

Effect of Amino Acids (Methionine and lysine) on the Dimensions of Ovaries and Oocytes in Iraqi Goats during the summer

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Abstract

This study was conducted in Diyala Governorate. Before that, veterinary examinations were conducted to ensure the safety of the experimental animals for the purpose of measuring the required characteristics. This study continued for three months from 7/1/2024 to 10/1/2024. This experiment was applied to 12 female Iraqi local goats, with ages ranging from (1.5-2 years) and weights ranging from (22-25) kg. Field experiment animals were randomly divided into four groups, with three replicates in each group. The control group (T1) which was untreated, while the other three groups were treated with methionine and lysine, which were placed in capsules and inserted into the mouth. This process was repeated every 48 hours. The amino acids (methionine and lysine) were dosed as follows: (T2) was dosed only with a concentration of 2 grams of methionine/animal, the (T3) was dosed only with a concentration of 2 grams of lysine/animal, and (T4) was dosed with 2 grams of methionine with 2 grams of lysine/animal. At the end of each month of this study, all animals were slaughtered and samples were collected at a rate of 12 ovaries per month. The results showed that the fourth group had a significant ($p < 0.05$) superiority in ovarian dimensions (weight, length and thickness), reaching 4.94 Kg, 16.86 mm and 9.24 mm, respectively, compared to T1, T2 and T3 groups. The T2 and T3 groups also had a significant superiority in ovarian dimensions compared to the T1 group. The results showed that there was a significant effect in T4 group in the number of mature follicles are 7.56 and their diameters were 5.60 mm, and the immature follicles were 3.67. A significant superiority was observed in the diameters of the Oocytes of T4 (118.44) compared to T1, T2 and T3 groups, respectively.

Keywords: Methionine, Lysine, Ovary, Follicles, Goat.

)It is not necessary that the keywords are taken from the title (

Introduction

Goats in Iraq are considered economic animals, as they constitute the most important part of the livestock industry, as their products are considered the main source of animal protein, which is important for human food [1]. Sheep and goats also meet the main needs of the population in terms of food, social and economic security due to the increasing demand for them [2,3]. Improving the production levels of animals during their reproductive life is essential for the

development and success of projects in the field of animal production [4.]

Pregnancy is one of the most critical and energy-intensive periods, which requires attention and careful monitoring of the behavioral and physiological changes that occur during it [5], such as metabolic disorders and oxidative stress, which are common problems that greatly affect goat productivity. Most of the follicles in the ovary undergo atresia and die frequently as a result of oxidative stress due to the effect of free radicals on the primary follicles during the

long duration of daily lighting, and it also affects the quality of Oocytes and the size of the follicle [6-8], and a few of them mature and are released for fertilization during the ovulation period [9]. To improve the reproductive characteristics of goats in terms of quantity, type, and cell growth, and thus increase the ovary dimensions [10], as the dimensions of the ovary differ and depend on the reproductive and physiological state of the animal [11], the means of breeding and reproduction must be enhanced by applying techniques through the use of antioxidants such as vitamins such as vitamin C [12] or amino acid compounds glutathione [13] and carnitine [14].

Amino acids are organic compounds that contain an amine group (NH₂) and a carboxyl group (COOH). These acids are considered the basic building blocks in the formation of peptides and proteins [15]. In addition to their role in protein formation, amino acids also generate energy [16,17].

Methionine and lysine are the first two essential amino acids which play a vital role in reproduction. Methionine is a donor of the methyl group through the conversion process in which the intermediate compound (SAM) is produced and contributes in the formation of DNA and RNA [18]. It also provides the sulfur element to form sulfur acids, which are antioxidants in the body, as it contributes in the formation of glutathione, which protects the structure of the plasma membrane when exposed to oxidative damage [19]. It also has a major role in protecting cells from damage caused by free radicals in the body [20].

Lysine plays a fundamental and essential role in building all proteins. It also improves muscle growth and bone development by increasing calcium absorption to form collagen and treat osteoporosis [21, 22]. It has

a prominent role in fatty acid metabolism and leads to lowering cholesterol levels. It is also involved in the production of carnitine, which plays a prominent role in protecting cells from damage caused by free radicals [14].

