Hepatocarcinogenesis in Wistar Rats: Molecular Interception by Herbal Products

Thesis submitted to the faculty of science for the award of the degree of
DOCTOR OF PHILOSOPHY
In
TOXICOLOGY

By
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(Mir Tahir Maqbool)

Dr. Sarwat Sultana (Supervisor)

Date:
DECLARATION

I hereby declare that the thesis entitled “Hepatocarcinogenesis in Wistar Rats: Molecular Interception by Herbal Products” presented in the thesis embodies the results of original work carried out by me for Ph.D. degree in Toxicology at Molecular Carcinogenesis and Chemoprevention Laboratory, Department of Medical Elementology and Toxicology, Jamia Hamdard, New Delhi. This work has not been submitted in part or full for any other degree or diploma.

Date: Mir Tahir Maqbool
Dedicated to my Parents
ACKNOWLEDGEMENT.... • • •

And my success in my task can come only from Allah. In Him I trust, and to Him I turn (in repentance)

Al-Quran (Surah Hud, 11:88)

I thank to Almighty for providing me enough patience, enthusiasm and strength that enabled me to complete this work successfully. I would like to give glory to the Almighty for his grace and success in all my endeavors and for bringing me this far in my academic career.

I wish to thank late Al-Haaj Hkm. Abdul Hameed Sahib, the founder of Jamia Hamdard, for providing a platform for researchers in India.

My heartfelt thanks and all gestures undoubtedly goes to my mentor and supervisor of my research career, Dr. Sarwat Sultana for her inspiration, motivation, inflexible rules, and professional productive guidance to hasten and complete the work on schedule. It would not have been possible to complete this research without her timely encouragement and helpful advices. The motherly love and professionalism along with endless patience she showed during the entire period of my research is to be commended.

My sincere appreciation is reserved for all of my teachers Dr. S. Raisuddin (Head of the department), Dr. Ehsan Ahmad Khan, Dr. Fakhrul Islam, Dr. M. S. Siddiqui, Dr. Haider A. Khan for their teachings and motivations during my M.Sc. and all through the course of my Ph.D. I am also highly thankful to Dr. Suhel Parvez and Dr. Abdur Rub for their selfless suggestions during the course of my studies.

I am also thankful to the staff of Central Instrumentation Facility, Dr. S.D. Sharma and Mr. Irshad for their timely help in providing instrumentation facility. The help rendered by the Incharge of animal house Dr. Amreesh Kumar Tiwari and by staff of Central Animal House Facility namely Mr. Santraj, Mr. Tariquat and Mr. Ibrahim is creditable.

I will ever remain grateful to Mr. Junaid, Mr. F.A. Zaidi, Mr. Mueed, Mr. Akhlaq, Mr. Razi, for their constant support during my research work. Thanks are due to Mrs. Zia Fatima, Librarian, Faculty Library and Mr. Shamim for their content help.

I am certainly grateful to have such lovable seniors like Dr. Naghma Khan, Dr. Sonia Sharma, Dr. Anuradha Sehrawat, Dr. Tajdar Hussain Khan, Dr. Lakshmi Prasad, Dr. Tamanna Jahangir and Dr. Sahar Rahman who always motivated me and helped me during my studies.

I also extend my hearty thanks to my lab mates Lateef, Muneeb, Quaiyoom, Qamar, Dr. Kehkashan, Dr. Rizwan, Farrah, Rehan, Sana, Oday, Nemat, Kazim, Summaiya, Tanveer and
Arjumand, who have been my true companions during the course of Ph.D. I am also thankful to for their kind support and companionship.

Special words of thanks to my Lab Attendants Late Mr. Babu Khan, Mr. Nizamuddin, Mr. Faisal and Mr. Shaban for being available at odd hours for the successful completion of the experiments.

I am indebted to my parents for their irrational, unbreakable belief in me that bordered on craziness at times. They have always supported, encouraged and guided me in strengthen my faith in Allah. It was in fact their true love and prayers that empowered me to do something meaningful in my life. I owe them a lot.

It is a real pleasure to acknowledge the tremendous debt of gratitude I owe to my grandfather Khawja Abdul Khafiq, my elder brother Mir Idrees Maqbool and Sayiama Wafie, who has been a constant source of inspiration and encouragement making me feel stronger.

I also express my gratitude towards my seniors and colleagues Dr. Muzamil Andrabi, Dr. Zubair Alvi, Dr. Amjed Hussani, Dr. Rasikh Javaid, Dr. Rashid, Dr. M. Zaffar, Dr. Ajaz, Dr. Tanveer, Dr. Youssouf M Sumji, Dr. Mubashir Masoodi, Dr. Tasduq Abdullah, Dr. Shahzada Adil, Dr. Nayeem, Dr. Mohammad Mushahid Khan, Dr. Shazi Shakil, Dr. Rizwan Ahmad Ansari, Dr. Abu Tahir, Syed Shadab Raza, Syed Ovais, Zahid, Hina, Firoz Ahmad, Khalid Rashid, Vaibhav, Andleeb, Hayate, Ajaz, Sadiq, Ishfaq, Saba, Tabish, Mehvish, Sumaira, Samiya, Meraj Ahmad Khan, Meraj, Neha and Sumaira.

