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EFFECT OF L. TYROSINE ON PRODUCTIVE AND REPRODUCTIVE PERFORMANCE OF FEMALE NEWZEALAND RABBITS

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SUMMARY

This study is a trial to induce early puberty in immature female rabbits using *L. tyrosine* as oral supplementation. A total number of thirty-six immature female rabbits were used. Twenty- three of them were administered an oral dose of 100mg/kg body wt. *L. tyrosine* at the beginning of the third month age. A second similar oral dose was administered to ten of the administered group after one month from the first dose. Weekly body weight and blood samples were taken. At the end of the 3rd and 4th months age, three females from each group were slaughtered, ovaries and liver were exteriorized and gonadosomatic index (GSI) and hepatosomatic index (HIS) were calculated. Histological sections from ovaries were prepared. Serum T3, T4, oestradiol -17 fl (E2) and progesterone were measured by radioimmunoassay. Females were mated when they reach 2800 + 100 gm b. wt. Conception rate and number and weight of litters were recorded.

The results revealed that, *L. tyrosine* supplementation resulted in significant increase in total body weight, GSI and serum T3, T4, E2 and progesterone. The elevation in progesterone was so late in relation to T3, T4 or E2. *L. tyrosine* also increased conception rate and the number of litters but the litter weights were significantly lowered. It is concluded that *L. tyrosine* can be effectively used to induce puberty and improve productivity in immature female rabbits as indicated by the increase in body weight, hormone levels, conception rate and number of litters at birth and their survival rate till one-month age.

INTRODUCTION

Rabbits have been exploited as a source of rapid income particularly to the small farmer. They bred on a large scale system. New Zealand white (NZW) rabbits reach sexual puberty at 5-8 months age and gave a large number of litters (5-

8 per littering) nearly monthly besides they have a long breeding season extends from October to May (Rastogi, 1984). Organizing these systems on a scientific basis would be better to reach quickly into the target aim of improving productive and reproductive potentials of rabbits. The does generally reach puberty when they upgrade to 70-75% of their mature weight and puberty in rodents is marked by vaginal opening and first estrus (Rastogi, 1984). L. tyrosine is a semi essential amino acid involved in formation of catecholamines (dopamine, epinephrine and norepinephrine) from adrenal gland and thyroid hormones (T3 and T4) from thyroids (Harper et al., 2000). Dopamine, one of the hypothalamic catecholamines, is effective in controlling prolactin secretion through activation of prolactin inhibiting factor (Kamberi et al., 1971). Dopamine is also involved in activating the release of growth hormone (Muller, 1973).

Norepinephrine is involved in the transmission of the stimulatory effect of progesterone on the release of LH and FSH via an adrenergic receptor mechanism (Pushpa et al., 1972).

Julius et al. (1981) concluded that tyrosine might be useful therapeutically in diseases characterized by peripheral catcholamine deficiencies as depression, insomnia and huntington's chorea.

Exogenous *L. tyrosine* was found to decrease age of puberty in rats (Hammerl and Russe, 1987a), induced follicular growth, estrus and ovulation in an-ovulatory dairy cows (Munsterer, 1987), increase litter size in rats (Hammerl and Muller, 1988) and increase LH pulse frequency in growth-restricted lambs (Hall et al.1992). Besides, it hastens puberty , increases body weight and has an effect on the hisological structure of pituitary gland of rabbits (Abo-Elroos, 1992). It also improves body weight and egg production post-molting in hens (Abo El-Oyoun, 2003). In addition tyrosine acts as a strong antioxidant either directly by radical trapping (Van Overveld et al., 2000) or through stimulating synthesis of another compounds as LHRh, which is an effective inhibitor of lipid peroxidation due to its hydrophobic structure containing only one charged residue (Moosman and Behl, 2002).

This investigation was therefore planned to study the possibility to induce earlier puberty in New Zealand does by L tyrosine, to study the effect of L. tyrosine on hormonal levels (T3, T4, E2 and progesterone) and to study its effect on the number and size of litters.

MATERIALS AND METHODS

This study was carried out in cooperation between the Animal Production research Institute, Agricultural Research Center, Sakha and Department of Physiology Faculty of Veterinary Medicine, Kafr El-Sheikh Tanta University, during the period from February till May 2003.

