Dose-dependent Effects of Iron Oxide Nanoparticles on Thyroid Hormone Concentrations in Liver Enzymes: Possible Tissue Destruction

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ABSTRACT

Purpose: Because of the small size of the iron oxide nanoparticles as a potential ingredient in many medical applications such as controlled drug delivery and cancer cells using heat therapy are extensive. However, the effect of nanoparticles on human health is not yet fully investigated. In this study, the effects of iron oxide nanoparticles on serum levels of liver enzymes, thyroid hormones and thyroid stimulating hormone in rats was studied in rats.

Methods: In this study, 28 rats of Wistar rats were divided into four groups. Groups, daily for 15 days, the iron oxide nanoparticles in a dose of 20μg /kg, 50μg /kg and 150μg /kg of distilled water was dissolved by garage tube . The control group received a daily mL of distilled water. Data were analyzed by ANOVA test and Tokey test.

Result: Serum alkaline phosphates alanine Aminoteransferas and thyroxin hormone in the group receiving 150 μg /kg increased significantly compared to the control group. Enzymes, serum aspartate Aminoteransferas groups receiving doses of 150 and 50 to the control group showed a significant increase. Serum concentrations of TSH in groups receiving doses of g/kgμ150 g/kgμ50 than the control group showed a significant decrease.

Conclusion: The results of this study indicate that high doses of iron oxide nanoparticles (g/kgμ150) have toxic effects on the liver and thyroid.

Introduction:

With the advancement of nanotechnology, nano -engineering applications is rapidly expanding into other fields such as electronics, medical, food industry, clothing industry, the cosmetics industry is sports equipment (1). Iron oxide nanoparticles as contrast agent for MRI is used to create the element .Today, the iron oxide nanoparticles for stem cell marking and tracing is used (2). The physicochemical properties of the nanoparticles are due as drug carriers in the treatment of cancer cells, are widely used in live environments (3). Well as nanoparticles have many biomedical applications such as tissue repair, safety assessment, detoxify biological fluids, cells , etc. are thermotherapy ( 4 ).The use of iron oxide nanoparticles as a drug transporter for the treatment of cancer dates back to 1970 and has continued ever (5). Despite the widespread use of these nanoparticles on human...
Dose-dependent effects of iron oxide nanoparticles on thyroid hormone…

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Health effects are not yet fully understood (1). Recently, some studies have proven that the marking process with iron oxide nanoparticles had no effect on cell viability and proliferation. But the practice fetus cavitations process and the differentiation of embryonic stem cells into nerve cells (neurogenesis) and poorly inhibited (6). The iron oxide nanoparticles trigger inflammatory responses in rats are treated with these nanoparticles. Studies have shown that these nanoparticles are able to stop the cell cycle at the G1 phase (1). Apopa and colleagues reported that iron oxide nanoparticles to increase the permeability of endothelial cells (7). Because of the size and shape of the nanoparticles, which can have harmful effects and instead they crossed the psychological barriers. Because of the size and shape of the nanoparticles, which can have harmful effects and instead they crossed the psychological barriers. However, our knowledge about its toxicity is very limited (8). Mitochondrial and cytosolic isoenzymes of aspartate Aminotransferases there and in the liver, muscle, brain and pancreas can be found. Aminotransferas a cytosolic enzyme that is specific for liver alanine Alkaline phosphates is an enzyme found in many tissues and there are plenty of bile duct obstruction, liver and bones is release and can lead to increased serum levels (9). Damage to liver cells causes release of these enzymes into the blood circulation. Many studies have shown that thyroid hormone system plays an important role in the metabolic actions of tissues plays and any malfunction of the endocrine system of irreparable damage to the tissues takes. In this study the effects of different amounts of iron oxide nanoparticles on serum liver enzymes, thyroid hormones and TSH were investigated.

Materials and Methods:

Animals used in experimental research on adult male Wistar rats weighing approximately 300-250 g Wistar rats from the animal house of Medical Sciences, Yazd martyr was prepared. At this time the animals had an average age of 3-5/2 months. Ambient temperature during the experiment was 25-20 °C during the day. The lighting conditions for 12 hours darkness and 12 hours light set. Drinking water from the municipal water supply for animal feed by rat (compact food) that the company was prepared animal feed and poultry was barking. In this study, the animals were divided randomly into two groups. The control group consisted of seven rats were tested in their daily ml of distilled water were fed for 15 days. The experimental group consisted of three subgroups, each consisting of 7 rats in which various amounts of iron oxide nanoparticles, Nanotechnology Research Center, Yazd was prepared and a ml of distilled water The minimum dose μg / kg 20, average dose μg / kg 50 and maximum dose μg / kg 150, 15-day oral gavage fed through a tube. All rats at the end of fifteen days, I took blood from the eye through the veins orbital. Each sample was centrifuged for 15 minutes at 3000 rpm. After separating the serum from the clot, hormonal and enzymatic assays were performed until a temperature of -20 °C and stored frozen. Liver enzymes, AST, ALT and ALP using enzymatic kits Pars test on IFCC recommended method were measured. Concentrations of thyroid hormones (T3 and T4) and TSH ELISA kit purchased from manufacturing Monobind Company of America and certain of each hormone were measured. Results by SPSS program and ANOVA and Tukey test were analyzed. Different levels 05/0P was considered significant.