Given the above-mentioned importance of methionine and lysine, the study aimed to determine the effect of supplementing methionine and lysine at different concentrations on the dimensions of the ovaries, Oocytes, and ovarian follicles in female local goats during the summer. Note that there are no studies similar to our research.

Material and Methods

The experiment was conducted in a farm in Diyala, Iraq. Veterinary examinations were conducted to check the health of animals. The study continued for three months, from July 1, 2024 to October 1, 2024, during the summer. This was preceded by preparatory period for 15 days, through this period the animals provided with fodder, nutritional supplements, and veterinary care throughout the experiment to ensure their health. The experiment was conducted on (12) female Iraqi local goats per month and this repeated for 3 months, so the total number of goats are 36 for the three months. They were cared for in the brans and also in the pastures. The purpose of that was to get the ovaries of sexually mature female goats which aged (1-2) years and their weigh was ranging between (22-25) kg. The experimental animals were divided into four groups. The first group was not dosed (control group). The other three groups were dosed orally after placing the amino acids in capsules, which were then pushed into the mouth. The dose process was repeated every 48 hours, as follows:

T1: The first group was not fed (control.)

T2: The second group was fed only 2 g of methionine/animal.

T3: The third group was fed only 2 g of lysine/animal.

T4: The fourth group was fed a combination (2 g of methionine and 2 g of lysine)/animal.

At the end of each month of experiment months, all animals were slaughtered, and samples were collected at a rate of 12 ovaries in each month of the experiment. After that the animal have skinned and its internal organs have removed, then they were examined visually and they were good and not deformed. The ovaries were also separated from the rest of the reproductive system parts. These parts were placed in plastic cups numbered for each animal containing a saline solution (0.9% NaCl), then placed inside a plastic box containing a quantity of ice until they were transferred to the laboratory for measurements after washing them to get rid of the remnants of membranes and blood. Then they were washed with the saline solution and dried [23]. The required measurements were carried out on them, which are weight, length and thickness. They were placed on drying paper to dry them, where the weight was measured using a sensitive electronic balance to ensure accuracy. The dimensions of the ovaries (length and thickness) were measured using the oven, where the length was measured between the front and back ends, and the thickness was measured from the top of the ventral surface to the top of the dorsal surface of the ovary [24]. Then, the diameters of the ovarian follicles for each ovary were measured using the oven, then Their dimensions and numbers were calculated and recorded [25]. The other part of the ovary was then preserved in 10% diluted formalin for histological sectioning and measurement of the dimensions of the ovarian follicles and

oocytes at the end of each month of the experiment, according to the histological method followed until histological sectioning and staining, as indicated in [26]. The readings were carried out by a specialist physician in accordance with [27].

Design

Mathematical model for the Complete Randomized Design (CRD):

$$Y_{ij} = \mu + t_i + \xi_{ij} \quad \text{where:}$$

Y_{ij} = the observed value of the studied trait

μ = the overall mean

t_i = the treatment effect ($i = 1, 2, 3, 4$)

ξ_{ij} = the standard error, which is normally and independently distributed with a mean of zero and a variance equal to $\sigma^2 e$.

Significant differences between means were compared using Duncan's multiple range test [28].

Results and Discussion

Table (1) showed significant effects ($P \leq 0.05$), as the fourth group (methionine and lysine) significantly outperformed the second and third groups in ovary weight 4.94 mm, in addition to the first group (control) without dose 4.18, 4.04, 3.59 mm, respectively. The second and third groups also outperformed the first group. A significant increase was observed for the fourth group in the average ovary length 16.86 mm compared with the first, second and third groups 14.45, 15.80, 15.61mm, respectively. The second and third groups also outperformed the first group (control). The results in (Table 1) indicated that the fourth group was significantly superior in ovarian thickness 9.24 mm compared with the first group (control) and the second and third groups 7.61, 8.36, 8.36 mm, respectively. The second and third groups also

outperformed the first group that was not dosed.

The results in (Table 1) are consistent with [29], as they showed that methionine and lysine work to increase the growth of cells that make up ovarian tissue and increase ovarian activity. This superiority may be attributed to the fact that methionine acts as an antioxidant through its formation of cysteine, which produces glutathione, which is an antioxidant that works to inhibit free radicals resulting

from thermal and oxidative stress. Likewise, lysine stimulates the formation of carnitine, which is an antioxidant that fights peroxides when exposed to thermal and oxidative stress [14, 30]. This leads to reducing the effect of daily lighting, which is reflected in the secretion of the hormones FSH and LH from the pituitary gland, which leads to the growth and development of ovarian tissue and thus increasing its dimensions [31].