Experimental animals:

A total number of thirty-six immature apparently healthy female New Zealand white rabbits (49 + 4 days age and 950 + 100 g body wt.) were used in this study. Animals were selected from the station and allotted individually in batteries in two groups, a control group (n=13) receiving no medication and a treated group (n=23) administered orally *L. tyrosine* (Servareinstrss comp. 100 mg/kg b. w. dissolved in 3 ml water) according to El-Amrawi (1997). After one month, three females were slaughtered from each group and half of the treated group (n=10) was readministered a second similar dose of *L. tyrosine*. During the experimental period rabbits were fed on a diet composed of 16.67% crude protein, 2.36% ether extract, 12.62% crude fibers and digestible energy 2500 k. calory/kg in addition to the nutritional requirements of vitamins and minerals according to NRC (1977). Rabbits were weighed weekly.

Sampling:

1. Blood samples:

Blood samples were collected once weekly from ear vein of rabbit for two weeks pre-treatment and then ten weeks post-treatment by the first dose. Serum samples were used for hormone analysis of triiodothyronine (T_3), thyroxine (T_4), oestradiol-17((E_2) and progesterone.

2. Histological samples:

Three females from control and treated groups were decapitated after one and two months from the administration of the first dose. Organs (liver, and ovaries) were exteriorized, weighted to calculate HSI (liver wt. in g/total body wt. in g x 100) and GSI (ovaries wt. in g/total body wt. in g x 100) and then fixed in 10% neutral formalin for histological sections. Sections of 5-7 micron thickness from ovaries were prepared and stained with haematoxylin and eosin (Drury and Wallington, 1980) for examination of the possible changes following *L. tyrosine* administration.

Hormone analysis:

Serum concentrations of estradiol-17fl(Active® Estradiol RIA DSL-4300), progesterone(Active® Progesterone DSL-3900), T_3 (Active(T_3 RIA DSL 3100) and T4 (Active® Thyroxine DSL-3200) ,from all groups along the experimentation period were measured by radioimmunoassay kits purchased from Diagnostic System Laboratories Inc.(DSL) according to Burtis and Ashwood (1994), Miller (1988), Engler and Burger (1984) and Yalow and Berson (1971) respectively. The procedures follow the basic principle of radioimmunoassay where there is a competition between a radioactive and a non-radioactive antigen for a fixed number of antibody binding sites. The amount of I125 labelled hormone bound to the antibody is inversely proportional to the concentra-

tion of unlabelled hormone present. The separation of the free and bound antigen is achieved by decanting or aspirating the antibody-coated tubes.

Reproductive traits:

All does were mated by healthy mature aggressive males, when they reach 75% of mature weight (2800 + 100 g). Conception rate was recorded ten days post-mating (abdominal palpation). Number and weight of litters at birth were recorded and survival percent of litters till one-month age was also calculated.

Statistical analysis:

All data were subjected to statistical analysis according to Snedecor and Cochran (1980) using one way ANOVA test. Treatments were compared by the least significant difference test (LSD).

RESULTS

Table (1) revealed that, total body weight, ovaries weight, GSI, liver weight and HSI increase with advancing age. *L. tyrosine* induced a significant increase in all these parameters with the highest values in rabbits administered two doses of *L. tyrosine*.

Concerning serum T_3 concentration (Table 2), it was found that, it increased significantly ($P < 0.05$) in control rabbits with advancing age. After one month of treatment serum T_3 increased significantly in treated females as compared to control. After two months of treatment, rabbits administered a second oral dose have a significantly higher levels of T_3 as compared to control or those administered one oral dose of L tyrosine.

Serum T_4 concentration (Table, 3) increased significantly with advancing age. One oral dose of L. tyrosine induced a significant increase in T_4 concentration compared to control. A second oral dose induced a further significant increase as compared to control rabbits or those administered one oral dose.

Serum E_2 concentration increased significantly ($P < 0.05$) in the last week of the third month age with a further increase in the forth month age of control rabbits. *L. tyrosine* administration results in earlier significant increase in E_2 concentration as compared to control. Meanwhile, administration of the second dose of *L. tyrosine* at the beginning of the 4th month age resulted in a further significant increase in serum E_2 (Table, 4).

In control group, serum progesterone level gradually increased at the last week of the 4th month (Table 5). In rabbits supplemented with *L. tyrosine*, progesterone concentration significantly increased at the last week of the third month. At the end of the 4th month rabbits supplemented with two oral doses of *L. tyrosine* recorded the highest concentration of progesterone.

Table (6) showed that, *L. tyrosine* supplementation to female rabbits before puberty resulted in increased number and survival of litters at one-month age while the mean litter weight was significantly decreased as compared to control. There is no significant difference in total litter

Table (1): Total body weight, ovaries weight, GSI, liver weight and HSI of female rabbits treated with L. tyrosine.

Age (month)	Treatment groups	Weight (g)				
		Total body	Ovaries	GSI %	Liver	HSI %
Two	Control	1347.25±98.7f	0.455±0.09 f	0.034±0.002 e	46.00±4.2 f	3.41±0.7 ab
	One dose	1342.50±77.3f	0.453±0.08 f	0.034±0.002 e	46.00±4.7 f	3.43±0.3 ab
	Two doses	1345.00±86.7f	0.440±0.07 f	0.032±0.002 e	45.00±4.2 f	3.39±0.6 b
Tree	Control	1787.50±59.7e	1.468±0.12e	0.083±0.003 d	59.50±4.7 e	3.39±0.3 b
	One dose	2057.50±88.9d	1.998±0.11 d	0.097±0.003 abc	72.50±8.8 d	3.53±0.3 ab
	Two doses	2065.00±99.6b	1.948±0.14 d	0.094±0.003 bc	78.23±7.9 cd	3.79±0.3 a
Four	Control	2430.00±93.2c	2.260±0.13 c	0.0930±0004 c	82.75±8.2 c	3.50±0.4 ab
	One dose	2895.00±89.6b	2.870±0.19 b	0.098±0.005 ab	97.75±8.9 b	3.38±0.4 b
	Two doses	3195.00±102.5a	3.262±0.24 a	0.102±0.005 a	107.25±9.1 a	3.37±0.3 b

Values are mean + S.E.
Values with the same letter in each column are not significantly different at $P < 0.05$.

Table (2): Serum T3 (ng/dl) in female rabbits orally administered L. tyrosine.

	Pretreatment		Post-treatment (1st month)				Post-treatment (2nd month)			
	2nd w	1st w	1st w	2nd w	3rd w	4th w	1st w	2nd w	3rd w	4th w
Control	82. 7 ± A 6.7 h	91.0 ± A 7.2 gh	94.3 ± B 6.4 efg	95. 7 ± B 8.8 efg	102.0 ± B 11.5 def	103.0 ± B 9.6 de	111. 7 ± C 13.1 ed	118.3 ± C 7.6 bc	122.7 ± C 12.3 ab	124.0 ± C 10.3 ab
One dose L- tyrosine	83.7± A 7.9 fg	89.0± A 9.2 f	1.30.3± A 10.4e	169.7± A 7.7 bc	172.7± A 8.6 ab	176.3± A 13.8 ab	156.7± B 11.7 d	161.3± B 10.6 cd	157.0± B 8.5 d	154.7± B 11.7 d
Two doses L- tyrosine	83.3± A 7.1 ij	91.3± A 12.2 i	133.4± A 11.9 h	173.0± A 17.3 de	170.7± A 12.6 def	181.7± A 10.4 d	211.3± A 14.9 b	230.7± A 16.4 a	205.3± A 16.4	199.0± A 20.3 c

•Values are means + S.E.
•Means followed by a common capital letter in each column are not significantly different at the 5% level by DMRT.
•Means followed by a common small letter in each raw are not significantly different at the 5% level by DMRT.

Table (3): Serum T_4 concentration (µg/dl) in female rabbits orally administered *L. tyrosine*.

Time / Treatment	Pretreatment		Post-treatment (1st month)				Post-treatment (2nd month)			
	2nd w	1st w	1st w	2nd w	3rd w	4th w	1st w	2nd w	3rd w	4th w
Control	1.31 ± A 0.09 d	1.36 ± A 0.10 cd	1.46 ± C 0.14 cd	1.48 ± C 0.13 cd	1.44 ± C 0.11 cd	1.51 ± B 0,12 cd	1.58 ± C 0.16 cd	1.94 ± C 0.13 ab	1.68 ± C 0.16 bc	1.62 ± C 0.15 bcd
One dose L- tyrosine	1.30± A 0.12 j	1.35± A 0.13 j	2.34± Ab 0.17 gh	3.15± A 0.24 bc	3.20± A 0.22 abc	2.90± A 0.13 cde	2.71± B 0.19 def	2.42± B 0.18 fgh	2.29± B 0.22 gh	2.10± B 0.15 hi
Two doses L- tyrosine	1.31± A 0.11 h	1.33± A 0.09 h	2.57± A 0.25 efg	2.90± Ab 0.21 cde	3.02± Ab 0.13 cd	3.01± A 0.19 de	3.45± A 0.18 abc	3.77± A 0.26 a	3.67± A 0.43 a	3.50± A 0.23 ab

