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EFFECT OF L-TYROSINE ADMINISTRATION ON MILK YIELD AND SOME BLOOD PARAMETERS IN NEW ZEALAND WHITE RABBITS DOES

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Sixty five young New Zealand White (NZW) does were distributed randomly into five equal groups in a completely randomized design included four intervals doses of L-tyrosine administration according to the age at administration. The first group was served as a control (no treatment), while the second group (T1) was given a single dose of L-tyrosine (100 mg/kg BW) at the second month of age, the third group (T2) was given two doses at 2 and at 4 months of age, the fourth group (T3) was given three doses at 2, 4 and at 6 months of age and the fifth group (T4) group was given four doses at 2, 4, 6, and at 8 months of age.

The results showed that L-tyrosine administration increased significantly ($P \leq 0.05$) the weekly milk yield in the treated groups than in control group. L-tyrosine affected significantly ($P \leq 0.05$) the concentration of estradiol hormone (E_2) at 10 months of age and progesterone hormone (P_4) at all ages. T1 group was higher than the other groups. Meanwhile L-tyrosine treatments did not affect on concentration of triiodothyronine (T_3), total lipids, total protein, albumin, globulin and albumin/globulin (A/G) ratio at 5 and 10 months of age .

***In conclusion,** effect of L-tyrosine administration (100 mg/kg LBW) at two months of age increased total milk yield production and improved sexual hormones P4 and E2 release significantly.*

Key Words: Rabbits does, L-tyrosine, New Zealand, Milk yield, Blood parameters.

L-tyrosine treatment at specific stage of age led to significant improvements in reproductive and productive performance in rabbits (El-Amrawi, 2008). In treated Friesian dairy cows with L-tyrosine during early postpartum period daily milk production increased ($P \leq 0.05$) during the 1st four months of lactation (Gabr, 2012). Also in ewes, Yassin *et al*. (2011) showed

significant increase in milk production as a result of L-tyrosine oral administration. In addition, L-tyrosine treatment showed a positive reflection on goats milk yield of fat, protein and lactose and showed higher levels when compared to the control group (Abu El-Ella *et al,* 2014).

In immature does of NZW rabbit, Omara *et al.* (2005) found that L-tyrosine administration as one oral dose (100 mg/kg LBW) at 49 days of age or two oral doses at 49 and 79 days of age resulted in significant increase in serum concentration of T_3, T_4, E_2 and progesterone (P_4) hormones. In ewe lambs, L-tyrosine increased significantly ($P \leq 0.05$) progesterone hormone (P_4) levels when compared to control (El-Battawy, 2006). In addition to El-Amrawi *et al* (1991) found that the plasma progesterone levels increased at estrus after treatment of anestrus buffaloes with L-tyrosine. On the other hand, Abu El-Ella *et al.* (2011) found P_4 concentration was similar in goat does for all groups without significant differences when they were supplemented with L-tyrosine at mating (onset of estrus). In goats, L-tyrosine supplementation led to increase concentrations of thyroid hormones and prolactin levels (Ibrahim, 2010).

Plasma total protein and globulin concentrations were higher ($P \leq 0.05$) in treated calves than in control group in Friesian calves received L-tyrosine (Abu EI-Hamd (2012). Also in heifers, Afet (2014) reported that concentrations of total blood plasma proteins, globulin, glucose and` albumin/globulin ratio increased after L-tyrosine supplementation. In goats, L-tyrosine administration significantly increased blood albumin and glucose concentration as compared to the control. Meanwhile, blood globulin decreased significantly due to L-tyrosine administration (Abu El-Ella *et al.*, 2014).

Therefore, the aim of the present work was to study the effect of L-tyrosine administration at different ages on some blood parameters, sexual hormones and milk yield in New Zealand White (NZW) rabbits does.

MATERIALS AND METHODS

The present study was carried out at a Private Rabbit Farm in Husseiniya, Sharkia Governorate, Egypt, during the period January, 2016 to February, 2017. Sixty five immature NZW does were distributed randomly into five equal groups in a completely random design included four intervals doses of L-tyrosine (L-tyrosine Pure Extra 99%®, Alpha Chemika, India) according to the age at administration. The first group was served as a control

(no treatment), while the second group (T1) was given a single dose of L-tyrosine (100 mg/kg BW) at the second month of age, the third group (T2) was given two doses at 2 and at 4 months of age, the fourth group (T3) was given three doses at 2, 4 and at 6 months of age and the fifth group (T4) was given four doses at 2, 4, 6, and at 8 months of age. At the beginning of the experiment, age of animals averaged two months and their weight was similar (1544.22±10.78g). All rabbits were individually housed in galvanized wired cages, where feed and water were provided *ad libitum.* Rabbits were fed on basal pellet ration contained yellow corn, soybean meal, clover hay, minerals and vitamins premix. The chemical composition of the commercial pelleted diet was as the following: crude protein 17.03%, ether extract 2.40%, crude fiber 12.65% and digestible energy 2675.00 Kcal/Kg. according to NRC (1977). Rabbits were kept continuously under the same managerial and environmental conditions during the whole experimental period. Rabbits were healthy and free of any external parasites or skin diseases.

