



Effect of glutathione injections on some semen characteristics of local billy goats.

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ABSTRACT

Given the importance of glutathione as an antioxidant, the study aimed to determine the effect of glutathione on the characteristics of semen in local goats. this study was conducted in the ruminant field of the Animal Production Department at the College of Agriculture, Diyala University. Local billy goats were trained continuously for two weeks as a preliminary stage for collecting semen. using an artificial vagina with microscopic examination of the required semen characteristics to make it ready for collection during the study period. The trial period lasted from 1/7/2022 to 1/10/2022. 15 sexually mature male local goats were used, their ages ranging from 1 to 1.5 years and their weights ranging from 35 to 40 kg. It was completed to divide the animals into 3 totals, where She was all group contains on 5 duplicates. and it was The difference in weights of the animals in all groups ranges from 1 to 1.5 kg. T1 injected Transaction The first 10ml poison was distilled water under the skin, and it was considered the treatment control while glutathione was dissolved in 10ml For each transaction, the other and in levels different from glutathione under skin, as follows: In the second transaction, T2 injected an amount of 15 mg for every kilo and transaction. Third, T3 injected by an amount of 30 mg for every kilo, end all month. It was completed with plural questioner semen using the vaginal artificial and procedure ratings necessary for the adjectives required. The results showed that injection of glutathione led to rise ($p < 0.05$) in the wass matitits in T3 in comparison with the. T1andT2 as for individual matitits, it has decreased in T1compared withT2andT3 Sperm concentration was higher in both treatments. T2sndT3 on a transaction, T1control: The results showed that the percentage of live, dead, and deformed sperm was significantly higher than the treatment. Compared with other transactions T1andT2.

Introduction

Livestock farming is an essential pillar of the global food system as it is an important source of income for many farmers in developing countries because it provides milk, meat, and hides, it can also be used as a source of fertilizer, and the primary purpose of raising livestock is to provide meat, as its meat is considered a food rich in proteins and energy that is indispensable for consumers in the world [1]. In addition, goat milk differs from cow's milk due to its greater ease of digestion, its different alkalinity, and its containment of small fat globules [2]. During prolonged lighting, male goats suffer from decreased semen vitality, which is reflected in their fertility as a result of the high percentage of dead [3] and deformed [4] sperm, which produce free radicals that attack the sperm membrane and its death, leading to a decrease in male fertility [5]. Much research has been conducted to this condition regarding how to use vitamins as antioxidants, such as vitamin C and vitamin A [6] or casein and other antioxidants [7]. also found in a previous study the effect of the fall and winter seasons on the semen characteristics of ram lambs.

Glutathione It is one of the essential non-enzymatic antioxidants in cells the animal, then It acts as an antioxidant to protect cells from free radicals [8]. It regulates the processes of oxidation and reduction. It is involved in other cellular processes such as protein folding and protecting protein thiols from oxidation [9]. Oegradation of. for glutathione effect on the characteristics of goat semen, [10] as glutathione had a significant effect on the individual and mass motility of sperm and the volume of semen. as noted [11], during an experiment in dairy goats, the adding glutathione led to an increase in sperm vitality and a decrease in the percentage of dead and deformed Sperm.

Materials and methods

This study was conducted in the ruminant field of the Department of animal Production/ College of Agriculture/ University of Diyala. Local male goats were trained continuously for a period of two weeks as a preparatory stage to collect semen, and an artificial vagina was used with microscopic examinations of the required characteristics of the semen to make it ready for collection during the study period. The

experiment period lasted from 1/7/2022 to 1/10/2022. 15 sexually mature male local goats were used, their ages ranged from 1 - 1.5 years, and their weights ranged from 35 to 40 kg. Semen was collected at the end of each month of the experiment, and the animals were injected with a concentration as follows:

The first group, T1: 10 ml of distilled water was injected under the skin.

The second group, T2: 15 mg/kg of glutathione was injected.

The third group, T3: 30 mg/kg of glutathione was injected.

mass matility was assessed. as spermas [12], the individual matility was estimated as [13] Statistical software was used, [14] in Completely randomized design CRD for trial data by design.

