

**PHYSIOLOGICAL PERFORMANCE AND IMMUNO  
COMPETENCE OF GROWING BARKI SHEEP  
FED AZZAWI DATES IN SIWA OASIS**

By

**MOHAMMED SAEED ABO EL-FATH ZIDANE**

B. Sc. Agric. Sc. (Animal Production), Minufiya University, 2004

**A thesis submitted in partial fulfillment  
of  
the requirements for the degree of**

**MASTER OF SCIENCE**

**in**

**Agricultural Science  
(Animal Physiology)**

**Department of Animal Production  
Faculty of Agriculture  
Ain Shams University**

**2010**

Approval Sheet

**PHYSIOLOGICAL PERFORMANCE AND IMMUNO  
COMPETENCE OF GROWING BARKI SHEEP  
FED AZZAWI DATES IN SIWA OASIS**

By

**MOHAMMED SAEED ABO EL-FATH ZIDANE**

B. Sc. Agric. Sc. (Animal Production), Minufiya University, 2004

**This thesis for M. Sc. degree has been approved by:**

**Dr. Medhat Hussein Khalil** .....

Prof. Emeritus of Animal Physiology, Faculty of Agriculture, Al-  
Azhar University

**Dr. Farouk Abd-Allah Khalil** .....

Prof. Emeritus of Animal Physiology, Faculty of Agriculture, Ain  
Shams University

**Dr. Esam El-Din Tharwat Mohamed** .....

Prof. of Animal Physiology, Faculty of Agriculture, Ain Shams  
University

**Date of Examination:** 28 / 4 / 2010

# **PHYSIOLOGICAL PERFORMANCE AND IMMUNO COMPETENCE OF GROWING BARKI SHEEP FED AZZAWI DATES IN SIWA OASIS**

By

**MOHAMMED SAEED ABO EL-FATH ZIDANE**

B. Sc. Agric. Sc. (Animal Production), Minufiya University, 2004

**Under the supervision of:**

**Dr. Esam El-Din Tharwat Mohamed**

Prof. of Animal Physiology, Department of Animal Production,  
Faculty of Agriculture, Ain Shams University (Principal Supervisor)

**Dr. Mohsen Shaker Abdel-Fattah**

Associate Research Prof. of Animal Physiology, Animal and Poultry  
Production Division, Desert Research Center

---

## ABSTRACT

**Mohammed Saeed Abo-Elfath Zidane: Physiological Performance and Immuno Competence of Growing Barki Sheep Fed Azzawi Dates in Siwa Oasis. Unpublished M.Sc. Thesis, Department of Animal Production, Faculty of Agriculture, Ain Shams University, 2010.**

This study was carried out to investigate the effect of partial substitution of crushed yellow corn (CYC) in concentrate feed mixture (CFM) with crushed date palm (CDP) at 50% (w/w) level on live body weight (LBW), thermoregulatory, hematological and some plasma biochemical parameters, thyroid activity, age at puberty, semen characteristics and early mating of Barki lambs. This study was performed during the period from April till December 2006 (244 days), in Siwa Research Station (Tegzerty Experimental Farm for animal production), belonging to Desert Research Center (DRC), Ministry of Agriculture and Land Reclamation, in corporation with Department of Animal Production, Faculty of Agriculture Ain-Shams University, Cairo, Egypt.

Forty-eight Barki lambs (18 males and 30 females) weaned at 121 days of age with average  $20.96 \pm 1.31$  and  $19.04 \pm 0.50$  kg body weight respectively were used in this study. Both sexes were divided randomly into two equal groups (9 male and 15 female in each). The first group served as control, while the second was fed experimental ration. One of two ration combinations (CFM) and berseem hay (Alfalfa) was offered to the control group in each sex, while the other ration combination (50% w/w of CDP replaced CYC in CFM) and berseem hay (Alfalfa) was offered to the treated group in each sex. The results showed that, level of blood plasma glucose (GLU) was higher ( $P < 0.01$ ) in the treated group (male and female) compared with the control group. Inclusion of CDP decreased ( $P < 0.01$ ) total cholesterol (CHO), triglycerides (Tri) and plasma total lipids levels (TL) compared with control group. Computed plasma globulin (GL) was higher ( $P < 0.01$ ) in treated group compared

with control group in both sexes. Minor increase occurred in total plasma protein in treated groups compared with control group.

The thyroid hormones activities, ( $T_3$  and  $T_4$ ) in blood plasma were increased with increasing body weight in both control and treated groups throughout the study period and were significantly ( $P<0.01$ ) correlated with body weight. Regardless the effect of treatment, the results indicated that female lambs had the highest values in Hb, Ht and RBC's compared with male lambs. For female lambs, the mean values of Hb, Ht and RBC's were 18.24 g/dl, 34.25% and  $12.36 \times 10^6/\text{mm}^3$ , respectively. The corresponding values for male lambs were 17.62 g/dl, 33.79% and  $11.87 \times 10^6/\text{mm}^3$ .

Concerning the effect of treatment, the results indicated that the group means for Hb, Ht, RBC's, MCV, MCH and MCHC were similar in control and treated groups within the same sex

Concerning the effect of treatment on total leukocytes number, the results indicated that, in both sex, minor improvement was observed in the total WBC's number of lambs fed treated diet relative to lambs fed control diet.

Plasma testosterone concentration was higher (1.6 ng/ml) in control group than treated group (1.49 ng/ml) at first ejaculation, while at the second and third ejaculation, treated group had higher (1.84 and 1.98 ng/ml) than control group (1.63 and 1.89 ng/ml).

The results showed that inclusion of CDP in CFM at level 50% (w/w) caused positive effects on ejaculate volume, sperm motility and sperm concentration; this might be due to the presence of phytoestrogen, as a steroidal component of date stones, which may have influenced sperm parameters. The results clearly show that the inclusion of CDP in CFM at level (50%, w/w) caused higher (80%) conception rate compared with control group (53.33%).

## ACKNOWLEDGEMENT

All thanks to **GOD**, creator of all and always helps me.

I would like to express my deep gratitude to **Prof. Dr. Esam El-Din Tharwat**, Professor of Animal Physiology, Faculty of Agriculture- Ain Shams University, to him my sincerest appreciation for providing so much of his time in supervising, guiding the work and revising the thesis. I am very grateful for his valuable comments, kind supervision and continuous encouragements throughout the study and writing the thesis to successful culmination.

Grateful acknowledgement is extended to **Dr. Mohsen Shaker**, Assistant Researcher Professor of Animal Physiology - Desert Research Center for all facilities offered to me throughout carrying out the investigation. I am very grateful for his valuable comments, kind supervision and continuous encouragements throughout the study and writing the thesis to successful culmination.

Grateful acknowledgement is extended to **Dr. Samir Mohamed Alsheikh**, Assistant Researcher Professor of Animal Breeding - Desert Research Center for his assistance in statistical analysis.

Depth thanks to **Dr. Ahmed Lotfy**, Assistant Researcher Professor of Animal Physiology - Desert Research Center for his encouragement.

Most thanks should be given to **my parents** for take care of me and encouraging me during the master study. Thanks are also to all my sisters (**Mona, Maha, Marwa and Maisa**) and their husbands for their helps to provide convenience for working thesis and their encouragement.

Sincere acknowledgement is extended to **Dr. Nagwa Hussein, DR. Mervat El-Bayomy** and **Dr. Marwa Khalifa** for their kind treatment and helping throughout the study.

My thanks to all my friends **A. Negm, A. Sallam, Dr. Ragab, Alaa Bakr, M. Shreif** and all in Maryout Research Station and all in Siwa Research Station especially **Mr. Fathi, Mr. Yehia** and **El-hag Abd-Alkader**.

My deepest thanks for **my best friend** who wanted me to do not say his name for his encouragement in all in my life, not only this study; really he is my best friend.