Table 1. Effect of methionine and lysine amino acid supplementation on ovarian size (Mean \pm S. E (

Trait	Weight (gm)	Length (mm)	Thickness (mm)
T1	3.59 \pm 0.06 c	14.45 \pm 0.23 c	7.61 \pm 0.20c
T2	4.18 \pm 0.19b	15.80 \pm 0.39b	8.46 \pm 0.22 b
T3	4.04 \pm 0.17 b	15.61 \pm 0.35b	8.36 \pm 0.23b
T4	4.94 \pm 0.33 a	16.86 \pm 0.34a	9.24 \pm 0.19a

Different letters in the column indicate significant differences (a, b, c: $P \leq 0.05$.) groups, which reached 81.77, 112.77, and 110.88 micrometers, respectively. The second and third groups also showed significant superiority over the first group.

Table 2 shows a significant effect ($P \leq 0.05$) on the number of mature follicles in favor of the fourth treatment, which reached 7.56 compared to the first, second and third groups, which recorded 2.67, 5.22, and 4.78, respectively. The second and third groups also outperformed with 5.22 and 4.78, respectively, compared to the first group 2.67. The fourth group also significantly affected the number of immature follicles 3.67 compared to the first and third groups 6.11 and 6.67, respectively. A significant effect was found on the diameters of mature follicles for the fourth group 5.60 mm compared to the first, second and third groups, which reached 2.18, 4.57, and 4.43 mm, respectively. The second and third groups also outperformed the first group. The fourth group also showed a significant effect on egg diameters, reaching 118.44 micrometers, compared to the first, second, and third

The researcher in [32] found that methionine and lysine stimulate the growth and development of follicles in their primary and mature stages and the production of good eggs capable of fertilization, and this is consistent with our current study. The reason for the superiority may be attributed to the fact that the dose of methionine and lysine has improved the reproductive performance of female goats due to the importance of absorbing these acids in the intestines, which has a positive effect on the body's metabolism and on the growth and development of embryos [33]. The duration of lighting affects the pineal gland, which plays an important role in sexual maturation, which negatively affects the number of mature and immature

follicles, as well as its effect on the secretion of follicle-stimulating hormones (FSH). Its decrease affects the decrease of estrogen from the follicle, which affects the number of follicles, their growth and development [34,35]. There is also a relationship between the diameter of the follicle and the diameter of the egg. The larger the diameter of the follicle,

the more eggs with good diameters are produced due to the accumulation of cells, which are necessary to nourish the egg. The reason for the increase in the diameter of the eggs is due to the accumulation of cell layers, which is important for nourishing the egg [36].

Table 2. Number of mature ovarian follicles and their diameters, immature follicles and egg diameters (Mean \pm S. E (

Trait	Number of mature follicles	Number of immature follicles	Diameter of mature follicles (mm)	Oocyte diameters (μ m)
T1	2.67 \pm 0.52c	6.11 \pm 1.20b	2.18 \pm 0.35c	81.77 \pm 4.86c
T2	5.22 \pm 1.07b	5.78 \pm 0.64ab	4.57 \pm 0.29b	112.77 \pm 3.33b
T3	4.78 \pm 0.94b	6.67 \pm 0.95b	4.43 \pm 0.30b	110.88 \pm 3.66 b
T4	7.56 \pm 0.94a	3.67 \pm 0.66a	5.60 \pm 0.28a	118.44 \pm 1.51a

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

Conclusion

Methionine and lysine supplementation resulted in a significant increase in ovarian dimensions (weight, length, and thickness), as well as an increase in the number of mature follicles and oocytes and their diameters, which positively impacts summer reproduction in female goats. Therefore, I recommend conducting further research on

methionine and lysine and on balanced doses for each animal due to their importance and impact on improving reproductive performance.

The combination of girdling and 10 g.L⁻¹ with either cultivar was superior treatment with most of parameters compared to the control of both cultivars.

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