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Effect of Iron Oxide Nanopartical on The FSH, LH and Testesteron Hormones in The offspring of Albino Rats

Reyim Hameid Kamel [1], Amel Ali AL-Taee[2]

[1]Collage of Science, Babylon University, Iraq, [2]Professor/Biology Dep., Collage of Science, Babylon University, Iraq.

Abstract

The study was carried out to investigate the effect of iron oxide nanoparticle(NP) on FSH,LH and Testosterone hormones in the offspring of albino rats. The study included twenty (20) offspring divided into two groups ,treated and control group . The results of the hormonal study showed the existence of significant increase ($P \leq 0.05$) in the mean levels of FSH,LH ,Testosterone of offspring treated groups compared with controls .

Keywords: *Iron Oxide Nanopartical, FSH, Testesteron Hormones*

Introduction

Nanotechnology can be defined as a branch of engineering and science , technology dealing with nanoparticles ultrafine objects in a range between (1 – 100) nm in dimension, the shape and size of these nanomaterial's can be controlled therapy by finding its way in a wide range of applications [1] . Nanoparticles (NPs) are at the forefront of rapid development in nanotechnology, their exclusive size-dependent properties make these materials indispensable and superior in many areas of human activities [2] .Being the most current transition metal in the Earth's crust, iron stands as the backbone of current infrastructure in comparison to group elements such as cobalt, nickel, gold, and platinum are some what neglected [3] Iron and oxygen chemically combine to form iron oxides (compounds), and there are ~16 identified iron oxides, in nature iron (III) oxide is found in the form of rust [4] . Generally, iron oxides are prevalent widely used as they have an imperative role in many biological and geological processes, they are also extensively used by humans, e.g. as iron ores in thermite, catalysts, durable pigments (coatings, paints, and colored concretes) and hemoglobin [5] . The three most common forms of iron oxides in nature are magnetite (Fe3O4), maghemite (γ-Fe2O3), and hematite (α-Fe2O3) [6] . Hematite is extensively used in gas sensors, catalysts and photocatalysts, magnetism and electrochemical capacitor [7,8,9] Iron oxides with different particle sizes and morphologies have been obtained by a variety of physical and chemical approaches such as chemical precipitation، solvo thermal, pulsed layer ablation, electro-spinning, hydrothermal and sol-gel methods ([10,11] . Since NPs are incorporated more and more in a variety of consumer products, it is likely that the general public may be exposed to NP-containing products such as personal care products, food and food packaging materials, textiles and medicine [12,13]. To develop such insights toxic properties of NPs should be identified and dose-response relationships established, despite the fact that there are a number of publications concerning undesirable effects of NPs various gaps still exist in the knowledge on the intrinsic hazards of NPs the potential human exposures to NPs and the relationship between exposure and adverse health effects (risks) of NPs [14,15,16]. Existing information on potential adverse health effects is mainly based on animal experiments although in vitro studies with cell lines have recently added to the insight in potential hazards of NPs, these particles have been shown for example to induce cytotoxic, genotoxic, inflammatory and oxidative stress responses in different mammalian cell lines [17,18,19]

Material and Method

Animals:

Thirty six healthy adult female albino rats weight (225±10gm), age (10-12)weeks were purchased from Iraqi Center for Drug Research/ Baghdad. All these animals were housed during the period of experiment in the animal house unit in science college of Babylon University, under controlled temperature (21 ± 1 C 0)

and constant light-dark schedule (12 hours light and 12 hours dark cycle), food and water were available. The pregnant rats administrated orally (150 mg/kg) of B.W. iron oxide NPs by gavage tube for 21 days of pregnancy until they give birth ,they offspring left for tow months until they became adult and then killed, the serum was taken from the offspring for hormonal study .

Experimental Design:

Twenty offspring were randomly divided into two groups.

Group I: Control group (n=10).

Group 2: Treated group (n=10).

Blood Samples Collection and Serum Preparation

To perform the blood biochemical tests, blood sampling was collected form adult offspring (male and female). The blood samples were centrifuged and the serum of samples were separated at 3000 RPM for 10 minutes. The concentrations of LH, FSH and Testosterone of serum specimens were measured according to Cusabio Elisa kit.

Statistical analysis:

All data were subjected to a one-way analysis of variance (ANOVA) to determine the level of significance between control and the treated groups. The significancy was tested by finding LSD. Data are reported as mean ± standard error (±SE). [20] .

Results

Follicles Stimulating Hormone (FSH) level

The results of our study showed that FSH levels increased significantly (P≤0.05)in the offspring (females and males) (1.581±0.017b,1.309±0.0009b) respectively as compared with control groups (0.814±0.011a,0.809±0.008a) (Table 1-1).

Luteinizing Hormone (LH) level

The results of study revealed significant increased (P≤0.05) in the level of LH in the females of treated groups (1.3608±0.440b) compered with control (0.825±0.220a) .while males had non-significant change in the treated groups (1.004±0.1003b) compared with control groups (0.832±0.121b) (Table 1-1).

Testosterone Hormone level.

