

بسم الله الرحمن الرحيم





شبكة المعلومات الجامعية التوثيق الالكتروني 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



PHYSIOLOGICAL RESPONSES OF CAMELS TO DIFFERENT SOURCES AND LEVELS OF SELENIUM

By

HOSSAM KHALED SAAD EL-DEEN

B.Sc. Agric. Sci. (Animal Production), Fac. Agric., Cairo Univ., Egypt, 2007

M.Sc. Agric. Sci. (Animal Production), Fac. Agric., Cairo Univ., Egypt, 2013

THESIS

**Submitted in Partial Fulfillment of the
Requirements for the Degree of**

DOCTOR OF PHILOSOPHY

In

**Agricultural Sciences
(Animal Production)**

**Department of Animal Production
Faculty of Agriculture
Cairo University
EGYPT**

2021

Format Reviewer

Vice Dean of Graduate Studies

APPROVAL SHEET

**PHYSIOLOGICAL RESPONSES OF CAMELS TO
DIFFERENT SOURCES AND LEVELS OF
SELENIUM**

**Ph. D. Thesis
In
Agric. Sci. (Animal Production)**

BY

HOSSAM KHALED SAAD EL-DEEN

B.Sc. Agric. Sci. (Animal Production), Fac. Agric., Cairo Univ., Egypt, 2007

M.Sc. Agric. Sci. (Animal Production), Fac. Agric., Cairo Univ., Egypt, 2013

APPROVAL COMMITTEE

Dr. MONA ABD ELTAWAB EL-KHASHAB
Professor of Animal Physiology, Fac. Agric., Fayom University

Dr. GAMAL MAHMOUD AHMED SOLOUMA
Professor of Animal Physiology, Fac. Agric., Sohage University

Dr. GAMAL ASHOUR HASSAN.....
Professor of Animal Physiology, Fac. Agric., Cairo University

Date: / / 2021

SUPERVISION SHEET

**PHYSIOLOGICAL RESPONSES OF CAMELS TO
DIFFERENT SOURCES AND LEVELS OF
SELENIUM**

**Ph.D. Thesis
In
Agric. Sci. (Animal Production)**

By

HOSSAM KHALED SAAD EL-DEEN

B.Sc. Agric. Sci. (Animal Production), Fac. Agric., Cairo Univ., Egypt, 2007

M.Sc. Agric. Sci. (Animal Production), Fac. Agric., Cairo Univ., Egypt, 2013

SUPERVISION COMMITTEE

Dr. GAMAL ASHOUR HASSAN

Professor of Animal Physiology, Fac. Agric., Cairo University

Dr. SHERIF MOHAMED DESSOUKI

Associate professor of Animal Physiology, Fac. Agric., Cairo University

Dr. FATEN FAHMY ABOU-AMMOU

Head Researcher of animal husbandry, APRI, NRC

Degree : Ph.D.

Title of Thesis: Physiological Responses of Camels to Different Sources and Levels of Selenium

Supervisors: Dr.Gamal Ashour Hassan

Dr. Sherif Mohamed Dessouki

Dr. Faten Fahmy Abou-Ammou

Department: Animal Production

Branch: Animal Physiology

Approval: / / **2021**

ABSTRACT

This study was carried out to investigate the impact of selenium supplementation (8 mg/h/d) on the antioxidant capacity of camel calves and its reflection on growth performance. Seventeen camels at 18 months with an average body weight of 172.47 ± 10.56 kg were randomly classified into 3 groups; (Organic selenium/6 animals and inorganic selenium/ 6 animals) plus vitamin E (15 IU/kg DM) and control / 5 animals.

The results indicated that, a significant increase in blood metabolites (Glu, TP, Alb, and TL) reflect a good nutritional status. Also, triiodothyronine and ALP increased significantly evidence that an improvement in metabolism was occurring. Furthermore, the values of ALT, AST, BUN, and Crt have insignificant variations, but all in the normal range, which confirms that no harmful effects are caused by selenium supplementation. Moreover, an improvement of antioxidant status was clearly observed by a significant increase in glutathione peroxidase, catalase, total antioxidant capacity, and decrease in malodialdehyde for supplemented groups Vs the control group. In addition, a significant increase in Selenium, calcium, and potassium in treated groups. Although sodium has an insignificant difference, it took the same trend.

