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# SEMEN QUALITY AND TESTICULAR ACTIVITY OF GROWING RAMS TREATED BY TYROSINE

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## ABSTRACT

*From 14 Tyrosine-treated and 16 non-treated rams, 12-20 months old, semen was collected and evaluated once weekly for 10 weeks. Testosterone was estimated as well as scrotal circumference and testicular length were measured once every two weeks. From results obtained, there was an improvement in semen quality and androgenic activity as well as an increase in the scrotal circumference and testicular length in tyrosine treated rams comparing to that in control.*

## INTRODUCTION

The amino acid L-Tyrosine acts as a precursor of catecholamines, dopamine and norepinephrine (Gibson & Wurtman, 1977). It has been found that the hypothalamic catecholamines helps in releasing GnRH (Hammerl & Russe, 1987). The release of GnRH from the hypothalamus is followed by an increase in levels of FSH and LH which control gonadal functions (Hafez, 1986). Thus, Tyrosine administration might have an indirect effect on the gonadal activity. Such effect can be assessed by keeping in mind the close relationship between the testis producing potential and either the testicular measurements (Yarney, et al., 1990) or scrotal circumference (Ley, et al, 1990). Therefore, the present study was designed to visualize the alteration in semen quality, androgenic activity, testicular length and scrotal circumference when growing rams were treated by the amino acid L-Tyrosine.

## MATERIAL AND METHODS

The study was conducted on a total of 30 rams, kept in farm of Fac. Agric., Moshtohour, during the period from March, 1st to June, 1st, 1991. They varied in age (12 - 20 months), body weight (40 - 55 kg) and in breed (6 Ossimi, 6 Rahmani and 18 Cross of 1/2 Ossimi x 1/2 Rahmani). Each ram was allowed a daily constant ration of 2 kg concentrate mixture and green fodder ad-lib.. In two separate pens, rams were divided into two comparable groups; the first of 14 rams was treated by L-Tyrosine (Reinst. Fab. Servo, Heidelberg-Germany) in single dose of 100 mg/kg body weight by oral administration (Knoblach, 1988).

The second of 16 rams was left without treatment as control. For a period of justification, rams of both groups were subjected to a daily exercise and training on male or female teaser for sexual stimulation and adaptation on using the artificial vagina in semen collection. After nearly one month, from the date of treatment, semen was collected and evaluated (Zemjanis, 1970) from all rams once weekly for 10 weeks as period of data collection. During that period, blood serum samples for testosterone estimation in addition to measurements of the testicular length and scrotal circumference were taken once every two weeks from 13 Tyrosine-treated and 11 non-treated rams. Testosterone (pg/ml) was estimated by the RIA technique according to Dobson (1983). The testicular length was measured by using a standard metal caliber. The scrotal circumference was measured at the point of maximal horizontal dimension using a tape measure. Data obtained on semen quality were statistically computed by the Mixed Model Computer (Harvey, 1987). Data on testosterone, testicular length and scrotal circumference were analyzed, where appropriate according to Denenberg (1976).

## RESULTS

From Table (1), there was a significant ( $P < 0.05$ ) improvement in the ejaculate volume, sperm concentration, sperm motility and live sperm percent for semen of Tyrosine-treated rams ( $0.96 \pm 0.02$  ml,  $2,41 \pm 0.04 \times 10^6$  /ml,  $63.20 \pm 0.48\%$  and  $68.10 \pm 0.37\%$ , resp.) when compared to that of control ( $0.87 \pm 0.03$  ml,  $1.80 \pm 0.06 \times 10^6$  /ml,  $59.8 \pm 0.64\%$  and  $63.4 \pm 0.49\%$ , resp.). The percentage of protoplasmic droplets appeared significantly ( $P < 0.05$ ) lower in semen of Tyrosine-treated rams ( $0.68 \pm 0.49\%$ ) than that of control ( $0.97 \pm 0.08\%$ ), contrary to percentages of primary and secondary sperm abnormalities which appeared non-significant. Irrespective of treatment, Ossimi ram semen generally appeared inferior in its quality to other breeds, where no significant difference was observed between the quality of Rahmani and Cross rams' semen.

