

Chronic Consumption of Paraaxon Changes Thyroid Hormone Levels in Rats

Kronik Paraaxon Tüketimi Sıçanda Tiroid Hormon Düzeylerini Değiştirir

Fatemeh Nabavizadeh Rafsanjani, Mohammad Vahedian Ardakani, Amir Davoodi, Omid Reza Pirnazar

Tehran University of Medical Sciences, Physiology, Tehran, Iran

*Tehran University of Medical Sciences, Tehran, Iran

**Baghiatallah University of Medical Sciences, Tehran, Iran

***Baghiatallah University of Medical Sciences, Tehran, Iran

Abstract

Objective: Paraaxon is an organophosphorus compound. These substances absorbed variously and inhibit acetylcholinesterase enzymes. The aim of this study was to investigate the effects of the chronic consumption of paraaxon on thyroid hormones.

Material and Methods: In this study, was carried out at the Baghiatallah University of Medical Sciences, Tehran, Iran, 36 female N-Mari rats weighing 200-250gr were used. The first group (paraaxon) received 0.05 mg/kg/day paraaxon subcutaneously for one month. The second group (alcohol) received the same chronic doses of ethyl alcohol (96%) and the third group (control) received no drugs. Animals were anaesthetized with ethyl ether (96%). The blood was collected from the tail and prepared their serums. Then T4 and TSH levels were measured by RIA. ANOVA and Tukey tests were used for comparison between groups and $P < 0.05$ considered as significant.

Results: The T4 level was significantly higher in the paraaxon group than those in the alcohol and control groups: 2.41 ± 0.17 , 0.31 ± 0.03 and $0.17 \pm 0.02 \mu\text{g/dl}$ respectively, $P < 0.01$. Also the TSH level was significantly lower in the paraaxon group than those in alcohol and control groups: 0.09 ± 0.01 , 0.24 ± 0.01 and $0.22 \pm 0.03 \mu\text{U/ml}$; respectively, $P < 0.01$.

Conclusion: Paraaxon in chronic exposure increases T4 level and decreases TSH level. *Turk Jem 2007; 11: 34-6*

Key words: Paraaxon, thyroid, hormones

Özet

Amaç: Paraaxon bir organofosfor bileşimidir. Bu maddeler değişken olarak emilmekte ve asetilkolinesteraz enzimlerini inhibe etmektedir. Bu çalışmanın amacı kronik paraaxon tüketiminin tiroid hormonları üzerine etkilerini araştırmaktır.

Gereç ve Yöntemler: Bu çalışmada ağırlıkları 200-250 gr arası değişen 36 dişi N-Mari sıçan kullanıldı. Birinci grup (paraaxon) subkutan yolla 0.05mg/kg/gün paraaxon aldı. İkinci grup (alkol) aynı kronik dozda %96'lık etil alkol ve üçüncü grup (kontrol) hiç bir ilaç almadı. Hayvanlar %96'lık etileter ile anestezi aldı. Kan örnekleri kuyruktan alındı ve serumları hazırlandı. T4 ve TSH düzeyleri RIA ile ölçüldü. Grupları birbirleriyle karşılaştırmak için ANOVA ve Tukey testleri kullanıldı. $P < 0.05$ bulunması halinde anlamlı olarak kabul edildi.

Bulgular: T4 düzeyi paraaxon grubunda alkol ve kontrol grubuna göre daha yüksek bulundu: sırasına göre 2.41 ± 0.17 , 0.31 ± 0.03 and $0.17 \pm 0.02 \mu\text{g/dl}$, $P < 0.01$. Aynı zamanda paraaxon grubunda TSH düzeyleri alkol ve kontrol gruplarına göre anlamlı daha düşüktü: sırasıyla 0.09 ± 0.01 , 0.24 ± 0.01 and $0.22 \pm 0.03 \mu\text{U/ml}$; $P < 0.01$.