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

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

μ = overall mean of the experiment

a_i = main effectFor glutathione

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

Significant differences between means were compared using Duncan's multinomial test [15]

Results and Discussion

mass and individual sperm matility and sperm concentration

was found that there was a significant difference at the level of ($P \leq 0.05$) in treatment T3, which was recorded ($88.13 \pm 0.40\%$). Compared with the two treatments, T1 and T2, which recorded (85.13 ± 0.86 and $74.73 \pm 0.67\%$) in the percentage of mass matility, respectively, treatment T2 was significantly superior to treatment T1. was also found that there was a significant difference at the level of ($P \leq 0.05$). In percentage of individual traffic, the groups outperforms. T3 recorded ($77.27 \pm 0.53\%$) compared with the two groups T1 and T2, recorded (74.33 ± 0.54 and

64.53±0.59% respectively), as for the treatment T2. was morally superior to treatment T1. Significant superiority was found at the level of ($P \leq 0.05$) in sperm concentration for groups T3, which recorded ($910 \times 0.24 \pm 3.49\%$), compared to

groups T1 and T2 ($910 \times 0.27 \pm 2.47$ and $910 \times 0.30 \pm 1.77$ respectively). as for the T2 treatment, it was significantly superior to the T1

Table. 1. Effect of glutathione on mass and individual motility and Sperm concentration of local male goats (mean $\pm$ standard error)

Para meters groups	mass motility %	Individual motility %	Sperm concentration ($\mu\text{L} \times 10^9$)
T1	c 74.73±0.67	c 64.53±0.59	c 1.77±0.30
T2	b 85.13±0.86	b 74.33±0.54	b 2.47±0.27
T3	a 88.13±0.40	a 77.27±0.53	a 3.49±0.24

The averages marked with different lowercase letters vertically indicate the presence of significant differences between the injection groups at the level of $P \leq 0.05$ according to Duncan's multiple range test:

The reason may be due to the injection of glutathione, which stabilizes the middle part of the sperm, which leads to the maintenance of sperm motility, because glutathione protects the plasma membrane of the sperm from lipid peroxidation and prevents the formation of oxygen and oxidative stress [16]. The reason for the increase in mass sperm motility may be attributed to the injection treatments. To an increase in the level of testosterone as a result of glutathione injections increases the secretions of the accessory glands from energy sources such as fructose and sorbitol [17] provide the sperm with the energy necessary to increase their movement [18] This result is consistent with what was found by [19] in mice.

Glutathione may have worked to fight free radicals, which led to an increase in individual motility in sperm [20] or the increase in individual motility may be attributed to a high concentration of glutathione in the epididymis, which works to mature sperm and increase motility [16]. by increasing energy sources. ATP and increased calcium influx (Ca^{2+} , which in turn increases sperm tail movement [21] This result agreed with previous studies such as the study [22] in dairy goats.

The reason for the significant increase in sperm concentration may be due to

glutathione, which acts as an antioxidant, as it plays an important role in the defense mechanism to protect the sperm-generating cells and sperm from oxidation, which increases sperm production [23] It may be due to an increase in the concentration of glutathione in the seminiferous tubules in the testicle, which It leads to an increase in spermatogenic cell divisions (Spermatogonia) [24] This result was consistent with what was found by [25] in men [19] in mice.

Effect of glutathione on live, dead, and deformed sperm

was found that there was a significant superiority ($P \leq 0.05$) of live sperm in treatment T3, recorded $87.87 \pm 1.13\%$, compared to treatments T1 and T2, which recorded 85.27 ± 0.97 and $73.40 \pm 0.79\%$, respectively. as for treatment T2, it was significantly superior to treatment T1. it was found that there was a significant superiority at the level ($P \leq 0.05$) of dead sperm in treatment T3, which recorded $12.10 \pm 1.13\%$, compared to treatments T1 and T2, recorded 14.73 ± 0.97 and $26.60 \pm 0.79\%$, respectively. as for treatment T2, it was superior to treatment T1. as for the deformed sperm, it was found that there was a significant

superiority at the level ($P \leq 0.05$) in the T3 treatment, which recorded $8.53 \pm 1.21\%$, compared to the T1 and T2 treatments, which recorded 13.27 ± 0.98 and $17.73 \pm 1.46\%$, respectively. as for

the T2 treatment, it was significantly superior to the treatment. T1.