•Values are means + S.E.
•Means followed by a common capital letter in each column are not significantly different at the 5% level by DMRT.
•Means followed by a common small letter in each raw are not significantly different at the 5% level by DMRT.

Table (4): Serum oestradiol-17((E2) concentration (pg/ml) in female rabbits orally administered *L. tyrosine*.

Time / Treatment	Pretreatment		Post-treatment (1st month)				Post-treatment (2nd month)			
	2nd w	1st w	1st w	2nd w	3rd w	4th w	1st w	2nd w	3rd w	4th w
Control	71.5 ± A 6.6 d	78.8 ± A 6.8 d	83.1 ± A 5.9 d	91.3 ± B 8.1 cd	99.3 ± B 6.8 cd	121.1 ± B 4.8 bc	141.2 ± B 9.2 ab	144.1± C 11.3 ab	148.4 ± C 10.4 ab	158.4± C 7.9 a
One dose L- tyrosine	73.6± A 6.1 e	76.0± A 3.8 e	120.3± A 8.6 d	170..5± A 13.4 cd	197.0± A 15.7 bc	193.3± A 13.7 bc	205.8± A 17.4 ab	222.4± B 22.1 ab	233.4± B 37.2 a	229.6± B 19.5 a
Two doses L- tyrosine	75.2± A 4.7 g	80.6± A 8.2 f	172.4± A 11.4 d	172.4± A 11.4 d	196.6± A 17.8 d	193.5± A 15.2 d	231.2± A 17.8 c	281.1± A 21.5 b	311.8± A 27.3 a	311.1± A 19.6 a

•Values are means + S.E.
•Means followed by a common capital letter in each column are not significantly different at the 5% level by DMRT.
•Means followed by a common small letter in each raw are not significantly different at the 5% level by DMRT.

Table (5): Serum progesterone concentration (ng/dl) in female rabbits orally administered *L. tyrosine*.

Time / Treatment	Pretreatment		Post-treatment (1st month)				Post-treatment (2nd month)			
	2nd w	1st w	1st w	2nd w	3rd w	4th w	1st w	2nd w	3rd w	4th w
Control	0.018± A 0.002 b	0.022 ± A 0.002 b	0.022 ± A 0.002 b	0.022 ± A 0.002 b	0.022 ± A 0.002 b	0.030 ± A 0.003 ab	0.033 ± B 0.003 ab	0.037 ± C 0.003 ab	0.050 ± C 0.004 ab	0.058 ± C 0.005 a
One dose L- tyrosine	0.019± A 0.001 h	0.021± A 0.001 h	0.023± A 0.002 gh	0.025± A 0.202 gh	0.028± A 0.002 fgi	0.045± A 0.004 cdef	0.050± AB 0.005 bcde	0.062± BC 0.006 abcd	0.079± BC 0.006 ab	0.088± BC a
Two doses L- tyrosine	0.019± A 0.001 i	0.023± A 0.002 i	0.024± A 0.002 hi	0.025± A 0.002 hi	0.026± A 0.002 hi	0.040± A 0.003 fghi	0.073± A 0.006 def	0.127± A 0.011 c	0.166± A 0.016 b	0.199± A 0.017 a

•Values are means + S.E.
•Means followed by a common capital letter in each column are not significantly different at the 5% level by DMRT.
•Means followed by a common small letter in each raw are not significantly different at the 5% level by DMRT.

Table (6): Conception rate and number, weight and survival of litters of female rabbits treated with *L. tyrosine*.