Sonuç: Kronik paraoxona maruz kalmak T4 düzeylerini artırmak ve TSH düzeylerini düşürmektedir. *Turk Jem 2007; 11: 34-6*

Anahtar kelimeler: Paraaxon, tiroid, hormonlar

Introduction

Paraaxon is an organophosphorus compound. Organophosphate chemicals are serine esterase and protease inhibitors, widely used in agriculture as insecticides and acaricides. In addition they find use in industry and technology as softening agents

and additives to lubricants and some of them are declared as chemical warfare agents (7,8). After entering the blood stream, they are spread in all the body (2) and causes nicotinic and muscarinic signs. These symptoms are salivation, lacrimation, vomiting, urinary and fecal incontinence, severe muscle pain and neurological and respiratory disorders (2, 11). Moreover it has been

observed that organophosphates not only affect the acetylcholinesterase but also may alter the liver, kidney and endocrine glands functions (4, 9). Abnormal thyroid hormone levels have been described in the presence of the use of number of drugs.

In this present study we aimed to investigate the effects of chronic paraoxon poisoning on thyroid hormones, which have the most important role in the determination of basal metabolic rate, maintaining the metabolic homeostasis.

Materials and Methods

In this study was carried out at the Baghiatallah University of Medical Sciences, Tehran, Iran, 36 female N-Mari rats were used. The rats were obtained from animal room of Baghiatallah University Medical Sciences. Rats weighed between 200-250gr. Animals were housed with a room temperature of 25 ± 2 C and a light: dark cycle of 12 hours on and 12 hours off. Rat food and water were available ad libitum and were classified into the following three groups (n=12):

- 1- Control group: had access to normal food and water.
- 2- Paraoxon group: received 0.5 mg/kg paraoxon subcutaneously daily for one month (11).
- 3- Alcohol group: received 0.05 mg/kg ethyl alcohol (96%) subcutaneously daily for one month (Alcohol is as paraoxon solvent). Animals were anaesthetized with ethyl ether (96%). The blood was collected from the tail by cutting of the end point of that. Blood samples were exposed to centrifuge in 1000 cycles for 10 minutes, their serums were kept at -70°C . Then the thyroxin (T4) and thyroid stimulating hormone (TSH) were measured by RIA. Results were expressed as Mean \pm SE. ANOVA and Tukey tests were used for comparison between groups. $P < 0.05$ was considered to be statistically significant.

Results

The hormones T4 and TSH levels are measured. The T4 level was significantly higher in the paraoxon group than those in the alco-

hol and control subjects: 2.41 ± 0.17 , 0.31 ± 0.03 and 0.17 ± 0.02 $\mu\text{g/dl}$, respectively, $P < 0.01$ (Figure 1).

There was no significant difference between alcohol and control groups in the T4 level (0.31 ± 0.03 vs. 0.17 ± 0.02 $\mu\text{g/dl}$) (Figure 1). The TSH level was significantly lower in the paraoxon group than those in the alcohol and control groups: 0.09 ± 0.01 , 0.24 ± 0.01 and 0.22 ± 0.03 $\mu\text{U/ml}$, respectively, $P < 0.01$ (figure 2).

There was no significant difference between alcohol and control groups in the TSH level (0.24 ± 0.01 vs. 0.22 ± 0.03 $\mu\text{U/ml}$) (Figure 2).

Discussion

In our study we have observed that T4 and TSH level were increased and decreased significantly after exposure chronic to paraoxon in paraoxon group.

In the before study, some investigators have shown that T3, T4 and TSH level were decreased after acute organophosphate poisoning in the rat (8). This invention is showing hypothyroidism. This may be due to accumulation of acetylcholine after organophosphate poisoning. However they could not say that the finding is primary hypothyroidism, because TSH levels were also suppressed and this may be due to effects of dopamine and somatostatin on thyroid hormones. There is evidence that acetylcholine is involved in regulating pituitary functions (10). Several lines of evidence support a role for cholinergic regulation of TSH secretion through by somatostatin. Dopamine stimulates somatostatin release from the median eminence and increase its portal blood concentration and this increase suppress the serum TSH levels and it may have caused the decrements in T3 and T4 (3, 5).