Table 2 Effect of glutathione on live, dead and deformed sperm in male goats (mean $\pm$ standard error).

Parameters groups	Live sperm %	Dead sperm %	Deformed sperm %
T1	c 73.40 ± 0.79	c 26.60 ± 0.79	c 17.73 ± 1.46
T2	b 85.27 ± 0.97	b 14.73 ± 0.97	b 13.27 ± 0.98
T3	a 87.87 ± 1.13	a 12.1 ± 1.13	a 8.53 ± 1.21

The averages marked with different lowercase letters vertically indicate the presence of significant differences between the injection groups at the level of $P \leq 0.05$ according to Duncan's multiple range test:

The reason

for the significant superiority of the percentage of live sperm in the parameters can be attributed to the significant effect of glutathione in increasing the individual and mass motility of sperm, or it may be due to the effect of glutathione injections, which led to an increase in testosterone [26]. in the seminiferous tubules due to testosterone binding protein (ABP), and thus is reflected in Higher percentage of live sperm [27] this result agreed with what found [29] in pigs

The reason for the decrease in dead sperm may be due to the effect of glutathione injections, as it reduced oxidative damage to the mitochondria, which reduces programmed sperm death by reducing the levels of free radicals such as free oxygen compounds (ROS), improving the

percentage of live sperm and reducing dead sperm [30]. may also return to glutathione, which causes an increase in testosterone [31]. contributes to improving the percentage of live sperm.

The reason for the low percentage of deformed sperm may be attributed to the injection of glutathione, which is an effective scavenger to counteract the production of reactive oxygen species. Therefore, glutathione is an antioxidant that prevents the formation of ROS [32] and reducing the percentage of defective sperm [19]

Conclusion: Improving semen characteristics outside the reproductive season. High testosterone levels outside the reproductive season.

References

- [1] Ederer, P., Baltenweck, I., Blignaut, J. N., Moretti, C., & Tarawali, S. (2023). Affordability of meat for global consumers and the need to sustain investment capacity for livestock farmers. *Animal Frontiers*, 13(2), 45-60.
- [2] Dinkissa. AF and Girgo UG (2022). analysis of Lactation, Reproductive Performance and Disorders of Dairy Cows in

Waliso and Ilu Districts Oromia, Ethiopia. *Diyala Agricultural Sciences Journal*, 2(14): 10-23.

[3] AL-Adly A.M.S (2023). effect of different doses of L-Tyrosin On the characteristics of semen in male Afghan goats during the summer in Iraq. Master Thesis. faculty of Agriculture. Diyala University.