Blood samples (3 ml) were taken twice from four does in each group. The first sample was taken pre-mating at 5 months of age and the second sample was taken at 10 months of age in the seventh day post parturition before mating. The blood sample was collected from the central ear vein which was cleaned with absolute alcohol. Xylol was applied on ear to increase blood flow (Hoppe *et al*., 1969). Blood samples were collected by a syringe and centrifuged at 3,000 rpm for 15 min. The serum was removed and stored frozen at -20 C^{o} until analysis.

Milk yield for each doe was recorded for one day/week at 8:00 am as the difference in the weight of pups before and after suckling. The pups were separated before suckling for 14 hour at the 1st, 2nd, 3rd, 4th week of lactation period.

Serum concentration of estradiol (E_2), progesterone (P_4) and triiodothyronine (T_3) were determined by Electro-chemiluminescence immunoassay (ECLIA) technology using Siemens ADVIA Centaur® Immunoassay System (Siemens Healthcare GmbH, Germany). The intra-assay CV was 8%, inter-assay CV was 6.3% for estradiol. The intra-assay and inter-assay CV for T3 values were lower than 6.2% and 7.1%, respectively. The intra-assay and inter assay C.V. were less than 10% for the P4.

Serum total protein, total lipids and albumin were determined by colorimetric assay using auto analyzer Dimension® RxL Max® Integrated

chemistry system (Siemens Healthcare GmbH, Germany). *Intra-* and *inter* assay precision were in all instances below 3 and 4 CV%, respectively. Globulin was calculated by subtracting between serum total protein and albumin content. Albumin /globulin ratio was calculated.

Data were statistically analyzed as completely randomized design according to Snedecor and Cochran (1982) using analysis of variance procedure described by SPSS (2011). The mathematical model was as follows:

$$Y_{ij} = \mu + A_i + E_{ij}$$

Where, Y_{ij} = An observation, μ = The overall mean, A_i = Effect of L-tyrosine treatments (i = 1 to 5), and E_{ij} = Random error.

Significant differences among treatments were tested by Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

1. *Total weekly milk yield*

The averages weekly of total milk yield (g/day/doe) during the four weeks from birth to weaning age was affected by L-tyrosine treatments are presented in Table 1.

The treatment with L-tyrosine administration significantly ($P \leq 0.05$) increased average milk yield during the second and the third weeks after parturition and also during the total period of lactation in all treated groups compared to control group. On the other hand, milk yield was increased in the treated does with L-tyrosine during the first and the fourth weeks without significant differences compared to control group. Figure (1) showed the increase in total weekly milk yield in all treated does with L-tyrosine was higher 23.94% to 34.9% over the control group.

Milk yield increase is mostly referred to the increase in blood supply (Mepham, 1982) and the energy intake of mammary gland cells (Wurtman, 1982), in addition to its effect on increasing growth hormone via its effect on brain catecholamines (Martin, 1980). Peel *et al*. (1981) found significant increase in milk yield as a result of L-tyrosine administration and may be due

Table1. Effect of L-tyrosine treatments on the average weekly milk yield at first, second, third, fourth week of suckling and total milk yield (g /day/doe, Means ± S.E)

Treatments	First week	Second week	Third week	Fourth week	Total milk yield
Control	106.50 ± 3.88	137.50 ± 13.17 [b]	167.75 ± 26.64[b]	73.50 ± 21.27	485.25 ± 48.07 [b]
T1	136.00 ± 12.43	188.33 ± 6.64 [a]	220.17 ± 14.56[a]	108.67 ± 17.89	653.17 ± 29.48 [a]
T2	135.40 ± 8.99	179.00 ± 12.12 [a]	204.20 ± 13.07[a]	82.80 ± 15.11	601.40 ± 18.99 [a]
T3	121.83 ± 16.59	202.17 ± 15.32 [a]	207.83 ± 20.44 [a]	97.67 ± 20.40	629.50 ± 35.61[a]
T4	145.33 ± 8.41	210.67 ± 7.31 [a]	203.67 ± 1.76 [a]	89.33 ± 9.06	649.00 ± 8.33[a]
Significance	**NS**	**	*	**NS**	*

[a,b] Means with different superscripts in the same column are significantly different with respect to their P-values.
NS = Not significant * = Significant P≤0.05 ** = Significant P≤ 0.01.