As shown from Table (2), testosterone level and scrotal circumference seemed significantly ( $P < 0.01$ ) better with Tyrosine-treated rams ( $304.37 \pm 7.40$  pg/ml and  $27.50 \pm 0.30$  cm, resp.) than those with control ( $131.49 \pm 4.90$  pg/ml and  $25.30 \pm 0.40$  cm, resp.). However, there was no apparent difference in the testicular length between the treated ( $8.90 \pm 0.20$  cm) and non-treated ( $8.60 \pm 0.30$  cm) rams.

Respecting to breed, there was a non-significant decrease in the testosterone level and testicular length as well as a significant ( $P < 0.05$ ) shortness in the scrotal circumference of Ossimi rams ( $205.23 \pm 18.00$  pg/ml,  $8.40 \pm 0.30$  cm and  $24.30 \pm 0.50$  cm, resp.) when compared to those of either Rahmani ( $246.30 \pm 17.60$  pg/ml,  $8.60 \pm 0.20$  cm and  $26.90 \pm 0.60$  cm, resp.) or cross ( $224.50 \pm 13.30$  pg/ml,  $9.00 \pm 0.40$  cm and  $28.10 \pm 0.40$  cm, resp.) breeds (Table, 2).

Table 1) : Effects of Tyrosine treatment and breed difference on quality of ram semen (Least-Square means  $\pm$  SE).

Factors	Volume (ml)	pH	Concen. (10 <sup>6</sup> /ml)	Motility (%)	Live (%)	Abnormalities %		
						Prim.	Sec.	Pr.Dr.
<b>Treatment: -</b>								
. Tyrosine (14)	0.96a $\pm$ 0.02	6.97a $\pm$ 0.02	2.41a $\pm$ 0.04	63.20a $\pm$ 0.48	68.10a $\pm$ 0.37	1.35a $\pm$ 0.03	2.90a $\pm$ 0.15	0.68b $\pm$ 0.05
. Control (16)	0.87b $\pm$ 0.03	6.97a $\pm$ 0.02	1.80a $\pm$ 0.06	59.80b $\pm$ 0.64	63.40b $\pm$ 0.49	1.25a $\pm$ 0.05	2.85a $\pm$ 0.21	0.97a $\pm$ 0.08
<b>Breed:</b>								
. Ossimi (6)	0.80b $\pm$ 0.03	7.02 a $\pm$ 0.03	1.94b $\pm$ 0.07	57.00b $\pm$ 0.79	64.20b $\pm$ 0.60	1.45a $\pm$ 0.05	3.32a $\pm$ 0.24	1.09a $\pm$ 0.12
. Rahmani (6)	0.99a $\pm$ 0.04	6.95a $\pm$ 0.03	2.13a $\pm$ 0.08	63.40a $\pm$ 0.85	65.50b $\pm$ 0.65	1.28b $\pm$ 0.08	2.62a $\pm$ 0.26	0.69b $\pm$ 0.05
. Cross (18)	0.95a $\pm$ 0.02	6.94a $\pm$ 0.02	2.34a $\pm$ 0.05	64.20a $\pm$ 0.51	67.70a $\pm$ 0.39	1.25b $\pm$ 0.02	2.81a $\pm$ 0.18	0.80b $\pm$ 0.07

Pr. Dr. : Protoplasmic droplets

Values between brackets are number of cases.