# CONTENTS

	<b>Page</b>
<b>Abbreviations</b>	v
<b>List of Tables</b>	viii
<b>List of Figures</b>	xiii
<b>1. Introduction</b>	1
<b>2. Review of Literature</b>	3
2.1. Climatic factors affecting thermoregulation in small ruminant	3
2.1.1. Thermoregulation	3
2.1.2. Ambient temperature	5
2.1.3. Relative humidity	6
2.2. Utilization of Agro-industrial by-products in diets for growing lambs	6
2.2.1. Date palm	8
2.2.2. Chemical composition of date pits	8
2.3. Effect of date palm and date pits on body weight	9
2.4. Factors affecting lambs weight gain	12
2.5. Effect of ration protein and environment on sheep growth	15
2.6. Sheep water intake	17
2.7. Thermoregulatory parameters	18
2.7.1. Rectal temperature (RT, °C)	18
2.7.2. Skin temperature (ST, °C)	19
2.7.3. Respiration and heart rates (RR, HR)	20
2.8. Hematological parameters	21
2.9. Plasma biochemical parameters	23
2.9.1. Total plasma protein (TP)	24
2.9.2. Liver enzymes (ALT and AST)	25
2.9.3. Total plasma lipids (TL)	26
2.9.4. Total plasma cholesterol (CHO) and triglycerides (Tri)	27
2.9.5. Plasma glucose (GLU) concentration	29
2.10. Puberty	29
2.10.1. Age at puberty	29

2.10.2. Sexual hormones at puberty	30
2.10.3. Body weight at puberty	30
2.10.4. Effect of nutrition on puberty	30
2.10.5. Effect of sex, birth and weaning weights on productive performance of lambs	31
2.11. Effect of date palm on sperm production	32
2.12. Thyroid activity	34
<b>3. Materials and Methods</b>	37
3.1. Meteorological parameters	37
3.2. Animals, housing and experimental design	37
3.3. Experimental feedstuffs	38
3.4. Azzawi date palm preparation and analysis	39
3.5. Live body weight	39
3.6. Thermo-cardio-respiratory parameters	40
3.6.1. Rectal and skin temperatures	40
3.6.2. Respiration rate (RR)	41
3.6.3. Heart rate (HR)	41
3.7. Blood collection	41
3.8. Hematological parameters	41
3.8.1. Blood hemoglobin (Hb)	41
3.8.2. Hematocrit (Ht)	41
3.8.3. Erythrocytes count (RBC's $\times 10^6$ cells/mm <sup>3</sup> )	42
3.8.4. Total leukocytes (WBC's $\times 10^3$ cells/mm <sup>3</sup> ) and differential counts	42
3.8.5. Erythrocyte indices	42
3.8.5.1. Mean Corpuscular Volume (MCV)	42
3.8.5.2. Mean Corpuscular Hemoglobin (MCH)	42
3.8.5.3. Mean Corpuscular Hemoglobin Concentration (MCHC)	43
3.9. Plasma biochemical analysis	43
3.9.1. Plasma total proteins (TP)	43
3.9.2. Plasma albumin (AL)	43



3.9.3. Plasma globulins (GL)	43
3.9.4. Albumin/Globulin ratio (A/G ratio)	43
3.9.5. Plasma total lipids (TL)	43
3.9.6. Plasma total cholesterol (CHO)	44
3.9.7. Plasma triglycerides (Tri)	44
3.9.8. Plasma ALT and AST activities	44
3.9.9. Hormonal assays	44
3.10. Estrus detection	44
3.11. Mating season	45
3.12. Semen collection and evaluation	45
3.13. Economic efficiency	46
3.14. Statistical analysis	46
<b>4. Results and Discussion</b>	<b>48</b>
4.1. Climatic conditions	48
4.2. Diets chemical composition	48
4.3. Thermo-cardio respiratory responses	51
4.3.1. Rectal and skin temperatures	51
4.3.2. Respiration and heart rates	55
4.4. Growth performance	60
4.4.1. Post-weaning lamb performance	63
4.4.2. Total Weight Gain (TWG)	65
4.5. Haematological parameters	65
4.5.1. Hemoglobin, hematocrit and erythrocytes	65
4.5.2. Erythrocyte indices	71
4.6. The immune system	75
4.6.1. Total leukocytes count	75
4.6.2. Differential leukocyte counts (DLC)	78
4.7. Thyroid activity:	83
4.8. Feed and water intakes	87
4.9. Productive performance	90
4.10. Economical evaluation	92
4.11. Plasma biochemical analysis	92

