ABSTRACT

Background: Nanotechnology or nanoscience considers as a new field of science which has an effective role in the day to day life aspects. This field deals with the production, processing, and use of materials ranging in nanometers. Recently, this field becomes a confederate science that is usually used in other fields of science, like electronics, physics, and engineering.

Materials and methods: Study design starts with the choice of nanoparticles (NPs) [titanium dioxide nanoparticles (TiO\textsubscript{2})]. Eighteen white male rats were used in this research. Study groups classified into six groups (each group includes three animals): two control groups (for oral and i.p. administration) and four treatment groups (group I: treated with 400 mg/kg orally and i.p., group II: treated with 150 mg/kg orally and i.p.).

Results and discussion: Results of this research include the presence of some inflammatory cells infiltration (lymphocyte infiltration), as it showed in the figures of the histological sections of the treated groups compared with the control group. These results were found to be different than studies of other researches that refer to the presence of many undesired hepatic histological and biochemical changes, such as, the effects on membrane structure, oxidative stress, binding protein, or DNA, cell death or apoptosis, and hepatocytes necrosis.

Conclusion: In conclusion, TiO\textsubscript{2} induce lymphocyte infiltration, but there are no additional deleterious histological changes in the liver tissue.

Keywords: Liver histology, Nanoparticles, Rat, TiO\textsubscript{2}.
confirmed by electron microscopy. Therefore, it is so essential to identify the potential dangers of new enhancements using nanoparticles for avoiding human harms.\textsuperscript{10}

TiO\textsubscript{2} represent one of the well-known, widely produced NPs in the world because of their great physicochemical properties, like biocompatibility, stability against corrosion, have low cost, whitening, photocatalysis, and its easy to be prepared at nano sizes. They are considered one of the most famous NPs used in industry with several useful uses in different branches of sciences, like medicine, pharmaceuticals, cosmetics, neutralization, and the destruction of the cancer cells, gases purification, and filtration, especially air, treatment of water, and processes of decolorization.\textsuperscript{11-13} TiO\textsubscript{2} photocatalyst may destroy the cell membrane; solid the proteins of many viruses, reduce, and restrain virus activation. It also kills bacteria up to 99.97\%\textsuperscript{14}. TiO\textsubscript{2} was found to kill golden grape coci, coliform, and green suppuration bacilli, in addition to mildew and suppuration fungus.\textsuperscript{14}

However, TiO\textsubscript{2} has high redox activity, and a large surface area to weight ratio. These specific properties are common causes of adverse effects on human health and the environment, and intrinsic toxicity to them.\textsuperscript{12,15} Besides, a previous study showed that zinc oxide and TiO\textsubscript{2} NPs may cause the production of free radicals in the skin, may cause damage in the DNA, and can cause alteration of protein structure that may be an important reason for types of cancers and tumors.\textsuperscript{16}

\section*{MATERIALS AND METHODS}

The study design starts with the choice of NPs (TiO\textsubscript{2}, size 21 nm) which was prepared previously. The solvent used in the study was dimethyl sulfoxide, which was associated with mortality, so the solvent was replaced by distilled water to complete the experiment.

Eighteen white male rats were used in this research. Study groups classified into six groups (each group includes three animals): two control groups (for oral and i.p. administration) and four treatment groups (group I: treated with 400 mg/kg orally and i.p., group II: treated with 150 mg/kg orally and i.p.). The period of study was 1-month with a 48 hours treatment interval. The dose was prepared immediately according to body weight. Oral dosage was performed by using an oral tube (gavage method), while an insulin syringe was used in the i.p. dosage. Finally, animals were sacrificed at the end of the research for histological study.

\section*{RESULTS AND DISCUSSION}

The results of this research include the presence of some inflammatory cells infiltration (lymphocyte infiltration), as it showed in the figures of the histological sections of the treated groups compared with the control group (Figures 1 to 5).

Different research was performed on the effects of TiO\textsubscript{2} NPs.\textsuperscript{3,7} The TiO\textsubscript{2} which is considered one of the most produced NPs in the world, has attracted particular technological and scientific interest because of their specific and unique physical and chemical properties in addition to their different effects on human health.\textsuperscript{17} However, there is an obvious increase in the researches performed on the toxicities of many NPs, both in

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{Figure1.jpg}
\caption{Cross histological section of the liver of normal rat (control group) showing normal histology}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{Figure2.jpg}
\caption{Cross histological section of the liver of rat treated with 150 mg of TiO\textsubscript{2} (oral dose) showing the presence of lymphocyte infiltration (blue arrows); 200x}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{Figure3.jpg}
\caption{Cross histological section of the liver of rat treated with 150 mg of TiO\textsubscript{2} (i.p. dose) showing the presence of lymphocyte infiltration (blue arrow); 200x}
\end{figure}
The absence of deleterious changes (like carcinogenic effects, types of degenerations, and necrosis effects), may reflect important sides of the safety of these NPs in the field of this research.

REFERENCES

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