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THE EFFECT OF ADDING LEVELS OF THE ORGANIC ACID TAURINE ON IMPROVING THE CHARACTERISTICS OF DILUTED AND FROZEN SEMEN OF ARABI RAMS

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Abstract:

This study was conducted in the animal field of the College of Agriculture / University of Basra / Karma Ali site for the period from 1/10/2022 and for the forest of 31/1/2023. The study included raising (5) rams of adult godfathers with ages ranging from 2.5-3 years and close weights, and fed animals on a concentrated diet at a rate of 2 kg per animal with two meals in the morning and evening (1 kg in the morning and 1 kg in the evening), and trained rams on the process of collecting semen for two weeks using the artificial vagina of rams After the end of the training period, semen was collected three times a month and the study included adding different levels of organic acid taurine (0, 2 , 4 .6 mmol) to the sperm of rams and a safe with acid (liquid nitrogen at a degree -196 ºC) for a period of one month and two months and studying all the qualities of diluted and frozen semen Using a computer (CASA) and the results of the study were:

1- The treatment of T4 significantly (0.05>P) exceeded the rest of the transactions in the individual movement of sperm, and the duration of storage by freezing one month significantly (0.05>p) exceeded the duration of storage two months in the individual movement of sperm, as well as the treatment T4 significantly outperformed (0.05>p) at the duration of storage by freezing a month on the rest of the transactions and at the same period in the individual movement of sperm.

2- The control treatment outperformed morally (0.05>p) over the rest of the transactions in the concentration of sperm, and the duration of storage by freezing one month morally (0.05>p) exceeded the storage period of two months in the concentration of sperm, as well as the treatment of control morally (0.05>p) when the period of storage by freezing a month on the rest of the transactions in the concentration of sperm.

3- The T4 transaction significantly outperformed (0.05>P) the rest of the transactions in the percentage of live sperm, and the duration of storage by freezing one month significantly (0.05>p) exceeded the storage period of two months in the percentage of live sperm, as well as the T4 transaction significantly outperformed (0.05>p) for the period of storage by freezing one month on the rest of the transactions in the percentage of live sperm.

4- The control treatment recorded the highest percentages morally (0.05>P) in the percentage of dead sperm compared to the rest of the transactions, and the duration of storage by freezing two months recorded the highest percentages morally (0.05>P) for deformed dead sperm compared to the duration of storage by freezing for one month, as well as the control treatment at the duration of storage by freezing for two months recorded the highest percentages morally (0.05>P) for dead sperm.

5- The T4 transaction significantly outperformed (0.05>p) the rest of the transactions in the straight linear velocity VSL and the linearity of the LIN path of sperm, and the freeze storage period of one month significantly (0.05>p) exceeded the storage period of two months in the ratios of VSL, LIN for sperm,

as well as the T4 transaction significantly outperformed (0.05>p) at the duration of storage by freezing one month on the rest of the transactions in ratios VSL,LIN for sperm.

Keywords: taurine, semen,Arabi rams, frozen, liquid nitrogen

INTRODUCTİON

Frozen semen used for IVF increases the rates of dead and deformed sperm due to oxidative stress and effective oxygen release. ROS)) and damage to the sperm membrane and its contents (Pardede et al., 2020) , The addition of thinners to male semen without studying and knowing the effect of that diluent leads to the deterioration of semen characteristics such as motility and percentage of live sperm and increased perfusion of the sperm membrane during dissolving processes. (Farshad & Hosseini, 2013; Sangeeta et al., 2015) Diluents usually use egg yolk, fructose and all.Yesrol To increase the vitality of sperm and protect it from damage during freezing and thawing processes (Hosen et al., 2015; Seify et al., 2019). Hence, the ideas of researchers crystallized by adding amino and organic acids to semen diluted with egg yolk, fructose and all.Yesrol (Glycerin) In our current study, the organic acid taurine will be used with ram semen diluted with egg yolk and all.Yesrol According to the ratios proposed in the study, taurine is an organic acid that has several important roles in the cells of the body as it is one of the necessary components of cell membranes as it works to regulate the transport of nutrients through cell membranes and increase their susceptibility For the prevention of toxins and rid of free radicals and is also an antioxidant and its chemical formula $C_2H_2NO_3S$ and weightH Molecular (125.15 g / mol) It is also considered one of the organic acids that the body can manufacture and can be obtained from external sources, especially meat and fish, so many studies have confirmed that the use of taurine with some amino acids such as cysteine for bull semen thinners has an active role in maintaining the vitality and activity of sperm and protecting the acrosome after storage of semen by freezing and during thawing operations (Aly & Khafagy, 2014; Chhillar et al., 2012; Sarıözkan et al., 2009) Many recent studies and research on the importance of adding taurine as a diluent with egg yolk, fructose and all have also confirmedYesrol To the semen of male agricultural animals and the cycle of the actor in maintaining the osmotic pressure inside the sperm and preventing the breakdown of its membrane and the exudation of its components during thawing processes after freezing, thus producing efficient sperm during artificial insemination and increasing fertilization and pregnancy rates (Seify et al.,2019; Zhang et al., 2021) .