4.11.1. Plasma proteins	92
4.11.2. Plasma total cholesterol concentration (CHO)	97
4.11.3. Plasma triglycerides concentration (Tri)	102
4.11.4. Plasma total lipids concentration (TL)	103
4.11.5. Plasma glucose concentration (GLU)	105
4.11.6. Plasma urea nitrogen concentration (PUN)	107
4.11.7. Liver enzymes activity	109
4.12. Reproductive performance in male and female Barki lambs	112
4.12.1. Effect of CDP on blood plasma testosterone concentration (PTs)	112
4.12.2. Semen characteristics at the onset of puberty and post-pubertal age	114
4.12.2.1. Effect of CDP on sperm morphological characteristics.	114
4.12.2.2. Ejaculate volume (EV), percentage of dead sperm (DS), sperm motility (SM), sperm concentration (SC) and semen pH.	120
4.12.3. Puberty in ewe lambs and early breeding season	126
<b>5. Summary and Conclusion</b>	133
<b>6. References</b>	137
<b>Arabic Summary</b>	

## **ABBREVIATIONS**

<b>Abbreviation</b>	<b>Description</b>
A/G	Albumin/globulin
AH	Abnormal head
AL	Albumin
ALT	Alanine aminotransferase
AN	Animal
AN(Mo)	Animal (Month)
AN(S*T)	Animal (sex*treatment)
AST	Aspartate aminotransferase
AT	Ambient temperature
Bas	Basophile cells
C	Control
CDP	Crushed date palm
CF	Crude fiber
CFM	Concentrate feed mixture
CHO	Cholesterol
CP	Crude protein
CYC	Crushed yellow corn
D	Day
d.f	Degrees of freedom
DFI	Daly feed intake
DLC	Differential leukocyte counts
DM	Dry matter
DMI	Dry matter intake
DS	Dead sperm
EE	Ether extract
Eso	Eosinophile cells
EV	Ejaculate volume
FCR	Feed conversion ratio
FW	Final weight
GL	Globulin
GLU	Glucose
Hb	Hemoglobin
HDL	High-density lipoprotein
HR	Heart rate
Ht	Hematocrit( Packed cell volume)
Kg/h/d	Kilogram per head per day
l/h/d	Liter per head per day
LBW	Live body weight

LDL	Low-density lipoprotein
Lym	Lymphocyte cells
M.S	Mean square
MCH	Mean corpuscular hemoglobin
MCHC	Mean corpuscular hemoglobin concentration
MCV	Mean corpuscular volume
Mo	Month
Mo*S	Month*sex
Mo*S*T	Month*sex*treatment
Mo*T	Month*treatment
Mon	Monocyte cells
NS	Non significant
Nut	Neutrophil cells
OADG	Overall average daily gain weight
OGR	Overall growth rate
OM	Organic matter
P4	Progesterone
P <sub>st</sub> WADG	Post-weaning average daily weight gain
P <sub>st</sub> WGR	Post-weaning growth rate
PTs	Plasma testosterone
PUN	Plasma urea nitrogen
RBC's	Red blood cells
RH	Relative humidity
RR	Respiration rate
RT	Rectal temperature
S	Sex
S*T	Sex*treatment
S.O.V	Source of variation
SC	Sperm concentration
SE	Standard error
SM	Sperm motility
ST	Skin temperature
T	Treatment
T <sub>3</sub>	Tri-iodothyronine
T <sub>4</sub>	Thyroxin
TA	Tail abnormal
THI	Temperature humidity index
TL	Total lipids
TP	Total protein
Tri	Triglycerides
TSA	Total sperm abnormality
TWG	Total weight gain