	Number of litter	Total litter weight	Mean litter weight	Survival month		Conception rate
				Number	%	
Control	4.25 B	331.75 A	79.02 A	4.00 B	95.00 A	4/7
One dose L- tyrosine	5.25 AB	330.00 A	63.46 B	4.75 B	91.65 A	6/7
Two doses L- tyrosine	6.75 A	382.50 A	57.08 B	6.00 A	90.63 A	7/7

Values are means.
Means with the same letter in each column are not significantly different at $P < 0.01$.

weight between treated and control rabbits. Conception rate increased in L-tyrosine treated groups compared with control.

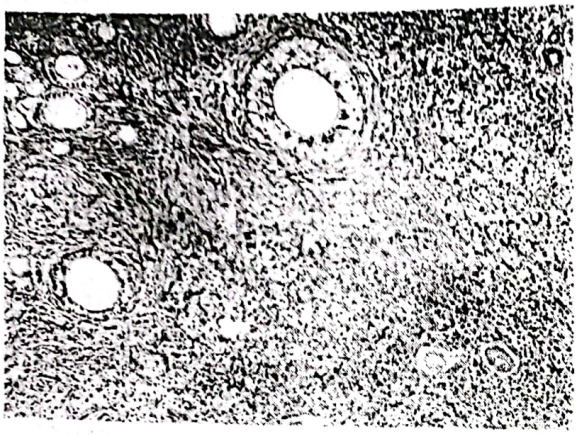

Fig. 1: The ovary of the control rabbits at 4 months age showing the immature ovarian follicles (H & E) X 100

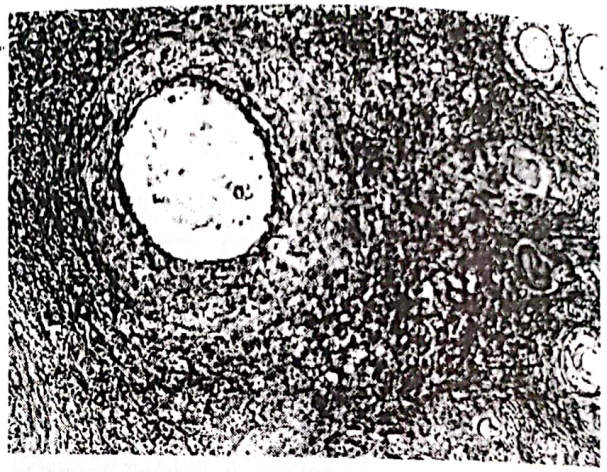

Fig. 2. The ovary of rabbit at 4-month age treated with one dose of L-tyrosine showed increase in size and maturation of ovarian follicle (H & E) X 100 .

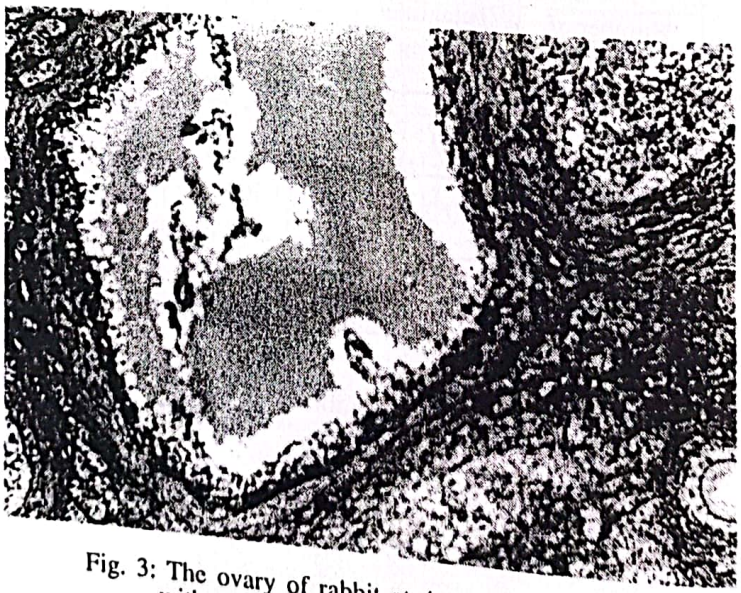

Fig. 3: The ovary of rabbit at 4-month age treated with two doses of L-tyrosine showing mature Graffian follicle (H & E) X 100.

Daily rhythm in the metabolism of dietary amino acids led to the discovery of a relationship between nutrient intake and neurotransmission (Wurtman et al., 1981). The increase in *L. tyrosine* in blood plasma resulted in elevated concentration of neurotransmitters in the brain (Wurtman et al., 1974). Hall et al. (1992) found a linear correlation between plasma and hypothalamic concentrations of *L. tyrosine*. Wurtman (1982) concluded that brain function could be modified by altering the synthesis of specific neurotransmitters through increased plasma concentrations of their amino acid precursors provided in the diet by supplementation.