MATERİALS & METHODS

This study was conducted in the animal field of the College of Agriculture / University of Basra / Karma Ali Complex, for the period from 1/10/2022 to 31/1/2022 (four months), the study included (5) adult rams with ages ranging from 2.5-3 years and with similar weights, the semen was collected from the five rams using the rams' artificial vagina and transported to the laboratory by test tubes to the laboratory and preserved from direct sunlight, and placed in the water bath at a temperature 37 m, and all special tests are conducted with the help of a computer (CASA), then the semen is diluted with diluents and as shown in Table (1) and diluted semen samples are filled with different levels of taurine (0,6,4,2) mmol in plastic bronchi with a capacity of 0.25 ml, and kept in liquid nitrogen bottles with a degree of -196 m for periods of one month and two months in the nitrogen tank (for the purpose of studying the effect of freezing on the characteristics of the semen of the Arab rams and the ability of taurine acid to maintain those qualities) so that Each time one reed is taken out of the nitrogen basin and dissolved in the water bath at a temperature of 37 ° C and for 2 minutes, then a drop of dissolved semen is taken and placed on a warm glass slide (37 m) and the slide is covered with the slice and placed under the microscope with a magnification of 400 X and the readings are taken using the computer analysis (CASA) Computer- assisted semen analysis, which included (individual movement of sperm, sperm concentration 'curved velocity of sperm VCL), straight linear velocity of sperm VSL, average velocity of sperm path VAP, sperm path linearity LIN and sperm reactive motion (WOP) As shown in Table 2, the percentage of live and dead sperm of frozen and thawed semen was also calculated by Chemineau et al.,(1991), so that a drop of diluted and cooled semen was taken and placed on a clean and warm glass slide(37 m) A drop of a mixture of eosin dye (5%) and nchrosin (10%) was added to it and mixed with semen for 10 seconds and dried in air for 1-2 minutes and examined under a microscope with a strength of 400X, research took the dead sperm color dye (bluish-pink) while the live sperm remained transparent, and calculated 200 sperm in different parts of the slide and towards the letter Z and according to the equations for calculating the percentages of live and dead sperm.

Table (1): Solutions to be used in extending the semen of Arabi rams in the experiment.

	Diluents (volume 100 ml)			
the components	**control (first)**	**Second diluent**	**Third diluent**	**Fourth diluent**
Tris(gm)	**3.07**	**3.07**	**3.07**	**3.07**
Citric acid (gm)	**1.64**	**1.64**	**1.64**	**1.64**
Fructose(gm)	**1.26**	**1.26**	**1.26**	**1.26**

Egg yolk (ml)	**2.5**	**2.5**	**2.5**	**2.5**
Gentamycin (ml)	**0.5**	**0.5**	**0.5**	**0.5**
Taurine (mmol)	**----**	**2**	**4**	**6**
Clycerol (ml)	**8**	**8**	**8**	**8**
Distilled water(ml)	**Complete the volume to 100 ml**			

STATİSTİCAL ANALYSİS

The data were analyzed statistically using the statistical program (SPSS,2019), as an experiment of two factors, the first factor includes different levels of taurine (0,2,4,6) mmol, and the second factor, which includes cooling and freezing periods for different periods according to the following mathematical model formula:

TBij+eijk+Yijk=μ+Ti+Bj

Whereas:

Yijk = represents the studied adjective

μ = overall average

Ti = concentrations of organic acid (0,2,4,6) mmol

BJ = freezing (for one and two months)

TBij = Interaction between amino acid concentrations and freeze storage durations.

eijk = randomly and naturally distributed experimental error with an average equal to zero and e2 variance.