All these findings were confirmed by organic group superiority in all growth parameters (total body gain, average daily gain, and growth rate) than the other two groups.

It has been concluded that the supplementation of selenium to growing camel diets by (8mg/h/d) improved growth performance and reduce oxidative stress without any harmful effect on animals. In addition, organic source showed a better effect than inorganic source.

Key Words: Camel calves, growth, selenium, metabolites, enzymes, hormones, minerals.

ACKNOWLEDGEMENT

Thanks to Allah who gives me everything I want.

*I would like to express my deepest thanks and gratitude to **Dr. Gamal Ashour Hassan**, Professor of Animal Physiology, Faculty of Agriculture, Cairo University for suggesting and planning this work as well as for his direct supervision, revision of manuscript valuable and unlimited help in completing this study.*

*I would like to express my deepest thanks and gratitude to **Dr. Fatten Fahmy Abou Ammuo**, professor of Animal Husbandry, Animal Production Research Institute, Agriculture Research Center, for her courageous supervision, revision of the manuscript, valuable guidance.*

*Thanks and gratitude is also extended to **Dr. Sherif Mohamed Dessouki**, Associate professor of Animal Physiology, Animal Production Department, Faculty of Agriculture, Cairo University for his encouragement, continuous valuable suggestion, and guidance in preparing this study.*

*My sincere also extended to **Dr. Samah Abd-ElRahman** and **Dr. Moharam Fouad** for valuable help.*

*Last but not least great thanks and appreciation to My Colleagues **Dr. Ehab Salah**, **Dr. Hassan Abdou**, **Dr. Doaa Teleb**, and my friends for their patience and encouragement throughout the progress of this work.*

*Special thanks to my wife **Dr. Shaimaa Abdel-Azeem** for her spiritual effort and her great support in this work.*

CONTENTS

	Page
INTRODUCTION.....	1
REVIEW OF LITERATURE	4
1. The camel.....	4
2. The Maghrabi camel.....	5
3. Metabolic profile.....	6
a. Glucose.....	6
b. Total protein	8
c. Albumin.....	9
d. Globulin.....	10
e. Lipid profile	11
4. Liver function	14
a. Alanine aminotransferase	14
b. Aspartate aminotransferase	16
c. Alkaline phosphatase.....	17
5. Kidney function.....	18
a. Blood urea nitrogen.....	18
b. Creatinine	20
6. Thyroid function	21
7. Antioxidant biomarkers.....	24
a. Glutathione peroxidase.....	24
b. Malondialdehyde	25
c. Catalase	26

d. Total antioxidant capacity.....	27
8. Blood minerals	28
a. Selenium	28
b. Sodium	31
c. Potassium	32
d. Calcium	33
9. Growth performance.....	34
1. Body weight and total body gain	34
2. Average daily gain	35
3. Growth rate	36
MATERIALS AND METHODS.....	37
RESULTS AND DISCUSSION.....	48
1. Metabolic profile	48
a. Glucose	48
b. Total proteins.....	50
c. Albumin.....	52
d. Globulin.....	54
2. Lipid profile	56
a. Triglycerides.....	56
b. Total cholesterol.....	58
c. Total lipids.....	60
3. Liver functions	62
a. Alanine aminotransferase.....	62
b. Aspartate aminotransferase.....	64
c. Alkaline phosphatase	66

4. Kidney functions	68
a. Blood urea nitrogen.....	68
d. Creatinine.....	70
5. Thyroid hormones	72
a. Triiodothyronine	72
b. Thyroxine.....	74
6. Antioxidant biomarkers.....	76
a. Glutathione peroxidase	76
b. Malondialdehyde	78
c. Catalase.....	80
d. Total antioxidant capacity.....	82
7. Mineral profile	82
a. Selenium.....	82
b. Sodium.....	84
c. Potassium.....	87
d. Calcium.....	89
8. Growth performance.....	91
SUMMARY	96
REFERENCES	104
ARABIC SUMMARY.....	