- [4] Al-Lahibi, F.S.H. (2022).The effect of injections of the amino acid arginine (L-Arginine) On the characteristics of semen in Shami goats during the summer. Master Thesis. faculty of Agriculture. Diyala University.
- [5] Mahdawi,.(2019).the effect of injections of horse urchin stimulating hormone (eCG of male Shami goats on the effectiveness of the reproductive system during the summer in Iraq. Master Thesis. faculty of Agriculture. Diyala University.
- [6] Asadpour, R. J., and Nasrabadi. H. T. (2011). Influence of added vitamin C and vitamin E on frozen-thawed bovine sperm cryopreserved in citrate and Tris-based extenders. *Veterinary Research Forum*, 2:37-44.
- [7] Silva,S.,Soares,A.Batista, A. F.Almeida, J.Nunes, C.Peixoto and M.Guerra.(2011).in vitro and in vivo evaluation of frozen sperm in tris egg-yolk and supplemented with superoxide dismutase and reduced glutathione. *Reprod Domestic Anim*, 46:874–881.
- [8] Khalil, R.I., (2018) Effct Of Autumn And Winter Seasons On Seminal Traits And Testicular Measurements Of Awassi Ram Lambs. *Diyala Agricultural Sciences Journal*, 10(2), 1-11.
- [9] Chai, Y. C., & Mieyal, J. J. (2023)Glutathione and glutaredoxin—key players in cellular redox homeostasis and signaling. *Antioxidants*, 12(8), 1553.
- [10] Averill-Bates, DA (2023).the antioxidant glutathione. In *Vitamins and hormones* (Vol. 121, pp. 109-141). Academic Press.
- [11] Dai França, CS, Bezerra, PA, Mendes, CS, Rocha, LF, Santana, ALA, Souza, RS, ... & Barbosa, LP (2021) Docosaehaenoic acid associated with vitamin E in the diluent for cryopreservation of goat semen. *Semina: Ciências Agrárias*, 42(1), 255-266.
- [12] Evans, G. and Maxwell W. M. C. (1990).salamon's artificial insemination of sheep and goat. Butterworth. Sydney, Australia. 25(2): 53-61.
- [13]Walton, A. (1933).Technique of artificial insemination. *Mp. Bur. Anim. Genet.* 56. III-Edinburgh.
- [14] SPSS Inc (2011) Statistical Package for social Sci version 20 for windows Lead Technologies. Inc. USA.
- [15] Duncan, D. B. (1955) Multiple range and multiple F tests. *Biometrics*, 11(1): 1-42.
- [16] Alomar, M. (2021) Effects of oxidized glutathione, cysteine and taurine supplements on motility characteristics of different goat spermatozoa types. *Iranian Journal of Veterinary Science and Technology*, 13(2), 84-92.
- [17] Cevik, M., Tuncer,P.B Tasdemirand U. Ozgurtas.T.(2007) Comparisonof spermatological characteristics and biochemical seminal plasma parameters of normozoospermic and oligoasthenozoospermic bulls of two breeds.*Turk. J. Vet. Anim. Sci.* 31(6): 381-387.
- [18] Senger, P. L. (2003) Regulation of Reprod: nerves, hormones and target tissues. In: *Pathways to Pregnancy and Parturition*. Chapter 5. 2nd revised edn. Current Conceptions Inc., Washington, USA. pp. 102-127.
- [19] Raspa, M. Mahabir, E. Paoletti, R. M. Protti, Mercolini,L. Schiller P. and F. Scavizzi. (2018) Effects of oral D-Aspartate on sperm quality in B6N mice. *Theriogenology*, 121: 53-61.
- [20] Macchia, G., . Topo, E Mangano, N. E. D'Aniello and Boni. R. (2010) DL-Aspartic acid administration improves semen quality in rabbit bucks. *Anim. Reprod. Sci.* 118(2-4): 337-343.
- [21]Cornwall, GA (2009). New insights into epididymal biology and function. *Human Reprod update*, 15(2): 213-227.
- [22] Barbato, V., Talevi, R. Braun, S. A.Merolla, Sudhakaran, S. Longobardi S. and Gualtieri. R. (2017) Supplementation of sperm media with zinc, D-aspartate and co-enzyme Q10 protects bull sperm against exogenous oxidative stress and improves their ability to support embryo development. *Zygote*. 25(2): 168-175.