DİSCUSSİON AND RESULTS

The effect of transactions and duration of storage by freezing on the characteristics of the semen of the Orabi rams

Individual movement of sperm

Noting from Table (2) that the transaction has a significant impact ($p<0.05$) in the individual movement of sperm as the treatment of T_4 On transactions T_2, T_6, control averages were 58.93, 56.84, 49.88 and 44.99% respectively. It is also noted that the duration of storage by freezing (one and two months) has a significant impact ($p<0.05$) in the individual movement of sperm, as the period of one month exceeded the storage period of two months, as the averages were 57.13 and 48.19%, respectively. When studying the overlap between the effect of the transaction and the duration of storage, it was found that (T_4 When the period is one month) achieved the highest percentages morally ($p<0.05$) in the individual movement of sperm compared to the rest of the transactions and the rest of the storage periods, as the individual movement was 63.98% compared to the rest of the transactions and storage periods, so the control treatment was recorded at the storage period of two months with the lowest percentages significantly ($p<0.05$) in the individual movement of sperm was 42.01%, The results of the study were consistent with what he explained (Chauhan et al., 2010: Al-Mamun et al., 2015). That the percentage of sperm moving gradually decreased significantly after freezing and thawing, and that the movement of sperm was significantly affected by the duration of freezing and for longer periods, which led to a greater decrease in movement, and they showed that the freezing process affects the individual movement of sperm and the general movement negatively, and the most important morphological changes after the freezing and thawing processes Damage was observed in the plasma membrane and mitochondria of sperm, which negatively affects the ability of sperm, vitality and movement, as the speed of freezing and the rate of thawing They have a significant effect on maintaining the vitality and mobility of sperm after freezing Sharma et al., 2017) and Al-Saiady et al.,2019 Al-Mamun et al.,2020:Therefore, in our current study, it was suggested that rapid freezing (liquid nitrogen) be used in freezing diluted semen samples. The results of the current study were also consistent with what many researchers showed about the importance and role of taurine for diluted and frozen semen in improving and increasing the movement of sperm and its vitality after thawing.. He pointed out Sarıözkan et al., (2009) The addition of levels of organic acid taurine to the diluted and frozen semen of bulls improved the individual movement of sperm during thawing processes. As shown (Lambert et al., 2014, Zhang et al.,2021: Sohail et al., 2016) in their study of the sperm of rams fed at levels Different from Taurine and frozen with liquid nitrogen at a degree of 196− ° C that the individual movement of sperm was higher when stored for three hours and at room temperature, while it began to decrease when increasing the storage period of 7-5 hours and different concentrations of organic acid taurine, the researchers have interpreted that the organic acid taurine worked as an antioxidant and rid the frozen semen of free radicals and peroxides during the thawing processes as it kept the membranes of sperm and sperm acrosome from deterioration and increased rates of movement.

Table (2): The effect of treatments and duration of cold storage on the individual motility (%) of ram sperm (Mean ±Std).

Storage duration / treatments	Month	two months	Treatments impact rate
control	47.96 ± 0.17	42.01± 0.75	44.99 ± 3.22 D
T2	61.77 ± 0.33	51.92 ± 0.18	56.84 ± 5.27 B
T4	63.98 ± 0.21	53.90 ± 0.93	58.93 ± 5.42 A
T6	54.81 ± 0.32	44.97 ± 0.27	49.88 ± 5.27 C
Average effect of storage duration	57.13 ± 6.49 A	48.19 ± 5.07 B	2.34 LSD for interference

Large letters horizontally and vertically mean that there are significant differences at the level (p<0.05) of the effect of storage period and treatments.Control (no taurine added), T2 (2 mmol taurine added), T4 (4 mmol taurine added), T6 (6 mmol taurine added).

