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Short Communication

Evaluation of Iron Oxide nanoparticles effects on tissue and Enzymes of Thyroid in Rats

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Abstract

Objective: Iron oxide nanoparticles have extensive application in MRI and heat therapy of canceras contrast elements. However, the effects of nanoparticles on human health have not been fully investigatedyet. In this study, effects of iron oxide nanoparticles on thyroid hormones (T3 and T4) and TSH in adult male wistar rats were studied. Material and Methods: Three experimental groups of ratswere fed daily by three different concentrations of iron oxide nanoparticles (20 µg/kg, 50 µg/kg and 150 µg/kg that dissolved in one ml of distilled water) by gavage tube. Feeding repeated for 15 days. Then serum T3 and T4 levels was measured in experimental and control groups. Results: Results showed there are no significant changes inserum T4 levels in the experimental group that received lowest dose. But rats received the highest dose showed a significant increase in T3 level compared to control group. Also Yrmy TSH hormone concentration in the groups receiving the middle and max dosage of treatment is significantly lower than the control group. Conclusion: Experimental results also showed high concentration of iron oxide nanoparticles inhibits the Ndkryny pituitary axis and can cause malfunctions of the hypothalamusand thyroid glands.

Keywords: Iron Oxide nanoparticles, TSH hormone, T3 hormone, FSH hormone, Rat.

Introduction

Some nanoparticles, such as iron, cobalt and nickel are known as magnetic nanoparticles because of magnetic properties and stability[1,2]. Iron oxide nanoparticles have widespread application for invivo and invitro researchdue to the physiochemical characteristics[3].

The nanoparticles have many biomedical applications including tissue reconstruction, safety survey, disposal poisoning of biological fluid, heat therapy of cancer cells and etc[4]. Another important application of nanoparticles is in MRI (MRI is a standard method in medical diagnostics now)[2]. Iron oxide nanoparticles used for drug delivery in cancertherapy since 1970 and its applications has continued to now[4-6]. Effects of these nanoparticles are not yet fully known, despite oftheir wide using in human health[4]. Treatment by iron oxide nanoparticles has different effect including increased concentrations of cytokines and inflammatory responses and its effect is in gene expression level[4]. Many of these nanoparticles have proven mild toxic effects[4]. Apopa and colleagues in 2009 reported that iron oxide nanoparticles increased endothelial cell permeability[7]. Nanoparticles because of their shape and size can pass through physiological barriers instead of having harmful effects; however our information about its toxicity is very low and limited[8]. I believe that prolonged exposure to iron oxide nanoparticles resulted disruption of thyroid hormones (T3 and T4) and TSH and endocrine system dysfunction also. Many studies have been shown that thyroid hormones play an important role in the tissues metabolism[9]. Arriving of iron oxide to tissue causeHrkvnh and irreversible damage to the tissues. In this study the effects of different amounts of iron oxide nanoparticles have been studied on the concentration of thyroid hormones,endocrine hormones and metabolism. This study used FyalytIbn nanoparticles. Areas whit increased protection against these nanoparticles also recognized.

Material and Methods

Thisstudy was conducted on experimental animals and we used adult male Wistar rats weighing 300-250 g were estimated from the animal house of martyr portal was developed. Animalswhit average age of 3-5/2 months selected. Testing carried out at temperature of 25-20 centigrade degree that day duration was 12 hours and 12 hours dark lighting. Municipal tap water was used adjusted drinking water and eating animals for food by rats (feed compression) that the Company prepared feed was barking in this study, experimental animals were randomly divided into two groups as follows:

First group: control group consisted of 10 animals were fed by one ml of distilled waterduring one day and this feeding repeat for 15 days.

Second group: experimental group consisted of three sub-groups, each consisting of 10 animals which threated by various amounts of iron oxide nanoparticles that solutions were prepared by distilled water with a maximum concentration (150 µg/kg), average concentration (50 µg/kg) and minimum concentration (20 µg/kg). Feeding was done orally by gavage (through the tube) and continued for 15 days.Fifteen days after the end of experiments blood sample of all animals prepared from retro orbital eye veins. Samples were centrifuged at 3000 rpm for 15 minutes.After separating the serum from the clot by Smplr, serums frozen at temperature of - 20 ° C and stored, then used for hormones measurement.Viscosity of thyroid hormones (T3 and T4) and TSH measured by ELISA method andusing specific kits(from the America Monobindcompany). The resulting progeny of liver enzyme levels based on the statistical program SPSS and analyzed by ANOVA and Tukey test was the difference in the level P <0.05 was considered significant.

