بسم الله الرحمن الرحيم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

MONA MAGHRABY

“The Effect Of Titanium Dioxide Nanoparticles And Its Withdrawal On Submandibular Salivary Gland Of Albino Rats”

Histological and Immuno-Histochemical study

Thesis submitted in partial fulfillment for Master Degree in Oral Biology, Faculty of Dentistry, Ain Shams University

By

Mark Mokhles Fekry Tawadrous
B.D.S (2012)
Faculty of Dentistry, Cairo University
Demonstrator in Oral Biology Department, Faculty of Dentistry,
The British University in Egypt

Supervisor

Prof. Dr. Medhat Ahmed El-Zainy
Professor of Oral Biology
Former Vice Dean of Society and Environmental Affairs
Faculty of Dentistry, Ain-Shams University

Co-supervisor

Prof. Dr. Reham Magdy Amin
Professor of Oral Biology
Faculty of Dentistry, Ain-Shams University

Faculty of Dentistry
Ain-Shams University
2020

Acknowledgement

First, thanks to **GOD,** the most gracious and the most merciful. The completion of this thesis wouldn't have become possible without the help and support of several people to whom I'm greatly in debt. I believe it is my duty to register here my deep gratitude to them.

I would like to thank **Prof. Dr. Medhat Ahmed El-Zainy,** Professor of Oral Biology, Former Vice Dean of Society and Environmental Affairs, Faculty of Dentistry, Ain Shams University, for his support, continuous encouragement and appreciated suggestions that guided me to accomplish this work.

I want to express my deepest gratitude to **Prof. Dr. Reham Magdy Amin,** Professor of Oral Biology, Faculty of Dentistry, Ain Shams University, for her considerable support and valuable supervision. Her deep knowledge, sincere suggestions and contributions with her constant follow up have made this work fulfilled.

Many thanks to all the members of the Oral Biology Department, Faculty of Dentistry, Ain Shams University for offering lots of help.

Finally, to all my wonderful friends in the department and the BUE family each one of you was more like a brother or sister to me, your help is greatly appreciated.

Dedication

First of all, I am very grateful to God for giving me the strength to accomplish this work and for the endless blessings bestowed upon me.

To the most amazing wife anyone can wish for, without her outstanding help and support I wouldn't have finished my work.

To my lovely daughter Sophia, I love you so much you mean the world to me and cherish our life with your gorgeous spirit.

To my mother and father, words will never express my gratitude to both of you, I am who I am because of them, their sacrifices and belief in me. I wish I can always live up to their expectations and make them proud.

To my sisters and their families, having them around is a true blessing.

To my father, mother and sister in law, they are like second father and mothers to me and always by my side. Thank you can never be enough for what they have done.

To my big family, here is a chance to show you how proud I am to belong to such a loving, respectful and honorable family.

Table of Contents

List of Abbreviations

Abbreviation	Meaning
Ag	Silver
Al2O3	Alumina
ATP	Adenosine Triphosphate
Au	Gold
Bax	Bcl-2-associated X protein
Bcl-2	B-cell lymphoma 2
BV	Blood vessel
BW	Body weight
CT	Connective tissue
DNA	Deoxyribonucleic acid
E530	Magnesium oxide MgO food additive
ED	Excretory ducts
EM	Electron microscope
Fe3O4, Fe2O3	Iron oxides
GCT	Granular convoluted tubules
gm	Gram
H&E	Hematoxylin and Eosin
H2O2	Hydrogen peroxide
HCl	Hydrochloric acid
I.G	Intra-gastric
I.P	Intraperitoneal
ID	Intercalated ducts
IL-1b	Interleukin 1 beta
IL-6	Interleukin 6
kg	Kilogram
Lab	Laboratory
LM	Light microscope
m	meter
mag	Magnification
mg	Milligram

MgO	Magnesium oxide
MP	megapixel
NF-jB	nuclear factor-kappaB
nm	nanometer
NP	Nanoparticle
ºC	Celcius
Orig.	Original
pH	Potential Hydrogen
R&D	Research and Development
RBCs	Red blood cells
ROS	Reactive oxygen species
SD	Standard deviation
SG	Salivary gland
SiO2	Silicon dioxide
SiO2NP	silicon dioxide nanoparticle
SMG	Submandibular salivary gland
St.D	Striated ducts
TEM	Transmission electron microscope
TiO2	Titanium dioxide
TNF a	Tumor necrosis factor a
UK	United Kingdom
USA	United States of America
ZnO	Zinc Oxide

List of Figures

List of Tables

Abstract

Background: Titanium dioxide (TiO2) Nanoparticles is the most widely used white pigment in food industry, and despite its wide range of uses, it has many side effects on different body tissues.

Aim of the study: To investigate the toxic effect of titanium dioxide nanoparticles and the possible recovery after withdrawal on rat submandibular salivary gland (SMG) histologically and immunohistochemically.

Materials and methods: Forty-eight male albino rats of two months' age were used in this study and were divided into Group I (control) which were further subdivided into four sub-groups corresponding to experimental groups (Group IA, IB, IC and ID) and experimental groups (Group II, III, IV and V). Referring to the experimental groups, Group II received 50 mg/kg/day TiO2NPs orally for 30 days while Group III, IV and V received same dose and duration as Group II but were left for recovery for two, four and six weeks respectively. The specimens of the right side of rats' SMG were stained by H&E and studied under light microscope for histological changes, while the left side were prepared and examined immunohistochemically by using caspase-3 apoptotic marker.

Results: Histological examination of the Group II showed that acinar cells demonstrated some histological alterations including pyknotic, hyperchromatic and crescent shaped nuclei with variable sized cytoplasmic vacuolations. The ducts showed some signs of degeneration with loss of their normal cellular outlines. However, there was some improvement in Group III and IV that escalated in Group V that was almost same histological picture as the control group.

Apoptotic changes expressed by anti-active caspase 3 were highly observed Group II and statistical results showed the highest statistical significance. Significant difference was observed between studied groups.

Conclusion: The use of TiO2NPs leads to histological alterations in submandibular salivary glands of rats and induced apoptotic changes on their cells, which was confirmed statistically. These apoptotic changes were decreased gradually as the recovery periods increased and almost reversed to normal after 6 weeks.