The results of our study showed no significant change in the level of testosterone in the offspring of both females and males groups (2.081±2.885a, 0.826±0.005a) respectively compared with control groups (0.510±0.014a, 0.517±0.006a) (Table 1-1).

Table (1): Effect of iron oxide nanoparticle on LH, FSH and Testosterone level in the offspring of Albino rats.

Hormones (pg/ml) Groups	FSH Mean ± S. D	LH Mean ± S. D	Testosterone Mean ± S. D
Females Group			
Control female	0.814±0.011a	0.825±0.2202a	0.5108±0.014a
Treated female	1.5815±0.017b	1.3608±0.440b	2.0818±2.885b
Sig. level (P≤0.05)	S	S	S
males Group			
Control male	0.8095±0.0089a	0.832±0.1219a	0.517±0.006a
Treated male	1.3093±0.0009b	1.004±0.1003b	0.826 ±0.0058b
Sig. level (P≤0.05)	S	S	S

***different symbols mean significant differences (P≤0.05) .**

Discussion

The present study results showed that there were significant increase ($P \leq 0.05$) in the levels of FSH, LH and testosterone in offspring . NPs may effect hormone secretion in two ways: 1. NPs pass through the blood-brain barrier into the hypothalamus and secretory cells of the pituitary altering the secretion of GnRH, LH and FSH thus undermining the normal positive and negative feedback of the hypothalamic-pituitary-gonadal axis and affecting the normal secretion of ovarian estrogen and progesterone. 2. NPs enter the ovaries through circulation and accumulate in theca cells and granulose cells, which effects steroidgenesis [21] . Some in vitro studies showed that some NPs could be swallowed by granulose cells resulting in changes in the secretion of hormones and dysplasia of the ovum, another studies showing that NPs can enter both thecal cells and granule cells and affect their normal function particularly relating to their key role in hormone secretion [22] . Before ovulation, androgens and androstenedione secreted by thecae cells diffuse into granule cells and are transformed into steroid hormones, during this process NPs can directly affect the secretion of sex hormones by destroying these secretory cells in the ovaries[23,24] In vivo studies have shown that long-term (90 consecutive days) exposure to titanium dioxide NPs (TiO2 NPs) in female mice results in an imbalance of sex hormones and mineral element distribution leading to a reduction in pregnancy rate and oxidative stress and disruption of ovarian gene expression [25,26].Moreover, in vivo experiments in rats showed that silver NPs could get transferred from the mother to offspring through the placenta and breast milk [26] . The neurohormones such as GnRH, follicle stimulating hormone (FSH) and luteinizing hormone (LH) secreted by the hypothalamus and pituitary play crucial roles in positive and negative feedback regulation during oogenesis, NPs may indirectly effect oogenesis and ovarian health by disturbing the balance of these sex hormones [27] . In which the treated female groups showed significant differences in this parameter comparing to the related control. Those results agree with [28] . who found that iron oxide nanoparticle treatment led to increases in the levels of the serum LH in female mice. In contrast to study used copper nanoparticle reveled decrease in the level of sex hormones FSH, LH and testosterone n male rats [29] . In this study, iron oxide nanoparticle treated groups in female and male rats showed significant increases in production of reproductive hormones as compared to control.. Another study showed significant increases in the levels of LH and FSH in males of Wister rats using gold nanoparticles [29] . Alterations in testosterone levels leading to impaired male reproductive function that have been investigated in numerous in vivo studies that observed inhalation rats to nanoparticle-rich diesel exhaust (NRDE-NPs) significantly increased testosterone, these findings suggest that the increased levels of testosterone due to the disrupted balance between androgen-metabolizing and testosterone biosynthetic-enzymes [30,31]. Another attempting to clarify the mechanism responsible for the rise in testosterone levels, research group confirmed that increased testosterone biosynthesis could be attributed to an increase in the mRNA expression of StAR and cytochrome P450 side-chain cleavage (P450scc) an enzyme responsible for the conversion of transported cholesterol to pregnenolone in Leydig cells [32,33].Another study investigated the effect of silver nanoparticles consumption instead of drinking water animals from each group were selected and the levels of sex hormones were evaluated also and the level of testesteron increased with "testicle hyperactivity [34] .

In our study Fe2O3-NPs might have interfered with hypothalamo-hypophyseal-testicular axis as a potential endocrine disruptor contributing to the increased serum testosterone levels as reported by [35] . As evidenced from our results the iron content in the serum and testes revealed that Fe2O3-NPs accumulated in both, therefore the Fe2O3-NPs crossed and entered the blood tested barrier as reported in mice by [36] .

Conclusion

The study included twenty (20) offspring divided into two groups ,treated and control group . The results of the hormonal study showed the existence of significant increase ($P \leq 0.05$) in the mean levels of FSH,LH ,Testosterone of offspring treated groups compared with controls .

Financial Disclosure: There is no financial disclosure.

Conflict of Interest: None to declare.

Ethical Clearance: All experimental protocols were approved under the Collage of Science, Babylon University,Iraq and all experiments were carried out in accordance with approved guidelines.

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