

CARBON MONOXIDE: INFLUENCE ON AVIAN RESPIRATORY CONTROL

1050 710

by

REGINALD ROBERT TSCHORN

B.S., Kansas State University

A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

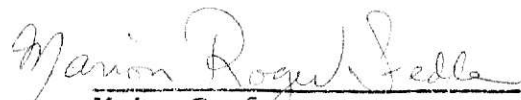
MASTER OF SCIENCE

Department of Physiological Sciences

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1974

Approved by


Major Professor

LD
2668
T4
1974
T83
C-2

TABLE OF CONTENTS

Document

| | Page |
|--|------|
| I. List of Figures | iv |
| II. List of Tables | v |
| III. List of Appendix Tables | vi |
| IV. Part 1: Cardiopulmonary Responses to CO Breathing in the Chicken | 1 |
| A. Abstract | 1 |
| B. Introduction | 2 |
| C. Methods | 3 |
| 1. Animal preparation | 3 |
| 2. Cardiopulmonary recordings | 3 |
| 3. Exposure gases | 5 |
| 4. Record and data analysis | 5 |
| D. Results | 6 |
| 1. Lethal exposure to carbon monoxide | 6 |
| 2. Sublethal exposures to carbon monoxide | 6 |
| E. Discussion | 11 |
| F. References | 14 |
| V. Part 2: Effect of Carbon Monoxide on Avian Intra- pulmonary CO ₂ -sensitive Receptors | 16 |
| A. Abstract | 16 |
| B. Introduction | 17 |
| C. Methods | 17 |
| 1. Animal preparation | 17 |
| 2. Experiment 1. Intrapulmonary CO ₂ -sensitive receptor response to carbon monoxide | 18 |
| 3. Experiment 2. Blood gas and HbCO response to carbon monoxide administration | 21 |

TABLE OF CONTENTS (Continued)

| | Page |
|---|------|
| D. Results | 21 |
| 1. Experiment 1. Response of intrapulmonary CO ₂ - sensitive receptors to carbon monoxide | 21 |
| 2. Experiment 2. Sternal movement, HbCO and blood gas tensions during CO administration | 23 |
| E. Discussion | 28 |
| F. References | 36 |
| VI. Acknowledgements | 38 |
| VII. Appendix Tables | 39 |

LIST OF FIGURES

| Figure | Page |
|---|------|
| 1. Diagrammatic arrangement of experimental animal and accompanying apparatus | 4 |
| 2. Cardiopulmonary records while 0.5% CO was administered | 7 |
| 3. Effect of 0.5% carbon monoxide on cardiopulmonary parameters | 8 |
| 4. Effect of 0.01%, 0.1% and 0.5% carbon monoxide on arterial carboxyhemoglobin concentration | 9 |
| 5. Effect of 0% and 0.1% carbon monoxide on cardiopulmonary parameters | 12 |
| 6. Schematic diagram of arrangement of the chicken for single-unit vagal recordings from intrapulmonary CO ₂ -sensitive receptors | 19 |
| 7. Effect of carbon monoxide on discharge frequency from an intrapulmonary CO ₂ -sensitive receptors and on cyclic respiratory movements | 22 |
| 8. Effect of 0.1% CO on discharge frequency of intrapulmonary CO ₂ -sensitive receptors in 5 receptors | 24 |
| 9. Effect of 0.1% carbon monoxide on static CO ₂ -sensitivity curves before, during and after CO administration | 25 |
| 10. Effect of 0.1% carbon monoxide on dynamic CO ₂ -sensitivity curves before, during, and after CO administration | 26 |
| 11. Effect of 0.1% carbon monoxide on respiratory frequency during unidirectional ventilation with 0% CO ₂ in the ventilating gas. Rate of carboxyhemoglobin formation and dissociation, during and after unidirectional ventilation with 0.1% carbon monoxide | 27 |
| 12. Carboxyhemoglobin formation and dissociation in unidirectionally ventilated chicken, during and after administration of 0.1% CO | 29 |
| 13. Effects on arterial oxygen tension during unidirectional ventilation with 0% CO ₂ and 0.1% CO | 30 |
| 14. Possible site and mode of action of CO on respiratory control | 34 |

LIST OF TABLES

| TABLE | Page |
|--|------|
| 1. Influence of inhalation of 0.01% CO for 60 minutes on various cardiopulmonary parameters in the Chicken | 10 |

LIST OF APPENDIX TABLES

Table

| | | |
|------|--|----|
| 1. | Effects of 0% carbon monoxide on frequency (f, breaths min ⁻¹) | 39 |
| 2. | Effects of 0% carbon monoxide on tidal volume (V _T , ml BTPS) | 40 |
| 3. | Effects of 0% carbon monoxide on minute volume (V̇, ml BTPS·min ⁻¹) | 41 |
| 4. | Effects of 0.01% carbon monoxide on frequency (f, breaths, min ⁻¹) | 42 |
| 5. | Effects of 0.01% carbon monoxide on tidal volume (V _T , ml BTPS) | 43 |
| 6. | Effects of 0.01% carbon monoxide on minute volume (V̇, ml BTPS·min ⁻¹) | 44 |
| 7. | Effects of 0.1% carbon monoxide on frequency (f, breaths min ⁻¹) | 45 |
| 8. | Effects of 0.1% carbon monoxide on tidal volume (V _T , ml BTPS) | 46 |
| 9. | Effects of 0.1% carbon monoxide on minute volume (V̇, ml BTPS·min ⁻¹) | 47 |
| 10. | Effects of 0.5% carbon monoxide on frequency (f, breaths min ⁻¹), tidal volume (V _T , ml BTPS) and minute volume (V̇, ml BTPS·min ⁻¹) | 48 |
| 11. | Effects of 0% carbon monoxide on heart frequency and blood pressure | 49 |
| 11.a | Effects of 0% carbon monoxide on change values of heart frequency and blood pressure | 50 |
| 12. | Effects of 0.01% carbon monoxide on heart frequency and blood pressure | 51 |
| 12.a | Effects of 0.01% carbon monoxide on change values of heart frequency blood pressure | 52 |
| 13. | Effects of 0.1% carbon monoxide on heart frequency and blood pressure | 53 |
| 13.a | Effects of 0.1% carbon monoxide on change values of heart frequency and blood pressure | 54 |