Results and Discussion

Results: Statistical studies and comparison of the thyroid hormones (T4 and T3) and TSH concentrations in animals that threated by iron oxide nanoparticles and controls were done, Asterisks* indicate significant differences at P <0.05 for each test group rather than the control group. Results showed there is no significant difference between experimental and control groups in the T3 hormone levels (figure 1A). T4 hormone concentration doesn't have significant differences between the groups received the intermediate dose, and lowest does. But T4 hormone concentration increased in group receiving the highest dose rather than control (figure 1B).

TSH hormone levels in the groups receiving the medium and maximum doses were significantly lower than the control that showed in figure 3. Next charts reveled the level of three hormones in experimented groups. Numbering in the next charts are the 1.00= controls, 2.00= animals that received the lowest concentration of nanoparticles 3.00 = animals that received the middle concentration of nanoparticles and 4.00 = animals that received the maximum-dose of nanoparticles.

Discussion: The results of this experimental study indicated the iron oxide nanoparticles causedsignificantly increased in serum hormones, T4, and Significant decrease in TSH serum hormone concentrations. It is possible nanoparticle effects can be applied through the inhibition of endocrine pituitary axis - hypothalamus that affects the hypothalamus, which is probably due to decreased TSH levels. Nanoparticles in the blood may inhibit the thyroid gland tissue damages. Dydynasyvn T4 Iron oxide nanoparticles are likely perturbed the liver enzymes that synthesize mono-amine oxidase and this is main location of the dysfunction of this enzyme. The use of monoamine oxidase inhibitors in rats can alter the pattern of TSH release[10]. TSH release will lead to decreasing in iodine transport mechanism[11].

Conclusion

Previous studies and our resultsindicated that iron oxide nanoparticles at high concentration(150 µg/kg)has toxic effects on the thyroid gland and inhibits the activity of this gland.

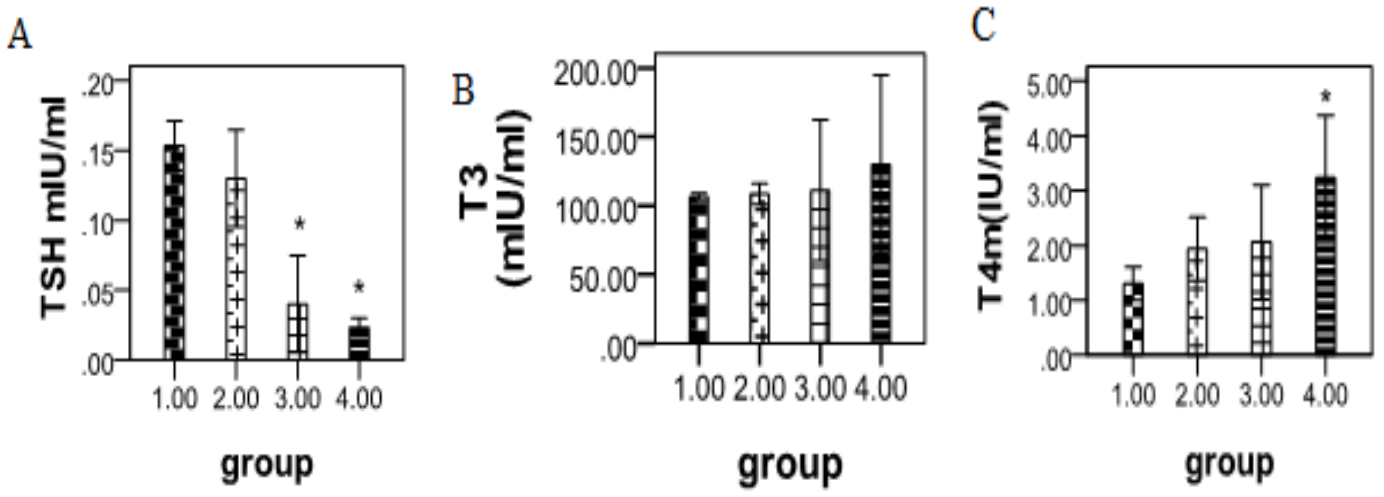

Figure-1
The resulting progeny of liver enzyme levels based on the statistical program SPSS and analyzed by ANOVA and Tukey test. A chart is serum T4 hormone level, B is serum T3 hormone and C is serum TSH levels in experimental and control groups

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