SPERM CONCENTRATİON

Table (3) shows that the treatment has a significant effect (p<0.05) on sperm concentration, as the treatment of controlling the parameters T_2, T_4, T_6 was superior as the averages were 56.10, 52.46, 46.70, 33.47×10⁶ respectively. It is also noted that the duration of storage by freezing (one and two months) has a significant effect on the concentration of sperm, as the period exceeded one month significantly (p<0.05).) on the storage period of two months, as the averages were 48.90 and 45.47 respectively. When studying the overlap between the effect of the transaction and the duration of storage, it was found that (control at the period of one month) achieved the highest results significantly (p<0.05) as it was 58.44×10⁶ compared to the rest of the transactions and storage periods by freezing, while the transaction T_6 recorded the lowest concentrations significantly (p<0.05) was 31.87×10⁶. The results of the current study were consistent with what was found by (Yang et al., 2015) that the concentration of sperm in frozen and thawed sperm decreases with increasing the duration of cold storage and freezing, as well as agreed with what was stated by (Al-Mamun et al., 2015), as they explained that the concentration of sperm in the sperm of rams decreased significantly after freezing and thawing, and confirmed that the movement and concentration Sperm was greatly affected by freezing with a decrease in the percentage of mobile sperm and gradually an increase in the percentage of immobile sperm, and that the freezing process caused a decrease in the concentration of sperm and its movement of rams' sperm by increasing the plasma membrane of sperm and losing its ability to maintain the contents of the sperm and shattering the entire body of sperm and a decrease in the concentration of sperm. Also, the duration of freezing and the temperature of thawing affected the general characteristics of male sperm animals after freezing and thawing, and that the effect of freezing on the concentration of frozen semen and the movement of sperm can be mitigated by the use of freezing protective materials, such as glycerol and organic acid taurine, as glycerol can Helps protect sperm from membrane damage and ice crystal formation Taurine is an effective antioxidant in ridding frozen and thawed semen of free radicals and peroxides (Sharma et al., 2017: Al-Saiady et al., 2019: Roberson et al., 2017).

Table (3): The effect of treatments and duration of freeze-storage on the concentration of Arabi ram sperm (×10⁶) (Mean ± standard error).

Storage duration / treatments	Month	two months	Treatments impact rate
control	58.44 ± 0.72	53.76 ± 0.25	56.10 ± 2.55 A
T2	54.07 ± 0.26	50.85 ± 0.22	52.46 ± 1.74 B
T4	48.00 ± 0.15	45.40 ± 0.61	46.70 ± 1.45 C
T6	35.07 ± 0.18	31.87 ± 0.30	33.47 ± 1.73 D
Average effect of storage duration	48.90 ± 9.09 A	45.47 ± 8.69 B	2.320 LSD for interference

Large letters horizontally and vertically mean that there are significant differences at the level (p<0.05) of the effect of storage period and treatments. Control (no taurine added), T2 (2 mmol taurine added), T4 (4 mmol taurine added), T6 (6 mmol taurine added).

PERCENTAGE OF LİVE AND DEAD SPERM

Table (4) shows that the treatment has a significant effect ($p<0.05$) in live sperm as the T_4 treatment significantly ($p<0.05$) outperformed the coefficients T_2, control, T_6 as the averages were 62.47, 60.37, 46.09, 49.48% respectively. It is also noted that the duration of storage by freezing (one and two months) has a significant effect ($p<0.05$) in live sperm, as the period exceeded one month significantly ($p<0.05$).) on the storage period of two months, as the averages were 57.10 and 52.09%, respectively. When studying the interaction between the effect of the transaction and the duration of storage, it was found that (T_4 at the period of one month) recorded the highest results significantly ($p<0.05$) compared to the rest of the transactions and the rest of the storage periods, as the percentage of live sperm was 64.27%, while the control treatment at the period of two months was the lowest percentages significantly ($p<0.05$) for live sperm, it was 42.59%, as well as Table (5) shows that the transaction has a significant impact ($p<0.05$).) in dead sperm, where the control treatment recorded the highest percentages significantly ($p<0.05$) on the coefficients $_6$ T, T_2, T_4 as the averages were 21.45, 19.52, 17.97, 17.04% respectively. It is also noted that the duration of storage by freezing (one and two months) has a significant effect ($p<0.05$) on the percentage of dead sperm, as the period recorded two months the highest percentages significantly ($p<0.05$) in dead sperm over the storage period of one month, with averages of 20.26 and 17.72% respectively. When studying the overlap between the effect of the treatment and the duration of storage, it was found that (control at the period of two months) recorded the highest percentages significantly ($p<0.05$) in the percentage of dead sperm compared to the rest of the transactions and for the rest of the storage periods, as the dead sperm was 23.45%, while the T_4 treatment was recorded at the period of one month with the lowest percentages morally ($p<0.05$) in dead sperm, so it was 16.05%, these results agreed with many researchers that the freezing and thawing processes of semen lead to a reduction in the percentage For live sperm and high percentage of dead and deformed sperm through the occurrence of structural damage to the sperm membrane and increased formation of free radicals and peroxides with a detrimental effect on the vitality and activity of sperm (Amirat-Briand et al., 2009; Bucak et al., 2010). Therefore, many researchers confirmed that the addition of some substances such as amino and organic acids, as well as the method of freezing, and the type of preservatives. And their concentration, semen temperature and duration of dissolution have an effective effect in affecting the percentages of live, dead and deformed sperm, as these substances have an active role in preserving sperm from cold shock during cooling and freezing processes on the one hand, as well as having a major role in ridding dissolved semen of free radicals, reactive oxygen and peroxides with a toxic effect on sperm (Deneke et al., 2010; El-Sheshtawy et al., 2012; Kemal et al., 2010), Chhillar et al., 2012) pointed out in their study on diluted, cooled and frozen semen for rams containing organic acid taurine at levels of 50 and 100 mmol that organic acid has an effective effect, maintaining sperm membranes during freezing and thawing processes, reducing reactive oxygen levels (ROS), thus improving the ability, movement and activity of sperm, increasing mobility and live sperm percentage, and reducing the percentage of deformed sperm.Significant effect ($P<0.05$) as the individual movement of fresh semen and diluted Baltaurine and cooled and frozen was 70, 52 and 36% respectively as well as the effectiveness of sperm by 75, 57 and 34% respectively, and these results agreed with (Hu et al., 2010) in their study on buffalo bulls as they explained that such additions improve the movement of the effectiveness of sperm and maintain their membranes during the processes of cooling, freezing and thawing.

