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Influence of Nano-Silver on Graffian Follicles via Intraperitoneal Injection in Rats

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Abstract: Nanotechnology is a rapidly growing science of producing and utilizing nano-sized particles that measure in nanometers. Silver is one of these nanoparticles that are playing a major role in the field of nanotechnology and nanomedicine. The present study investigated the effect of nano-silver on graffian follicles. Nano-silver at concentrations of high-dose (10ppm) and low-dose (1ppm) were intraperitoneally injected into rats. The rats were sacrificed after the 30 days of the injection period, and the ovaries were obtained for histopathology observation. Results show that in groups which received nano-silver for 30 days was observed a decrease in follicles numbers. No destructive effects were seen in the control group. According to this study, we can propose that administration of nano-silver to the ovary appeared to have an inhibitory effect on ovulation induction.

Key words: Nano-silver · Ovary · Graffian follicle · Rat · Peritoneal injection

INTRODUCTION

Nanotechnology is the understanding and the manipulation of materials at the nanoscale level [1]. The word "nano" is used to indicate one billionth of a meter or 10^{-9} [2]. The term Nanotechnology was coined by Professor Norio Taniguchi of Tokyo Science University in the year 1974 to describe precision manufacturing of materials at the nanometer level [3]. With the rapid growth of nanotechnology and future bulk manufacture of nanomaterials comes the need to determine, understand, and counteract any adverse health effects of these materials that may occur during manufacture, during use, or accidentally. Although the applications of nanoparticles are increasing broadly in every field, concerns about their environmental and health impacts remain unresolved. Nanoparticles have become a part of our daily life, in the form of cosmetics (19), drug delivery system [4], and therapeutics [5]. Different type of nanomaterials like copper, zinc, titanium [6], magnesium, gold [7], alginate [8] and silver have come up but silver nanoparticles have proved to be most used as it has good antimicrobial efficacy against micro-organisms [9].

In addition to, these nanoparticles repeatedly are use in pharmacology, human and veterinary medicine, food industry [10], DNA hybridization dection [11] and other instances. Silver nanoparticles could move into the circulatory system by traversing the blood-lung barrier and, thus, distribute the whole body [12]. Silver nanoparticles, are showing severe toxic effects on the mammalian cells. The goal of the present research was to assess the toxicity of nano-silver to determine whether this nanoparticle can have an effect on secondary follicles in ovary.

MATERIALS AND METHODS

Laboratory Animals: Adult Wistar female rat with the average weight of 200g were obtained from the Shahrekord University. The animals were kept at 25°C with enough humidity. The rats were fed standard diets.

Animals' Treatment: Rats were randomly divided into four groups of seven animals. Each group was kept in a separate cage. Group 1 (or control group) and group 2 served as normal control and in each injection received only normal saline. Group 3, rats which received high dose (10ppm) of nano-silver through intraperitoneal injection, group 4, rats which received low dose (1ppm) through the same procedure. The treatment went on for four weeks.

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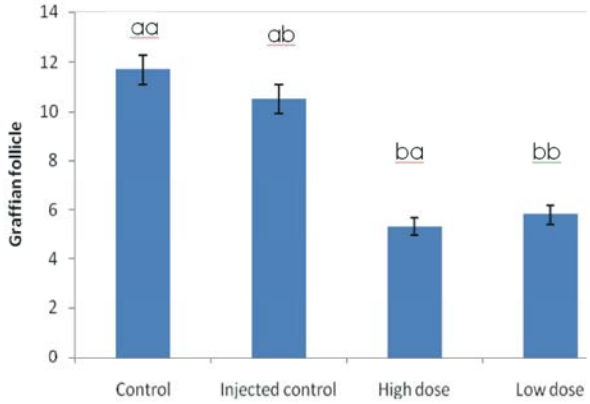

Fig. 1: Effect of nano-silver on graffian follicle number. Values represent the mean± the standard deviation obtained from at least seven independent experiments. Data were statistically calculated by one way ANOVA and Tukey's test. Different letters above bars indicate the presence of significant differences ($p_{<0.05}$).

Histological Examination: The rats were sacrificed and the ovary tissues were separated. The ovaries were fixed with buffer formalin solution in order to conduct histopathology experiments. Histological sections were prepared from the ovaries, stained and examined under light microscope.

Statistical Analysis: The data were analyzed and compared by using the statistical test including analysis of variances and Tukey test. P values less than 0.05 were considered as significant.

RESULTS

Results of this study showed that in groups which received nano-silver at concentrations of high-dose (10ppm) and low-dose (1ppm) via intraperitoneal injection, the number of graffian follicles decreased (Figure 1). There is a significant difference between treatment groups and control group.

DISCUSSION

Nanoparticles such as nano-silver, have various effects on different organs. Skin's continual exposure with these nanoparticles, leads to argyria appearance in this tissue that is because of the entrance of protein-nano-silver complex into the cells. When taking place of respiration with nano-silver, intense inflammatory responses have been known to occur in pulmonary cells that followed with the release of cytokines. In addition to which, after entrance of nano-silver to the blood, they can reach to organs such as the spleen, liver, heart and kidneys and they have different cytotoxic effects on these organs. Other different researches also have showed the effects of nanoparticles on male reproductive system, those nanoparticles to be able to cross blood-testis barrier and have arrived in this organ and then leading to some immunity responses. Results of our study showed that in groups, which received nano-silver, a number of secondary follicles decreased. We can propose that nano-silver has affected ovary follicles and caused a number of secondary follicles to be decreased. Probably, for the reason that after entrance of nano-silver to the of inside ovary cells, to cause oxidative stress in these cells, that activating of oxidative stress factors is leading to caspase cascade in cells. On the other hand, simultaneous with activated oxidative stress, cells confront with decreased antioxidants, that subsequent this instance, a reduction of secondary follicles takes place. Therefore, according to this study, we can suggest that nano-silver has cytotoxic effects on tissue ovary and affected ovulation [10-15].

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