In the present study we have observed T4 and TSH levels were increased and decreased respectively after consumption chronic paraoxon in case group. As there is no other study about the effect of chronic exposure to paraoxon on thyroid hormones in the literature, the results of the present study could not be com-

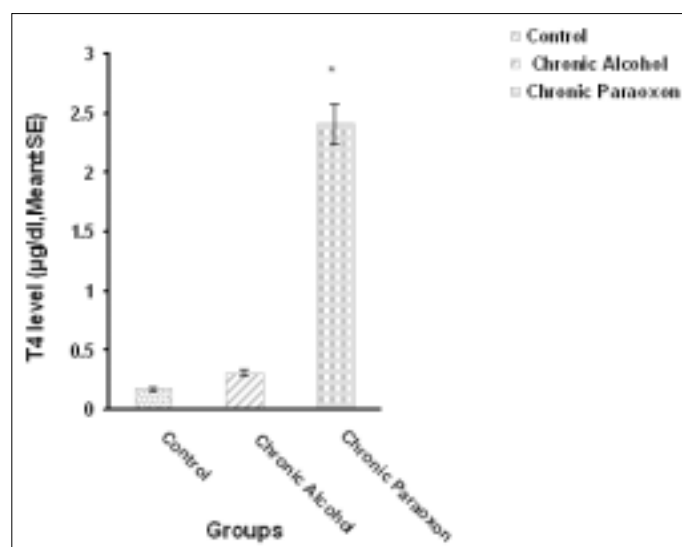


Figure 1. Comparison of the T4 level between the control, alcohol and paraoxon groups (n= 12 in each group) * $P < 0.01$

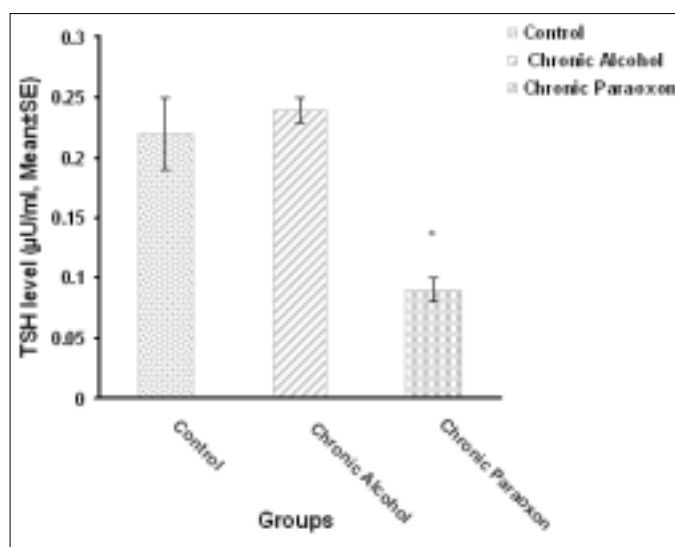


Figure 2. Comparison of the TSH level between the control, alcohol and paraoxon groups (n= 12 in each group) * $P < 0.01$

pared with any other study. But it seems in this research, that consumption chronic paraoxon affected on thyroid gland directly and due to hyperthyroidism. After increasing T4 level (hyperthyroidism), by induce negative feedback on the pituitary gland, decreases TSH level (1, 6). Also it is probable that paraoxon could effect on the thyroid gland and due to increases T4 level by these mechanisms:

- 1- Paraoxon activated follicular cells in the thyroid gland.
- 2- Paraoxon increased number and size of the follicular cells.
- 3- Paraoxon increased the activity or the amounts of thyrosin peroxidase, iodide pump and thyroglobulin.
- 4- Paraoxon activated the exocytosis and endocytosis process, that these processes are important in the synthesis of thyroid hormones.

All these assumption require further studies to be proved. Therefore, further histological and biochemistry studies of thyroid gland and the measurement of T3 level are recommended in order to understand the involved mechanisms.

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