- [23] Wagner, H., Cheng, J. W., & Ko, E. Y. (2018) Role of reactive oxygen species in male infertility: An updated review of literature. *Arab journal of urology*, 16(1), 35-43.
- [24] Castoria, G. Migliaccio, A. Bilancio, A. Domenico, M. Di Falco, A. De M. Lombardi and F. Auricchio. (2001). PI3-kinase in concert with Src promotes the S-Phase entry of oestradiol-stimulated MCF-7 cells. *The EMBO J.*, 20(21): 6050-6059.
- [25] D'Aniello, G., Ronsini, S. . Notari, T Grieco, N. . Infante, V D'Angel N. and A. D'Aniello. (2012). D-Aspartate, a key element for the improvement of sperm quality. *Adv. in Sexual Med*, 2: 47-53.
- [26] Abdullah, F., Nor-Ashikin, MNK, Agarwal, R., Kamsani, Y.S., Abd Malek, M., Bakar, N.S. & Musa, N.H. (2021) Glutathione (GSH) improves sperm quality and testicular morphology in streptozotocin-induced diabetic mice. *Asian journal of andrology*, 23(3), 281-287.
- [27] Macchia, G., Topo, E. Mangano, N. D'Aniello E. and Boni, R. (2010) DL-Aspartic acid administration improves semen quality in rabbit bucks. *Anim. Reprod. Sci.* 118(2-4): 337-343.
- [28] Adeoye, O., Olawumi, J., Opeyemi, A., & Christiania, O. (2018) Review on the role of glutathione on oxidative stress and infertility. *JBRA assisted reproduction*, 22(1), 61
- [29] Brunet, A. J., Santiago-Moreno A. Toledano-Díaz and López-Sebastián. A. (2012) Reproductive Seasonality and its Control in Spanish Sheep and Goats. *J.Reprod. Fertil*, 94: 45-55.
- [30] Bansal, AK, & Bilaspuri, G.S. (2011) Effects of oxidative stress and antioxidants on semen functions. *Veterinary medicine international*.
- [31] Falvo, S., Di Fiore, M. M. Burrone, L. Baccari, G. C. Longobardi S. and A. Santillo. (2016). Androgen and estrogen modulation by D-aspartate in rat epididymis. *Reprod. Fert., Dev.* 28(12): 1865-1872.
- [32] Sakai, K., Homma, H. Lee, J. A. Fukushima, T. Santa, T. Tashiro K. and K. Imai. (1998). Localization of d-aspartic acid in elongate spermatids in rat testis. *Arch. Biochem Biophys*, 351(1): 96-105.

تأثير حقن الكلوتاثيون في بعض صفات السائل المنوي لدى ذكور الماعز المحلي

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الملخص

نظراً لأهمية الكلوتاثيون للعمل كمضاد للأكسدة هدفت الدراسة الى معرفة تأثير الكلوتاثيون في صفات السائل المنوي لدى الماعز المحلي، تم إجراء هذه الدراسة في حقل المجترات التابع لقسم الإنتاج الحيواني، في كلية الزراعة بجامعة ديالى. وقد تم تدريب ذكور الماعز المحلي بصورة مستمرة لمدة أسبوعين كمرحلة تمهيدية على جمع السائل المنوي، وباستخدام المهبل الاصطناعي مع إجراء الفحوصات المجهرية للصفات المطلوبة على السائل المنوي لجعله جاهزاً للجمع أثناء فترة الدراسة. استمرت فترة التجربة من 7/1/2022 إلى 1/10/2022، تم استخدام 15 حيواناً من ذكور الماعز المحلي البالغة جنسياً، تتراوح أعمارها من 1 - 1.5 سنة، وتتراوح أوزانها بين 35 الى 40 كغم تم تقسيم الحيوانات إلى 3 مجاميع، حيث كانت كل مجموعة تحتوي على 5 مكررات. وكان الفارق في أوزان الحيوانات داخل كل مجموعة يتراوح بين 1 الى 1.5 كغم. حقنت المعاملة الأولى 10 مل ماء مقطر تحت الجلد واعتبرت معاملة السيطرة بينما تم اذابة الكلوتاثيون 10 مل لكل معاملة من المعاملات الأخرى وبمستويات مختلفة من الكلوتاثيون تحت الجلد كالتالي: المعاملة الثانية حقنت بمقدار 15 ملغم لكل كيلو والمعاملة الثالثة حقنت بمقدار 30 ملغم لكل كيلو، في نهاية كل شهر تم جمع السائل المنوي باستخدام المهبل الاصطناعي وإجراء التقييمات اللازمة للصفات المطلوبة. أظهرت النتائج أن حقن الكلوتاثيون أدى إلى ارتفاع معنوي ($p < 0.05$) في الحركة الجماعية للمعاملة T3 مقارنة مع المعاملتين T1 و T2 أما الحركة الفردية فقد انخفضت T1 بالمقارنة مع T2 و T3 أما تركيز النطف تفوق كل من المعاملتين T2 و T3 على معاملة T1 السيطرة كما بينت النتائج للنسبة المئوية للنطف الحية والميتة والمشوهة تفوق معنوي للمعاملة T3 مقارنة مع باقي المعاملات T1 و T2 كذلك تفوق T2 على T1.

الكلمات المفتاحية : الماعز، الجلوتاثيون، خصائص السائل المنوي