

# Effect L-Arginine Amino Acid Injection on Some Characteristics of Semen 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 semen, 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 (1.2-2) 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-Aarginine Acid in concentration 125, 250 and 375 mg /48 hour. Semen was collected by artificial vagina three times during the study. The results showed that the injection of L- Aarginine acid led to highly significant increase ( $p<0.01$ ) in individual motility, Mass motility, live spermatozoa percentage, Dead spermatozoa ratio, sperm concentration, abnormal spermatozoa percentage. There were significant effects ( $p<0.05$ ) for injection on the Mass motility of the sperm, where T4 and T3 were superior on T1 and T2 and T2 was superior on T1. A highly significant effect was also found ( $p<0.05$ ) for injection in the individual motility where T4 and T3 was superior on T1 and T2 and T2 were superior on T1. There was a significant effect of the injection in concentration, where T4 was followed by T3 then T2 and finally T1. The percentage of live spermatozoa was superior for T3 and T4 on T1 and T2 and T2 was superior on T1. There was a high significant effect in Dead spermatozoa so T4 and T3 were superior on T1 and T2, T2 was superior on T1 with the lowest percentage of Dead spermatozoa. There was also significant effects of injection in the percentage of abnormal form sperm, as T4 and T3 was superior on T1 and T2 and T2 were superior on T1 with the lowest percentage of abnormal spermatozoa.

**Keywords:** Semen Qualities – 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 and Faeq,1982)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 (Kalil,2018) 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, 2014) 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). and Vitamin C has been used to improve the traits of the semen for rams

(Al-Saab, 2015). 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<sub>ijk</sub> = View value k of the transaction.

μ = general mean of the experiment

a<sub>i</sub> = main effect of the L-Aarginine acid  
 e<sub>ijk</sub> = the value of the experimental error of observation, which is distributed normally and randomly independently with mean equal to zero and variance σ<sub>e</sub><sup>2</sup>.

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

**RESULTS AND DISCUSSION**

**The effect of L-Aarginine amino acid injection on individual and Mass activity and concentration of sperm**

Table-1 showed the effects of L-Aarginine amino acid injections on the Mass motility of the sperm There were significant effects (p<0.05), where T4 and T3 were superior on T1 and T2 and T2 were superior on T1 and there was no significant difference between T3 and T4 (87.00±1.31, 85.33±0.92, 64.11±1.54, 71.55±1.25) percentage, respectively. A highly significant effect was also found (p<0.01) for injection in the individual motility where T4 and T3 was superior on T1 and T2 and T2 were superior on T1 (86.77±1.21, 84.77±1.19, 66.11±1.41, 74.11±1.45) % respectively and there was no significant difference between T3 and T4. There is a significant effect of the injection in concentration, where T4 was followed by T3 then T2 and finally T1 (4.34±0.13, 3.80±0.11, 2.51±0.19, 1.98±0.13)×10<sup>9</sup> respectively.

Table 1: The effect of L-Aarginine amino acid injection on individual Mass activity and concentration of sperm (mean± SE).

Treatment	Individual movement %	Mass activity %	Spermatozoa concentration (ml ×10 <sup>9</sup> )
T1	1.41±66.11 c	1.54±64.11 c	0.13±1.98 D
T2	1.45±74.11 b	1.25±71.55 b	0.19±2.51 C
T3	1.19±84.77 a	0.92±85.33 a	0.11±3.80 B
T4	1.21±86.77 a	1.31±87.00 a	0.13±4.34 A

Different letters in column indicate significant differences (a, b, c: P≤0.05)

The main reason for the increase in the mass movement of the groups is due to the fact that arginine is an essential substance in the manufacture of polyamines, spermidine and spermine in the body and it affects the movement of sperms (Moinard *et al.*, 2005). Also, the high concentration of arginine improves the rate of mass movement and fertility through the formation of nitric oxide, while its low concentration led to a clear decrease in mass movement and fertility (Pegg, 1988). This result agreed with what was found (Grazul-Bilska *et al.*, 2015).