Table (4): The effect of treatments and duration of freeze-storage on the percentage of live sperm (%) of arabi ram sperm (mean ± standard error)

Storage duration / **treatments**	Month	two months	Treatments impact rate
control	49.23 ± 0.67	42.95 ± 0.29	46.09 ± 3.39 C
T2	62.93 ± 0.13	57.81 ± 0.29	60.37 ± 2.75 B
T4	64.27 ± 0.32	60.67 ± 0.52	62.47 ± 1.46 A
T6	51.99 ± 0.18	46.97 ± 0.21	49.48 ± 0.16 D
Average effect of storage duration	57.10 ± 6.81 A	52.09 ± 7.60	2.290 LSD for interference

Large letters horizontally and vertically mean that there are significant differences at the level ($p<0.05$) of the effect of storage period and treatments.
Control (no taurine added), T2 (2 mmol taurine added), T4 (4 mmol taurine added), T6 (6 mmol taurine added).

Table (5): The effect of treatments and duration of freeze-storage on the percentage of dead sperm (%) of arabi ram sperm (mean ± standard error)

Storage duration	Month	two months	Treatments impact rate

treatments			
control	19.25 ± 0.08	23.65 ± 0.48	21.45 ± 2.38 A
T2	17.09 ± 0.44	18.85 ± 0.21	17.97 ± 0.99 C
T4	16.05 ± 0.29	18.03 ± 0.17	17.04 ± 1.08 D
T6	18.52 ± 0.40	20.52 ± 0.39	19.52 ± 1.13 B
Average effect of storage duration	17.72 ± 1.32 B	20.26 ± 2.24 A	1.104 LSD for interference

Large letters horizontally and vertically mean that there are significant differences at the level (p<0.05) of the effect of storage period and treatments. Control (no taurine added), T2 (2 mmol taurine added), T4 (4 mmol taurine added), T6 (6 mmol taurine added).