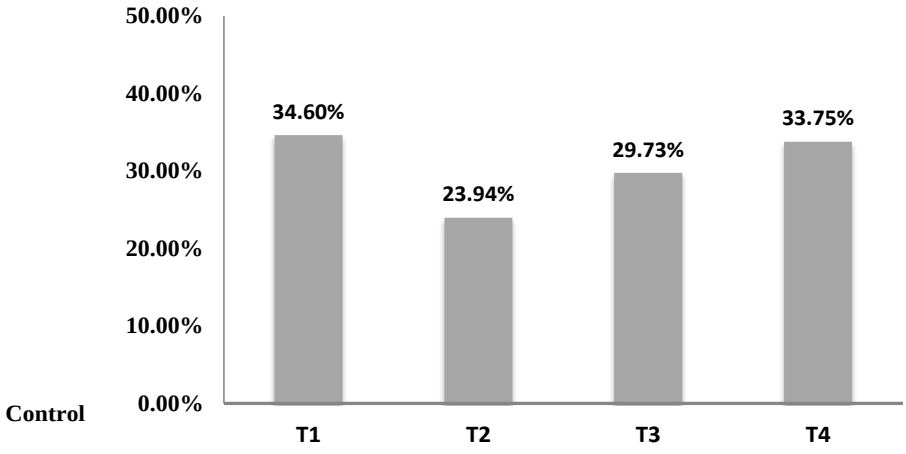

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Figure (1). Percent change in the average weekly milk yield as affected by L-tyrosine treatments in NZW does over the untreated does.

The results are in agreement with Yassin *et al*. (2011) who showed significant increase in milk production as a result of L-tyrosine oral administration in ewes. In addition, Gabr (2012) found that L-tyrosine treatment improved significantly daily milk production and milk composition in Friesian dairy cows.

2. Blood parameters

2.1. Hormonal profile

2.1.1. Estradiol hormone (E2)

The effects of using L-tyrosine administration on serum estradiol **(**E_2) levels of does at different ages are presented in Table 2. At 5 month of age, serum concentration of E_2 increased insignificantly in all treated groups compared with control group. However, the results revealed that significant differences were detected due to treatments in serum concentration of E_2 at 10 months of age. The females in T1 showed significant increase ($P \leq 0.05$) in serum concentration of E_2 compared with control and treated groups.

L-tyrosine supplementation during and post sexual puberty stage led to a reduction in sexual activity and inhibited ovarian activity compared to T1 Group which received a single dose of L-tyrosine at two months of age as shown in cows by Gabr (2012). The same author found that L-tyrosine inhibited follicular growth in the ovary and led to a decrease in average number of estrus cases and ovulatory cycles per cow during the ovulatory cycles. Also Wetzel (1985), Hammerl (1986) and Munsterer (1987) found a low number of estrus per cow which was associated with the exogenous L-tyrosine treatment. In NZW rabbits, Omara *et al*. (2005) found that administration of an oral dose (100 mg/ kg LBW) of L-tyrosine resulted in an earlier significant increase ($P \leq 0.05$) in serum E_2 hormone concentration as compared to control while administration of second dose of L-tyrosine at the mid of the third months of age resulted in further significant increase in E_2 concentration.

2.1.2. Progesterone hormone (P_4)

The effects of using L-tyrosine on serum progesterone (P_4) levels at different ages are presented in Table 2. Significant differences were detected due to treatments in serum concentration of P_4 at 5 and significant differences ($P \leq 0.01$) were detected at 10 months of age. Serum concentration of P_4 increased significantly in T1 as compared with control and treated groups.

This increment in P_4 hormone may be due to the stimulatory effect of L-tyrosine on GnRH of doe rabbits. L-tyrosine may involve stimulation of GnRH release because availability of L-tyrosine influences synthesis of norepinephrine (Wurtman *et al*., 1981 and Acworth *et al*., 1988), a neurotransmitter that stimulates hypothalamic GnRH release, pulsatile and preovulatory release of LH hormone from pituitary gland (Ramirez *et al*., 1984 and Terasawa *et al*., 1988). The catecholamines may mediate effect of other neurotransmitter and gonadal steroids on release of GnRH (Yen and Vale, 1990). On the other hand, decreasing in level of P_4 hormone in the other treated groups (T2, T3 and T4) may be returned to L-tyrosine treatments post sexual puberty which led to reduce sexual activity and inhibited ovarian activity compared to female in T1 as well as reported by Gabr (2012). Also, Abu El-Ella *et al.* (2011) found that concentration of P_4 hormone was less than 0.5 ng/ml in treated goat females when they supplemented with L-tyrosine at mating (onset of estrus).

2.1.3. Triiodothyronine hormone (T_3)

The effects of using L-tyrosine on serum T3 levels at different ages are presented in Table 3. The results revealed that insignificant differences due to treatments in serum concentration of T3 in both testing ages. Serum concentration of T3 decreased insignificantly in T4 compared with control and treated groups at 5 and 10 months of age.