The increase in the individual motility of the sperm may be due to the high concentration of the amino acid arginine, which restores energy sources (ATP) (Barrios *et al.*, 2000) through the formation of phosphoric acid, which is important in increasing the activity and movement of sperms (Gur *et al.*, 2012), and these results agreed with what was mentioned (Mann, 2012) in male rats.

The reason for the high sperm concentration may be due to the increase in the concentration of arginine acid, which is the main substance in the manufacture of ornithine, and the latter turns into Spermidine and Spermine, which are important in the formation and continuation of sperms (Morris *et al.*, 2002), and this result agreed with what was stated (Moinrad *et al.*, 2005).

### The effect of L-Arginine amino acid injection on Live, Dead and Abnormal spermatozoa ration

Table-2 showed the effects of L-Arginine amino acid injections on the percentage of live spermatozoa, T3 and T4 were superior on T1 and T2 ( $87.33 \pm 0.78$ ,  $88.44 \pm 0.80$ ,  $71.11 \pm 1.28$ ,  $79.00 \pm 0.70$ ) and T2 was superior on T1 and there was no significant difference between T3 and T4. There is a high significant effect in Dead spermatozoa, T4 and T3 were superior on T1 and T2, T2 was superior on T1 with the lowest percentage of Dead spermatozoa ( $11.55 \pm 0.80$ ,  $12.66 \pm 0.95$ ,  $28.88 \pm 1.28$ ,  $21.00 \pm 0.70$ ) % and there was no significant difference between T3 and T4 respectively. There was also significant effects of injection in the percentage of abnormal spermatozoa, T4 and T3 was superior on T1, T2 and T2 were superior on T1 with the lowest percentage of abnormal spermatozoa ( $7.66 \pm 0.83$ ,  $8.88 \pm 0.90$ ,  $14.88 \pm 1.04$ ,  $12.11 \pm 1.00$ )% and there was no significant difference between T3 and T4 respectively respectively.

Table 2: The effect of L-Arginine amino acid injection on Live, Dead and Abnormal spermatozoa ration (mean  $\pm$  SE).

Treatment	abnormal spermatozoa %	Dead spermatozoa %	Live spermatozoa %
T1	1.04 $\pm$ 14.88 c	1.28 $\pm$ 28.88 c	1.28 $\pm$ 71.11 c
T2	1.00 $\pm$ 12.11 b	0.70 $\pm$ 21.00 b	0.70 $\pm$ 79.00 b
T3	0.90 $\pm$ 8.88 a	0.95 $\pm$ 12.66 a	0.78 $\pm$ 87.33 a
T4	0.83 $\pm$ 7.66 a	0.80 $\pm$ 11.55 a	0.80 $\pm$ 88.44 a

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

The reason for the moral superiority of the percentage of live sperms of the groups may be attributed to the effect of the injection of the amino acid arginine on the secretion of the hormone prolactin, insulin and glucocan (Organicfood, 2010) which are important in the metabolism of cells and the period

of viability of sperm actively, which led to an increase in the percentage of live sperms (Barb *et al.*, 1991.) This result agreed with what was confirmed by (Hiney *et al.*, 1991) in poultry.

The reason for the moral superiority of the lowest percentage in dead sperm is due to the role of arginine and its presence in the male reproductive system and its effect on Lydick and Sertoli cells in large quantities, which leads to raising the level of testosterone, which has an important role in reducing the percentage of dead sperm (Marthin, 2014).

The moral superiority of the lowest percentage of abnormal sperm as a result of injecting arginine, which is included in the synthesis of nucleoproteins, and its participation in normal mitosis and meiosis (Srivastava *et al.*, 2006), as well as working to raise the level of testosterone, which increased the percentage of sperm and preserving their natural shape, which led to a reduction in the percentage of distorted sperms (Sukardi *et al.*, 2006).

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