My gratitude to my roommates, Dr. Umar Jahangir, Tahir Khuroo, Umar Khan, Abid Zargar, Pervaiz Rashid and Haroon for their constant support and companionship during the entire journey. They have been a constant source of joy, strength and enjoyment at the same time.

I also show my gratitude towards my friends Aijaz Khan, Bilal Baba, Masood Wani, Mir Rouef, Younce Jan, Jahangir, Yasir Rafiq, Feroz Gul, Khursheed, Shiraz Baba, Mir Javed, Syed Yasir, Arshid, Dr. Rasikh, Zubair, Dr. Akhter, Zuhaib, Dr. Shazad, Idrees, Umar Messi, Quayoom, Naveed, Umar, Zubair Bhat, Naseer, who served as anti-stress agents during the course of my work.

The financial assistance from Central Council for Research in Unani Medicine (CCRUM) and University Grants Commission (UGC) is gratefully acknowledged.

I am extremely grateful to entire Hamdard University family for the unstinted, affection, cooperation and generosity.

Last but not the least I pay my homage to a large number of helpless rats and mice who sacrificed their lives during the investigation of my studies in my laboratory.

Mir Tahir Maqbool
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Summary and Conclusion

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List of Publications
ABBREVIATIONS

α  
Beta

β  
Gamma

γ  
Percent

µ  
Micro

µg  
Micro gram

µl  
Micro liter

°C  
Degree celsius

2-AAF  
2-Acetylaminofluorene

ATP  
Adenosine triphosphate

BSA  
Bovine serum albumin

cm  
Centimetre

CAT  
Catalase

COX-2  
Cyclooxygenase-2

DAB  
Diaminobenzidine

DEN  
Diethylnitrosamine

DNA  
Deoxyribonucleic acid

DTNB  
5, 5'-dithio-bis-2-nitrobenzoic acid

EDTA  
Ethylenediaminetetraacetic acid

ELISA  
Enzyme linked immunosorbent assay

GA  
Glycyrrhizic acid

gm  
Gram

GPx  
Glutathione peroxidase

GR  
Glutathione reductase

GSSG  
Oxidized glutathione

GSH  
Reduced glutathione

GST  
Glutathione-S-transferase

h  
Hour

H₂O₂  
Hydrogen peroxide

iNOS  
Inducible nitric oxide synthase

MDA  
Malondialdehyde

mg  
milligram
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>ml</td>
<td>milliliter</td>
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<tr>
<td>MMPs</td>
<td>Matrix metalloproteinases</td>
</tr>
<tr>
<td>μmol</td>
<td>Micromoles</td>
</tr>
<tr>
<td>NAD</td>
<td>Nicotinamide adeninedinucleotide</td>
</tr>
<tr>
<td>NADPH</td>
<td>Nicotinamide adeninedinucleotide phosphate reduced</td>
</tr>
<tr>
<td>NF-kB</td>
<td>Nuclear factor-kappa B</td>
</tr>
<tr>
<td>nmol</td>
<td>Nanomoles</td>
</tr>
<tr>
<td>NO</td>
<td>Nitric oxide</td>
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<tr>
<td>OH</td>
<td>Hydroxyl radical</td>
</tr>
<tr>
<td>ONOO</td>
<td>Peroxynitrite radical</td>
</tr>
<tr>
<td>PB</td>
<td>Phosphate buffer</td>
</tr>
<tr>
<td>PCNA</td>
<td>Proliferating cell nuclear antigen</td>
</tr>
<tr>
<td>PBS</td>
<td>Phosphate buffered saline</td>
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<tr>
<td>PMS</td>
<td>Post mitochondrial supernatant</td>
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<tr>
<td>PNP</td>
<td>Para nitrophenol</td>
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<tr>
<td>PCA</td>
<td>Perchloric acid</td>
</tr>
<tr>
<td>QR</td>
<td>Quinone reductase</td>
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<tr>
<td>ROS</td>
<td>Reactive oxygen species</td>
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<tr>
<td>rpm</td>
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<tr>
<td>RNS</td>
<td>Reactive nitrogen species</td>
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<tr>
<td>SD</td>
<td>Standard deviation</td>
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<td>Sec</td>
<td>Second</td>
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<tr>
<td>SOD</td>
<td>Superoxide dismutase</td>
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<td>TBA</td>
<td>Thiobarbituric acid</td>
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<td>TBARS</td>
<td>Thiobarbituric acid reactive species</td>
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<tr>
<td>TCA</td>
<td>Trichloroacetic acid</td>
</tr>
<tr>
<td>TNF-α</td>
<td>Tumor necrosis factor- alpha</td>
</tr>
<tr>
<td>VEGF</td>
<td>Vascular endothelial growth factor</td>
</tr>
<tr>
<td>XO</td>
<td>Xanthine oxidase</td>
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