The current findings disagreed with results of Omara *et al*., (2005) who found that an oral supplementation of L- Tyrosine in NZW rabbits increased serum T_3 and T_4 hormones concentrations significantly ($P \leq 0.05$). Also in goats reported that L-tyrosine supplementation led to an increase in T_3 and prolactin hormones concentration (Ibrahim, 2010). On the other hand, Palinkas *et al*., (2007) reported that administration of L-tyrosine led to significant reduction in serum thyroid stimulating hormone (TSH).

2.2. Blood biochemical components profile

The effect of L-tyrosine treatments on all blood biochemical profile (total Protein, total Lipids, albumin, globulin and albumin/ globulin ratio were not significant detected among the treated groups and control group at 5 and 10 months of age as presented data in Table 4.

These results were in agreement with Abu El-Ella *et al.* (2014) who found that L-tyrosine did not change concentration of total protein in treated goats does. Krajnıèáková *et al*. (2003) recorded a statistically significant decrease ($P \leq 0.01$) in total lipid level on day 7 post parturition in goats. Abu EI-Hamd (2012) and Afet (2014) reported that the L-tyrosine supplementation did not affect significantly albumin concentration in blood in heifers and the valves of albumin. Also in goats, L-tyrosine administration significantly increased blood albumin concentration compared to the control does (Abu El-Ella *et al.*, 2014). These result values pointed out to normal performance of the rabbits and were within the normal range of the values reported by Habeeb *et al.* (1994), Marai *et al*. (1999)., Soliman *et al*. (2000) and Salem *et al.* (2003). These values indicated that the animals were generally in a good nutritional status and their livers were in normal physiological condition. Normal globulin values indicated good immunity status of animals. Also it is worthy to note that the values of A/G ratio were higher than 1.0 which indicates that animals did not suffer from any health problem that might affect the performance of experimental animals as reported by EL-Sayed *et al*. (2002).

Conclusively, effect of L-tyrosine administration (100 mg/kg LBW) at two months of age increased total milk yield production and improved sexual hormones P_4 and E_2 release significantly.

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تأثيرالحقن بالتيروسين على محصول اللبن وبعض مقاييس الدم لإناث أرانب النيوزيلندى الابيض

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أجريت هذة التجربة بهدف دراسة تأثير الحمض الأمينى التيروسين على أنتاج اللبن وبعض مكونات الدم لإناث أرانب النيوزيلندى الابيض. تم استخدام ٦٥ أنثى عمر شهرين متماثلة الوزن تقريبا وزعت عشوائيا فى عدد ٥ مجموعات كل مجموعة بها ١٣ أنثى تشمل ٤ فترات زمنية مختلفة لإضافة التيروسين كانت المجموعة الأولى الكنترول (بدون معاملة) وأعطيت المجموعة الثانية (T1) جرعة واحدة من التيروسين (١٠٠ ملجم/كجم من وزن الجسم) عند عمر شهرين بينما أعطيت المجموعة الثالثة (T2) جرعتين في عمر ٢ ثم فى ٤ شهور وتم إعطاء المجموعة الرابعة (T3) ثلاث جرعات عند عمر ٢، ٤، ٦ شهور. أعطيت المجموعة الخامسة (T4) أربع جرعات عند عمر ٢ ، ٤ ، ٦ ، ٨ شهور .وأظهرت المعاملات النتائج التالية:

المعاملة بالتيروسين ادت الى زيادة كمية اللبن المنتجة معنويا($P \leq 0.05$). فأعطت جميع المجموعات المعاملة بالتيروسين كميات أكبر من اللبن مقارنة بمجموعة الكنترول فى الاسبوع الثانى والثالث والاجمالى العام. كذلك أثرت اضافة التيروسين معنويا على تركيز هرمون الاستراديول (E_2) عند عمر ١٠ شهور وكانت أعلى تركيز له فى إناث المعاملة T1 وكذلك ارتفع مستوى تركيز هرمون البروجسترون P_4 معنويا فى المعاملة T1 مقارنة بباقى المجموعات التجريبية والكنترول فى جميع مراحل التجربة. بينما لم يتأثر كلا من مستوى هرمون ثلاثى يود السريونين (T_3) ونسبة الدهون الكلية اوالبروتين الكلي أو الألبيومين والجلوبيولين ونسبة الألبيومين/الجلوبيولين عند عمر٥ و١٠ شهور.

التوصية: نوصى بعد هذه النتائج بأهمية اضافة التيروسين عند عمر شهرين بمعدل ١٠٠ ملجم/ كجم من وزن الجسم للعمل على زيادة إنتاج اللبن لأنثى النيوزيلندى الابيض وزيادة افراز الهرمونات الجنسية الاستراديول والبروجسترول لتحسين الاداء التناسلى.