Tyrosine serves as a processor for the synthesis of dopamine, norepinephrine and epinephrine neurotransmitters implicated in the control of GnRh and LH pulses and LH surge (Ramirez et al., 1984).

The mechanisms of action of tyrosine is unknown, but it may involve stimulation of GnRh release because availability of tyrosine influences synthesis of norepiniphrine (Acworth et al., 1988), a neurotransmitter that stimulates hypothalamic GnRh release and pulsatile and preovulatory release of LH from pituitary (Terasawa et al., 1988). The catecholamines may mediate effects of other neurotransmitters and gonadal steroids on release of GnRh (Yen and Vale, 1990).

The results of the present study revealed that, body weight of does significantly increased after one month of *L. tyrosine* administration. Tyrosine acts as a growth promoting factor as it activates the hypothalamic catechalamine dopamine, which in turn activates the release of growth hormone and TSH (Muller, 1973), in addition to its importance in formation of thyroxin and protein synthesis (Harper et al., 2000). Abo-Elroos (1992) recorded that tyrosine might induce hyperactivity in the thyrotrophic cells resulting in the secretion of TSH in excess amount which consequently will stimulate the thyroid gland to produce thyroxin which, is essential for body metabolism. Moreover, tyrosine was recorded to have a powerful antioxidant activity trapping free radicals (Van Overveld et al., 2000) while Moosman and Behl (2002) attributed the special efficacy of LHRL as an antioxidant to be raised from the direct redox interaction of tyrosine resides within each molecule.

In the present study *L. tyrosine* administration induced an earlier puberty in treated does as shown by the increased ovaries weight, GSI and the histological findings in ovaries (Fig. 3).

L. tyrosine increased body weight of treated rabbits which attain puberty when they reach 70-75% of mature weight (Rastogi, 1984). *L. tyrosine*, in

addition to its role as a stimulant to growth and growth hormone and TSH release, is a precursor for adrenaline and nor adrenaline, neurotransmitters that stimulate the hypothalamus to release GnRh via an adrenergic receptor mechanism (Arthur, 1989). Release of GnRh stimulates pituitary gland to secrete FSH and LH. Papkoff et al. (1984) reported that the tyrosine residues of equine chronic gonadotropin play an important role in the manifestation of both the FSH and LH activity of the hormone.

The increase in liver weight in the present study was correlated with the increase in body weight, as there is no significant variations in HSI between control and treated does.

In accordance with our results, previous researchers reported that, exogenous tyrosine decreased age of puberty in rats (Hammerl and Russe, 1987a), induced follicular growth, estrus and ovulation in an-ovulatory dairy cows (Munsterer, 1987), increased litter size in swines (Hammerl and Russe, 1987b) and rats (Hammerl and Muller, 1988), induced estrus in anestrus buffaloes (El-Amrawi et al., 1991) and increased LH pulse frequency in growth-restricted lambs (Hall et al., 1992). Besides it stimulates ovarian follicleís growth in does (Abo Elroos, 1992) and stimulates follicular growth and egg production in laying hens (Abo-El-Oyoun, 2003).

Regarding serum T_3 and T_4 concentration in female rabbit, it appeared that serum T_3 and T_4 was gradually increased with advancing age and increase in body weight in control group. Thyroid glandís activity correlates with body weight as, it is responsible for the basal metabolic rate. Increasing body weight requires more energy expenditure from mitochondria with, increasing demands for more thyroid hormones (McDonald and Pineda, 1989) who also added that thyroid hormones stimulate appetite, enhance growth and stimulate most metabolic activities and metabolic rate. Besides, they stimulate secretions of other glands and also increased the needs of tissues for the hormone (Guyton and John, 1996).