LIST OF ABBREVIATIONS

ADG	Average daily gain
Alb	Albumin
ALP	Alkaline phosphatase
ALT	Alanine aminotransferase
APRI	Animal production research institute
ARC	Agriculture research center
AST	Aspartate amino transferase
BUN	Blood urea nitrogen
BW	Bodyweight
Ca	Calcium
CAT	Catalase
CC	Camel calves
CF	Crude fiber
CG	Control group
CP	Crude protein
CR	Creatinine
d	Day
dl	Deci liter (10^{-2} liter)
DM	Dry matter
EE	Ether extract
FBW	Final body weight
g	Gram (10^{-3} kilogram)
GHS-Px	Glutathione peroxidase
Glb	Globulin
Glu	Glucose
GR	Growth rate
h	head
IBW	Initial body weight
ISG	Inorganic selenium group
IU	International unit
K	potassium
L	liter
MDA	Malondialdehyde
mg	Milli gram (10^{-3} gram)

ml	Milli liter (10^{-3} liter)
NFE	Nitrogen free extract
ng	Nano gram (10^{-9} gram)
nm	Nano meter (10^{-9} meters)
nmol	Nano mole
OM	Organic matter
OSG	Organic selenium group
Se	Selenium
T3	Triiodothyronine hormone
T4	Thyroxine hormone
TBG	Total body gain
TC	Total cholesterol
TG	Triglycerides
TL	Total lipids
TP	Total protein
ROS	Reactive oxygen species
rpm	Revolution per minute

LIST OF TABLE

No	Title	page
1	Glucose concentration (Glu) of dromedary camel under different conditions.....	7
2	Total proteins (TP) concentration of dromedary camel under different conditions.....	9
3	Albumin (Alb) concentration of dromedary camel under different conditions	10
4	Globulin concentration (Glb) of dromedary camel under different conditions.....	11
5	Total lipids concentration (TL) of dromedary camel under different conditions.	12
6	Triglycerides concentration (TG) of dromedary camel under different conditions	13
7	Total cholesterol concentration (TC) of dromedary camel under different conditions.....	14
8	Alanine aminotransferase concentration (Alt) of dromedary camel under different conditions.....	15
9	Aspartate aminotransferase concentration (Ast) of dromedary camel under different condition	17
10	Blood urea nitrogen concentration (BUN) of dromedary camel under different conditions.....	20
11	Creatinine concentration (CR) of dromedary camel under different conditions	21
12	Triiodothyronine (T3) of dromedary camel under different condition.....	22

13	Thyroxine (T4) of dromedary camel under different condition.....	23
14	Glutathione peroxidase (GPx-SH) of dromedary camel under different conditions	25
15	Malondialdehyde (MDA) of dromedary camel under different conditions	26
16	Catalase (CAT) of dromedary camel under different conditions.....	27
17	Total antioxidant capacity (TAC) of dromedary camel under different conditions	28
18	Selenium (Se) of dromedary camel under different conditions.....	30
19	Sodium (Na) of dromedary camel under different conditions.....	31
20	Potassium (K) of dromedary camel under different conditions.....	32
21	Calcium (Ca) of dromedary camel under different conditions.....	34
22	Chemical composition for experimental feed stuffs on dry matter basis (%)......	39
23	Glucose (Glu, mg/dl) LSM $\pm$ SE for growing Maghrabi camels supplemented with different sources of selenium	49
24	Total Protein (g/dl) LSM $\pm$ SE for growing Maghrabi camels supplemented with different sources of selenium...	51
25	Albumin (g/dl) LSM $\pm$ SE for growing Maghrabi camels supplemented with different sources of selenium.....	53
26	Globulin (g/dl) LSM $\pm$ SE for growing Maghrabi camels supplemented with different sources of selenium.....	