w/w  
WBC's

Weight/weight  
White blood cells

## LIST OF TABLES

Table No.		Page
<b>I</b>	Composition of ingredient feed rations for control and treated groups.	38
<b>II</b>	Analysis of drinking water.	39
<b>1</b>	Chemical analysis (%) of experimental rations.	48
<b>2</b>	Means $\pm$ SE of climatic data throughout the study period.	49
<b>3a</b>	Means $\pm$ SE of monthly rectal temperature (RT, °C) of both male and female Barki lambs fed crushed date palm at Siwa Oasis.	52
<b>3b</b>	Means $\pm$ SE of monthly skin temperature (ST, °C) of both male and female Barki lambs fed crushed date palm at Siwa Oasis.	52
<b>4</b>	Analysis of variance for rectal temperature (RT) and skin temperature (ST) of Barki lambs fed crushed date palm at Siwa Oasis.	53
<b>5a</b>	Means $\pm$ SE of monthly respiration rate (RR, rpm) of both males and female Barki lambs at Siwa Oasis.	57
<b>5b</b>	Means $\pm$ SE of monthly heart rate (HR, bpm) of both males and female Barki lambs at Siwa Oasis.	57
<b>6</b>	Analysis of variance for respiration rate (RR) and heart rate (HR) of Barki lambs fed crushed date palm at Siwa Oasis.	58
<b>7</b>	Means $\pm$ SE of monthly live body weight (LBW, kg) of both males and female Barki lambs at Siwa Oasis.	61
<b>8</b>	Analysis of variance for live body weight (LBW) of Barki lambs fed crushed date palm at Siwa Oasis.	61
<b>9</b>	Means $\pm$ SE of post-weaning growth parameters in male and female Barki lambs fed crushed date palm at Siwa Oasis.	64

<b>10</b>	Analysis of variance of post-weaning growth parameters in male and female Barki lambs fed crushed date palm at Siwa Oasis.	65
<b>11a</b>	Means $\pm$ SE of hemoglobin concentration (Hb, g/dl) of male and female Barki lambs fed crushed date palm at Siwa Oasis.	66
<b>11b</b>	Means $\pm$ SE of hematocrit percentage (Ht, %) of male and female Barki lambs fed crushed date palm at Siwa Oasis.	67
<b>11c</b>	Means $\pm$ SE of erythrocytes count (RBCs, $10^6/\text{mm}^3$ ) of male and female Barki lambs fed crushed date palm at Siwa Oasis.	67
<b>12</b>	Analysis of variance for hemoglobin (Hb), hematocrit (Ht) and erythrocytes count (RBCs) of Barki lambs fed crushed date palm at Siwa Oasis.	69
<b>13</b>	Means $\pm$ SE of mean corpuscular volume (MCV, fl), mean corpuscular hemoglobin (MCH, pg) and mean corpuscular hemoglobin concentration (MCHC, %) of male and female Barki lambs fed crushed date palm at Siwa Oasis.	72
<b>14</b>	Analysis of variance for mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) of Barki lambs fed crushed date palm at Siwa Oasis.	73
<b>15</b>	Means $\pm$ SE of total leukocytes (WBC's, $10^3/\text{mm}^3$ ) in male and female Barki lambs fed crushed date palm at Siwa Oasis.	76
<b>16</b>	Means $\pm$ SE of Lymphocytes percentage (Lym, %) in male and female Barki lambs fed crushed date palm at Siwa Oasis.	77
<b>17</b>	Means $\pm$ SE of Neutrophils percentage (Nut, %) in male and female Barki lambs fed crushed date palm at Siwa Oasis.	77
<b>18</b>	Analysis of variance for total leukocytes (WBC's), Lymphocytes (Lym) and Neutrophils percentage (Nut) for	78