Tyrosine supplementation increased serum T_3 and T_4 in supplemented rabbit as compared with controls in the present study. This is attributed to the assumption that brain catcholamines, norepinephrine and dopamine, are synthesized by the physiologic precursor *L. tyrosine* (Badawy and Williams, 1982), and that norepinephrine rather than dopa is the hypothalamic catechalamine of importance in activating the release of TSH (Grim and Reichli, 1973). Moreover, McDonald and Pineda, (1989) recorded that thyroid hormones are necessary for normal FSH and LH secretion. Thereby, increasing the circulating tyrosine by administration in the present study will be insured by increasing the level of TSH which stimulates the thyroid gland to secrete thyroxin, in addition, ty-

rosine is the precursor amino acid for thyroid hormones synthesis (Harper et al., 2000). Generally tyrosine is a stimulant to the releasing factor of growth hormone and TSH and for thyroxin and protein synthesis (Harper et al., 1980). Moreover, the finding of Abo Elroos (1992) indicated that tyrosine might induce hyperactivity in the thyrotrophic cells, resulting in the secretion of TSH in excess amount, this consequently, will stimulate the thyroid gland to produce thyroxin. The previous researches support and findings in the present study in which tyrosine supplementation led to increase in body weight, thyroid hormones (T_3, T_4) serum concentration with increase in liver weight which was reflected on increased ovarian activity and earlier puberty as compared to control rabbit. Furthermore, Koritschoner et al. (2001) recorded that thyroid hormones is a major regulator of energy metabolism and T_3 upregulate tub mRNA neuronal cells and defects in thyroid status are frequently associated with changes in body weight.

Regarding E_2 serum concentration in does (Table 4) it is obvious that, E_2 increased significantly in the 4th week of the 3rd month age in control group and earlier one to two weeks in *L. tyrosine* treated groups. It is increased markedly after that in treated groups than controls. These findings were in agreement with Raun and Swerdloft (1986) in rats, Hammerl and Russe (1987a), Hammerl and Muller (1988) in rats, El-Amrawi et al. (1991) in buffalo, Hall et al. (1992) in lambs, Abo Elroos (1992) in rabbit, Steveneson et al. (1997) in cow and Abo El-Oyoun (2003) in laying hens. They recorded that, L. tyrosine induced early puberty and stimulated E2 secretion via its effect on hypothalamus to release GnRh which, consequently stimulates gonadotropins secretion from anterior pituitary that finally stimulates follicular growth (Fig. 3) with subsequent secretion of E_2 by granulosa cells. Moreover Abo Elroos (1992) concluded that *L. tyrosine* acts as a hormonal inducing factor as a synergetic transmitter between the hypothalamus, pituitary gland and gonads.

Concerning serum progesterone concentration (Table 5), it appeared that it increased significantly in the 4th week of the 4th month age in control group and earlier two weeks in the *L. tyrosine* treated groups and generally progesterone increased later in relation to E_2. The increased level of progesterone may be due to the stimulatory effect of tyrosine on GnRh. *L tyrosine* may involve stimulation of GnRh release because availability of tyrosine influences synthesis of norepinephrine (Wurtman et al., 1981), a neurotransmitter that stimulates hypothalamic GnRh release and pulsatile and preovulatory release of LH from pituitary (Ramirez et al., 1984 and Terasawa et al., 1988). The catecholamines may mediate effects of other neurotransmitter and gonadal steroids on release of GnRh (Yen and Vale, 1990). Stevenson et al. (1997) recorded that, supplemental tyrosine in-

crease expression of estrus in suckled cows after PGF 2α and tended to reduce intervals to first postpartum ovulation.

In the present study females are mated when they reach 75% of their mature weight (2800 ± 100 g). *L. tyrosine* treated females were mated earlier as they reach this weight earlier.

There was a significant increase in number of litters in *L. tyrosine* supplemented rabbit but the total litter weight was not significantly differed (Table, 6). GnRh release, under tyrosine effect, stimulates FSH and LH release from anterior pituitary in higher level resulting in increased number of mature ovarian follicles which reach maturity and became ready for ovulation at mating under effect of LH as rabbits are induced ovulatory animals, this was reflected on the increased conception rate in treated does.

As all rabbit are mated nearly on the same weight the capacity of the uteri of rabbit are nearly similar so the increase in number was accompanied with the decrease in their weights as there is no significant difference in total litter weight between *L. tyrosine* supplemented and control. We guess that if all rabbit are mated on the same age with the difference in their weights the treated ones will be heavier and will give a larger litter size, this need further investigation.

It was concluded that L. tyrosine can be effectively used to induce puberty in female rabbit as it increases body weight and conception rate of female and also increases number of litters at birth and survival rate till one month age.

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