Percentage of straight velocity VSL and linearity of the sperm LIN path

Table (6) shows that the transaction has a significant effect (p<0.05) on the straight linear velocity VSL (Velocity Straight Line) as the T_4 transaction outperformed the coefficients T_2, T_6, control as the averages were 35.50, 32.59, 26.65, 23.53 µm/s respectively. It is also noted that the duration of freeze storage (one and two months) has a significant effect (p<0.05) in VSL As the period exceeded a month significantly (0.05> (p) on the storage period of two months in the ratios of VSL, as the averages were 28.24, 30.89 µm / s respectively, and when studying the interaction between the effect of the transaction and the duration of storage, it was found that (T_4 at the period of one month) achieved the highest results significantly (p<0.05) compared to the rest of the storage periods, as VSL was 37.35 µm / s, while the control treatment recorded the lowest percentages significantly (p<0.05) at the period of two months, so the ratio of VSL 22.83 µm/s. Table (7) shows that the transaction has a significant effect (0.05> (p) in the linear sperm path LIN(Linearity(VCL\VSL), as the T_4 transaction significantly outperformed (0.05> (p) over the coefficients T_2, T_6, control as the averages were 35.57, 32.83, 28.33, 25.79% respectively. It is also noted that the duration of storage by freezing (one and two months) has a significant effect (0.05> (p in LIN, as the period exceeded a month significantly (0.05> (p) on the storage period of two months in LIN, as the averages were 32.78, 28.49% respectively, and when studying the interaction between the effect of the transaction and the duration of storage, it was found that (T_4 at the period of one month) achieved the highest results significantly (0.05> (p compared to the rest of the transactions and the rest of the storage periods, as LIN was 37.11%, while the control treatment at the period of two months recorded the lowest percentages significantly (0.05> (pin LIN). It was 23.91, as (Kumar et al., 2018) showed that the movement of sperm in semen differs during the cooling and freezing process as well as after thawing, as it was shown that the provision of controlled moderate cooling provides better support for motility and sperm safety in rams compared to uncontrolled cooling The percentage was LIN VAP, VCL, VSL, Sperm with high acrosomal is controllably higher, but there were cases of abnormal chrosome and a gradual decrease in the percentage of movement of all kinds VAP, LIN, VCL, VSL in the post-molting period, this decrease was lower in cryotherapy samples under controlled temperatures compared to uncontrolled cryogenesis, and the results of this study agreed with the findings of Moghaddam et al. 2012) where the motility of sperm in his study ranged between 62.3586.23 and this within the average range of motion 6090%, as he showed that there is an improvement in the motility in general of the sperm of rams that were fed on organic acid taurine, and this result is similar to what he found (Yang et al., 2010) that sperm motility rises with increasing levels of taurine, This is the result of the use of taurine, as it has a major role in maintaining sperm motility and stimulation even after freezing and thawing processes, as well as stimulating reactions within sperm mitochoneria (Tadros et al., 2005). In our current study, it was found that the freezing process caused a significant decrease (0.05>(p) in the concentration of sperm and its movement in the sperm of frozen rams, especially in the high-density part. From taurine in the average levels within the T4 treatment achieved the highest rates of movement, and (Sharma et al., 2017) found that the general sperm movement was significantly affected by freezing as it decreased significantly after the gradual thawing process. In another study on ram sperm, they explained that the freezing process causes a significant decrease in the level of proteins and lipids in the sperm membranes of semen, which affects the movement of sperm as well, that the level of reactive oxygen types (ROS) increased significantly after freezing and thawing, which affects the general sperm movement and function (Kumar et al., 2018), and that the effects of cryopreservation and freezing affect the quality of Cryo-storage semen significantly reduces sperm movement and increases sperm DNA damage (Al-Saiady et al., 2018), but the addition of taurine avoids all these changes and produces balanced sperm during freezing and thawing processes (Chhillar et al., 2012).

Table (6): The effect of parameters and duration of freeze-storage on the straight line speed (VSL micrometers/second) of arabi ram sperm (mean ± standard error).

Storage duration / treatments	Month	two months	Treatments impact rate
control	24.23 ± 0.61	22.83 ± 0.66	23.53 ± 0.95 D

T2	33.38 ± 0.57	31.81 ± 0.61	32.59 ± 1.00 B
T4	37.61 ± 0.63	33.39 ± 0.62	35.50 ± 2.33 A
T6	28.35 ± 0.50	24.94 ± 0.23	26.65 ± 1.86 C
Average effect of storage duration	30.89 ± 5.25 A	28.24 ± 4.63 B	3.202 LSD for interference

Large letters horizontally and vertically mean that there are significant differences at the level (p<0.05) of the effect of storage period and treatments. Control (no taurine added), T2 (2 mmol taurine added), T4 (4 mmol taurine added), T6 (6 mmol taurine added).

Table (7): The effect of treatments and duration of freeze-storage on the linearity of the trajectory of arabi ram sperm (LIN%) (mean ± standard error).

Storage duration / **treatments**	Month	two months	Treatments impact rate
control	27.68 ± 0.59	23.91 ± 0.25	25.79 ± 2.06 D
T2	34.59 ± 0.50	31.08 ± 0.11	32.83 ± 1.90 B
T4	37.11 ± 0.13	34.02 ± 0.27	35.57 ± 1.66 A
T6	31.74 ± 0.34	24.94 ± 0.25	28.33 ± 3.65 C
Average effect of storage duration	32.78 ± 3.64 A	28.49 ± 4.35 B	2.722 LSD for interference

Large letters horizontally and vertically mean that there are significant differences at the level (p<0.05) of the effect of storage period and treatments. Control (no taurine added), T2 (2 mmol taurine added), T4 (4 mmol taurine added), T6 (6 mmol taurine added).

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