Different letters within the same column for treatment and breed difference are significant at P < 0.05

## DISCUSSION

It appeared from the present study that the oral administration of L-tyrosine (Knoblach, 1988) was associated with a remarkable improvement in the sexual activity and semen quality of the treated rams when compared to the control. Such improvement might be attributed to the probable effects of tyrosine which might have a relationship to releasing the gonadotrophins, LH and FSH, which control sexual activity and semen production (Hafez, 1986). It has been assumed that dopamine, one of the hypothalamic catecholamines, synthesized by tyrosine, was capable of elevating LH and FSH release either in vitro or in vivo by stimulating the release of hypothalamic gonadotrophin-releasing factors, LRF and FRF, as synaptic neurotransmitters (Schneider & McCann, 1969; Kamberi, et al., 1970; Wurtman, et al., 1974; Fernstrom, et al., 1979). However, norepinephrine, other hypothalamic catecholamine, was supported as the natural catecholamine which facilitates LH release (Kalra, et al., 1972). Second, Tyrosine might induce its effect through its known role in synthesizing thyroxin

**Table 2):** Effects of Tyrosine treatment and breed difference on testosterone level, testicular length and scrotal circumference of rams (Means  $\pm$  SE).

Factors	Testosterone (pg/ml)	Testicular length (cm)	Scrotal circumference (cm)
<b>Treatment:</b>			
. Tyrosine (13)	304.37 $\pm$ 7.40a	8.90 $\pm$ 0.20a	27.50 $\pm$ 0.30a
. Control (11)	131.49 $\pm$ 4.90b	8.60 $\pm$ 0.30a	25.30 $\pm$ 0.40b
<b>Breed:</b>			
. Ossimi (6)	205.23 $\pm$ 18.00a	8.40 $\pm$ 0.30a	24.30 $\pm$ 0.50b
. Rahmani (6)	246.30 $\pm$ 17.60a	8.60 $\pm$ 0.20a	26.90 $\pm$ 0.60a
. Cross (12)	224.50 $\pm$ 13.30a	9.00 $\pm$ 0.40a	28.10 $\pm$ 0.40a

Values between brackets are number of cases

Different letters within the same column for treatment and breed differences are significant at  $P < 0.05$ .

as a secondary hormone controlling the gonadal function (Hafez, 1986) in addition to action of the hypothalamic catecholamine, norepinephrine, in activating the release of TSH (Grimm & Reichlin, 1977) which regulate the thyroid function. And third, Tyrosine might have a possible relationship to the steroidogenic activity of gonads. It has been suggested that the Tyrosine alleviated catecholamines maybe involved in the transmission of negative feedback mechanisms of gonadal steroids (Schneider & McCann, 1969).

Regardless of the effect of tyrosine treatment, the study also indicated the presence of significant breed difference in the quality of ram semen especially in the ejaculate volume, the sperm concentration, the sperm motility, the sperm alive and the secondary abnormalities. These findings came in agreement with some earlier studies on different breeds (Smyth & Gordon, 1967; Galal, et al., 1978; Colas, 1983), while others (El-Mikkawi, et al., 1967; El-Gamal, 1975) did not find any significant attribution to breed on the quality of ram semen.

Estimation of testosterone level in the present study, did not reveal any significant difference in relation to the breed difference. This finding might be expected because, regardless of the hereditary factor, all environmental stresses influencing testosterone activity (Hafez, 1986) are inconsistent for all rams under experimentation. However, a highly significant increase in level of testosterone was observed in the tyrosine-treated rams when compared to that in the control. Such increase might be attributed to the tyrosine - hypothalamic catecholamines relationship on releasing the pituitary gonadotrophins mainly LH (Kalra & McCann, 1973) which regulates the testicular release of testosterone (Schanbacher & Luntra, 1976; Wilson & Lapwood, 1979). In the meantime, the high level of testosterone, associated with tyrosine treatment, was shown to have a close relationship with the greatest scrotal circumference and testicular length. Thus, the scrotal circumference can be used as indication to the testicular activity following tyrosine treatment when compared to that in the non-treated animals. This finding came to support efficiency of the scrotal circumference for judging the testicular function (Notter, et al, 1981; Cartee, et al., 1990).

From the present study, it can be concluded that the oral administration of L-tyrosine might be beneficial to improve the semen quality and testicular activity of growing rams as indicated from increasing the total sperm output, testosterone level and the scrotal circumference.

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