiferous lumen of the tubule
T ₁	48.06 \pm 4.32 c	157.23 \pm 4.32 c	55.80 \pm 4.95 b
T ₂	66.00 \pm 3.05 b	182.53 \pm 3.05 b	51.10 \pm 5.16 b
T ₃	76.86 \pm 2.14 a	197.76 \pm 2.14 a	38.90 \pm 1.53 ab
T ₄	78.63 \pm 0.69 a	199.83 \pm 0.69 a	41.90 \pm 1.70 a

Different letters in column indicate significant differences (a, b, c: $P \leq 0.05$).

The significant differences in the diameter of the seminiferous tubule, the diameter of the lumen of the tubule and the thickness of the germ layer may be due to the presence of arginine in the seminiferous tubules, which led to an increase in the number of sex cells (Lyde K cells, Sertoli cells and germ cells) that form sperm (Da Silva et al., 2000), which leads to an increase in the number of sperm-forming cells, The diameter of the seminiferous tubule, the thickness of the germ layer and the diameter of the lumen of the seminiferous tubule (Barrios et al., 2000).

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