Results:

AST levels in the group receiving a dose μg / kg 50 and μg / kg 150 compared to the control group showed a significant increase (P≤0/05). Serum ALT and ALP in the experimental group received a single dose μg/kg150 than the control group showed a significant increase (P≤0/05). (Table 1).

Table 1: Serum liver enzyme levels in the control group and the experimental group receiving iron oxide nanoparticles

<table>
<thead>
<tr>
<th>Groups</th>
<th>Control</th>
<th>Minimum dose</th>
<th>Average dose</th>
<th>Maximum dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>AST</td>
<td>130/66±5/81</td>
<td>140±4/35</td>
<td>171/66±9/93*</td>
<td>214/33±8/56*</td>
</tr>
<tr>
<td>ALT</td>
<td>85±7</td>
<td>74±13/79</td>
<td>60±2/08</td>
<td>143±7/73*</td>
</tr>
<tr>
<td>ALP</td>
<td>490/33±6/06</td>
<td>489±17/52</td>
<td>440±9/01</td>
<td>586±18/7*1</td>
</tr>
</tbody>
</table>

(P≤0/05). Data as “Mean ± SD” are
Effect of different amounts of iron oxide nanoparticles on hormone T3 shows Between the experimental group and the control group showed no significant difference (P≤0/ 05). Hormone T4 in the groups receiving doses μg / kg 50 and μg / kg 20 than the control group showed no significant difference (P≤0/ 05). But the group receiving a dose μg / kg 150 and the control group there was a significant increase (P≤0/ 05). The TSH levels in the group receiving a dose μg / kg 50 and μg / kg 150 showed a significant decrease compared to the control group (Table 2).

**Table 2:** Serum concentrations of thyroid hormones and thyroid stimulating hormone in the control group and the experimental group receiving iron oxide nanoparticles

<table>
<thead>
<tr>
<th>Enzymes</th>
<th>Control</th>
<th>Minimum dose</th>
<th>Average dose</th>
<th>Maximum dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₃</td>
<td>106/3±1/2</td>
<td>108/3±3/75</td>
<td>111±3/75</td>
<td>129/6±32/51</td>
</tr>
<tr>
<td>T₄</td>
<td>1/3±0/15</td>
<td>1/93±0/29</td>
<td>2/06±0/52</td>
<td>3/23±0/56*</td>
</tr>
<tr>
<td>TSH</td>
<td>0/15±0/008</td>
<td>0/13±0/01*</td>
<td>0/04±0/01*</td>
<td>0/02±0/003*</td>
</tr>
</tbody>
</table>

(P≤0/ 05). Data as "Mean ± SD "are

**Discussion:**

The results of the effect of different amounts of iron oxide nanoparticles on liver enzyme levels indicate that iron oxide nanoparticles at high doses (μg / kg 150) caused a significant increase in the concentration of the enzymes. Monitoring of liver enzymes ALT and damaged liver cells release the enzyme is increased. It may increase due to the destructive effects of iron oxide nanoparticles on cells of the liver enzyme ALT are. Obstruction of the bile ducts also cause increased serum ALP is an enzyme. It is probably due to the destruction of liver cells and blockage of the bile ducts ALP concentrations increased. Increased AST and ALT levels may decrease due to increased anabolism or catabolism is it (10). Looks changes in liver enzymes due to the effects of iron oxide nanoparticles on thyroid hormones and due to its important role in the metabolic activity of the tissue is. Hepatocyte membrane stability and integrity are essential functions of the liver (9). According to the physicochemical properties of iron oxide nanoparticles have been stabilized over time and will cause liver dysfunction. Many studies have been done on the physiochemical characteristics of nanoparticles. For example, research showed that the nanoparticle has toxic effects on fish are cells (11). Also, due to its physico-chemical properties of nanoparticles, vitality and reduce the proliferation of cells (13,12 ). Study on carbon nanotube rodents that had accumulated in the respiratory tract and the brain showed that the nanoparticles are toxic (14).

In this study it was observed that the iron oxide nanoparticles significantly increased serum concentrations of T4 and TSH serum concentrations are significantly reduced. It is possible that these nanoparticles could be through inhibition of pituitary endocrine actions - affect the hypothalamus, which may be due to decreased TSH. The TSH level is expected to decrease thyroid hormone levels were also reduced, but the T4 level increased. This is probably due to destruction of thyroid tissue cells. Destruction of thyroid tissue, high levels of nanoparticles in the blood, which inhibits didination T4 and thyroid tissue is damaged. Research has shown that the use of mono -amine oxidase inhibitor in rats desert can alter the pattern of TSH release (15). Iron oxide nanoparticles are likely to impact on hepatic enzyme synthesis of mono-amine oxidase is the main place to make an impact on the release pattern of TSH, which in turn leads to a reduction in the transmission mechanism, should be (9).

**Conclusions:**

Due to the variation of the results of this experimental study can be concluded that Iron oxide nanoparticles have dose-dependent effects on various organs of the body is so that at high doses is toxic and damaging effects on the liver and thyroid gland activity and inhibits its activity.
Acknowledgments:

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Reference: