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

Cairo University

Faculty of Veterinary Medicine

Influence of thermal manipulations on quail embryo during embryogenesis and post hatching

Thesis presented by

Saad Nazeh Saad Abd El-Fatah

B.V.Sc., Cairo **U**niversity**, 2017**

Thesis submitted to

Cairo **U**niversity

For the Master`s degree in Veterinary Medical Sciences

(**A**natomy and **E**mbryology)

Under the supervision of

***Prof. Dr.* El-Sayed Fath Mohamed Khalifa**

Professor of Anatomy & Embryology

Faculty of Veterinary Medicine

Cairo University

***Prof. Dr.* Hamdy Mahmoud Rizk**

Professor of Anatomy & Embryology

Faculty of Veterinary Medicine

Cairo University

***Dr.* Karim Mohamed Khalil**

Lecturer of Anatomy & Embryology

Faculty of Veterinary Medicine

Cairo University

2021

Supervision Sheet

***Prof. Dr.* El-Sayed Fath Khalifa**

Professor of Anatomy and Embryology

Faculty of Veterinary Medicine

Cairo University

***Prof. Dr.* Hamdy Mahmoud Rizk**

Professor of Anatomy & Embryology

Faculty of veterinary medicine

Cairo University

***Dr.* Karim Mohamed Khalil**

Lecturer of Anatomy & Embryology

Faculty of veterinary medicine

Cairo University

2021

Cairo University
Faculty of Veterinary Medicine
Anatomy Department

Name: Saad Nazeh Saad Abd El-Fatah **Nationality:** Egyptian

Date of Birth: 5 / 1 / 1994 **Place of Birth:** El Behera governorate

Specialization: Anatomy & Embryology **Degree:** *Master*

Title of Dissertation: Influence of thermal manipulation on quail embryo during embryogenesis and post Hatching

Under supervision of:

Prof. Dr. **El-Sayed F. Khalifa** *Professor* of Anatomy & Embryology, Faculty of Vet. Med., Cairo Univ.

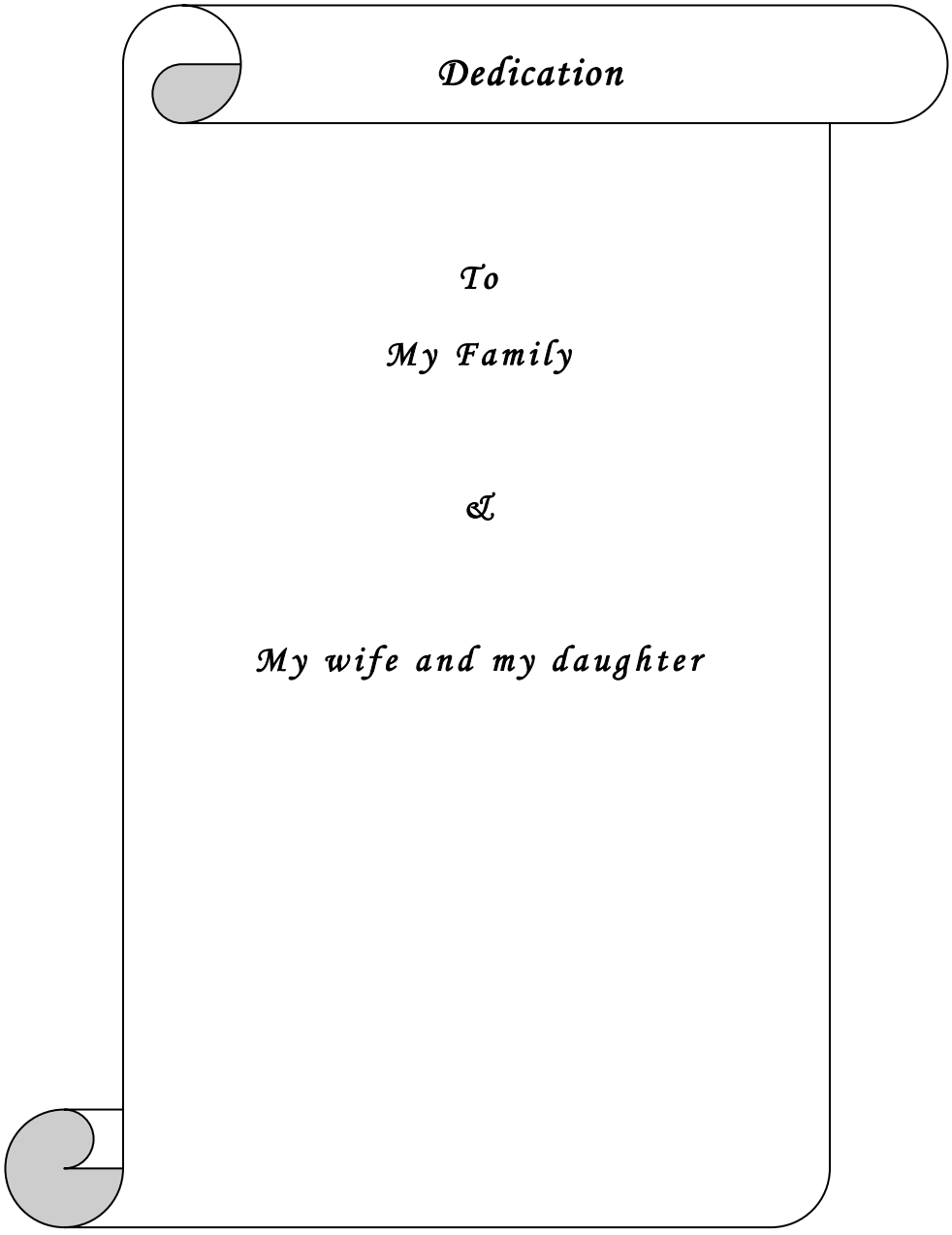
Prof. Dr. **Hamdy M. Rizk** *Professor* of Anatomy & Embryology, Faculty of Vet. Med., Cairo Univ.

Dr. **Karim M. Khalil** *Lecturer* of Anatomy & Embryology, Faculty of Vet. Med., Cairo Univ.

Abstract

Japanese quail embryo thermal manipulation was known as an effective protocol in improving post-hatch growth performance parameters and thermotolerance acquisition in association with several modifications in molecular, physiological and biochemical parameters. The aim of current study is to elucidate the onset and long-term effects of intermittent thermal manipulations during two-time window, early / late, of embryogenesis in Japanese quail (*Coturnix japonica*) on embryonic development, hatchability, muscle histogenesis carcass traits, internal organ weights and post hatch growth performance as well as on the expression of Myostatin & Pax7 genes during embryogenesis. The eggs of control group (Ctrl) was incubated at 37.7°C and 55% RH. Three thermally treated groups were incubated intermittently at 41°C and 65% RH intermittently (3 hours / day): Group (EE) during early embryogenesis (ED6 – ED8), group (LE) during late embryogenesis (ED12 – ED14), and group (EL) was thermally treated in both time window (early and late). The hatched chicks were reared under optimal managemental conditions (3 replicates per treatment). The results revealed that TM lead to significant hypertrophy of quail breast muscle in the early embryonic group (EE) without any negative effects on embryonic development, yolk consumption, hatchability, carcass traits and breast meat characteristics. Intermittent short-term (3 – 6h) thermal manipulation (39 - 40°C) protocols during early embryogenesis (ED6 – ED8) could be recommended as a safe and effective protocol to enhance muscle mass growth and breast muscle yield in quail broilers.

Keywords: *Coturnix japonica*; Embryogenesis; Growth performance; Thermal manipulation


Dedication
To
My Family
&
My wife and my daughter

Acknowledgment

*First of all, prayerful thanks to **ALLAH**, for everything.*

Special appreciation is warmly expressed to my dear supervisor

***Prof. Dr. El-Sayed F. Khalifa** for his supervision, invaluable support, valuable criticism and for his diligent effort, especially to his inspiration, encouragement and forbearance at all time.*

*My sincere thanks to **Prof. Dr. Hamdy M. Rizk** for his supervision, indispensable support, sincere cooperation, wrathful advices and generous help throughout the work. This research would not have been possible without his patience and support. I am equally thankful to **Dr. Karim M. Khalil** for his supervision, encouragement and generous help throughout the work.*

*I would like to express my thanks to **Dr. Hamdy M. Zaki**, lecturer of Meat Hygiene and Control, FVMCU for his continuous support, efforts and assistance in performing the practical part of this study to determine the quail meat quality parameters and quail carcass traits. I am thankful to **Dr. Hisham A. Abdelrahman** lecturer of Veterinary Hygiene and Management, FVMCU for his assistance in designing the experiments and performing statistical analyses. My thanks to **Dr. Hassanein H. Abo-zeid** Lecturer of poultry diseases, FVMCU for his help in performing gene expression analysis. I am thankful to **DVM. Mohamed A. Awad** for his assistance in histological analyses. I am also thankful to **DVM. Mahmoud Gamal** for his assistance in molecular analysis analyses*

Finally, it is great pleasure for me to express my thanks and gratitude to all members of Anatomy and Embryology Department for their continuous guidance and support.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

Abbreviations and Symbols

-bHLH	basic helix loop helix
-bp	Base pair
-cDNA	Complementary DNA
-CTRL	Control group
-DIO2/-DIO3	type 2 iodothyronine deiodinase-Thyroxine 5-deiodinase 3
- GAPDH	Glyceraldehyde 3-phosphate dehydrogenase
-ED	Embryonic day
-EE / LE / EL	Early embryonic / late embryonic / early-late embryonic
-MSTNR/F	Myostatin reverse / forward primer
-ETM	Embryonic thermal manipulation
-FVMCU	Faculty of veterinary medicine, Cairo University
-GAPDHR/R	Glyceraldehyde 3-phosphate dehydrogenase reverse/forward
-GH	Growth hormone
-H&E	Hematoxylin and eosin stain
-IACUC	institutional animal care and use committee
-Pax7	Paired pox protein 7
-MRF 4	Myogenic regulatory factor 4
-MSTN	Myostatin
-Myf5	myogenic factor-5
-MyoD	myoblast determination protein
-NBF	neutral buffered formalin
-PaxR/F	Paired pox protein reverse /forward primer
-IGF1	Insulin growth factor 1
-PCNA	proliferating cell nuclear antigen
-LPS / IL-6	Lipopolysaccharide / interleukin -6
-qRT-PCR	Quantitative real time Polymerase chain reaction
-RH	Relative humidity
-T3 and T4	Triiodothryronine and Tetraiodothryronine
-TGF-β	transforming growth factor-beta

Chapter (1):

Introduction

INTRODUCTION

Several species of quail are present worldwide, the Japanese quail (*Coturnix japonica*) is the smallest avian species reared for egg and meat production also it has a global importance as a laboratory animal ***(Huss, Poynter, & Lansford, 2008)***. Japanese quail is characterized by short generation interval and can produce 3 to 4 generations per year, so it is an important laboratory and economic animal model in biological and embryological researches ***(Minvielle, 2004).*** For many decades, the applied incubation temperatures were kept relatively constant throughout the incubation period in order to avoid possible deleterious effects of temperature changes on embryogenesis, hatchability and chick quality ***(Krausova & Peterka, 2007)***. In the fact, the natural incubation temperature fluctuates widely ***(Webb, 1987)***. So many studies have proved that carefully manipulation of incubation temperature during critical period within embryogenesis may induce alterations in the bird's metabolism and performance ***(Piestun et al., 2011)***. Therefore, when conducting thermal manipulation during incubation, consideration of three major aspects should be put in mind: timing, temperature degree, and length of exposure (duration). Subsequently the period in which to apply thermal manipulation during embryogenesis should be selected to match the specific physiological system to be affected and also should be connected with the development of hypothalamic-hypophyseal-thyroid axis and

hypothalamic-hypophyseal-adrenal axis ***(Piestun, Harel, Barak, Yahav, & Halevy, 2009; Piestun, Yahav, & Halevy, 2015; Yahav, Collin, Shinder, & Picard, 2004)***.

Embryo thermal manipulations during incubation do not restricted to high temperatures only ***(Yalcin & Siegel, 2003)*** but also include exposure to low temperatures during a certain time window of embryogenesis ***(Yahav, Collin, et al., 2004)***. Several studies in chickens and turkey illustrated that embryos are highly sensitive to elevated incubation temperature in early stages than late stages of incubation ***(Ande & Wilson, 1981; Moreng & Shaffner, 1951; Romanoff, Smith, & Sullivan, 1938)***, and the greater tolerance of embryos to high incubation temperature in late stages of incubation depends on embryo adaptation to high metabolic energy produced in the second half of incubation ***(French, 1997)***. Broilers spend up to 35% of its total life inside the egg and any factor affecting positively or negatively the growth and development during embryogenesis can have a significant long-lasting effect on post hatch performance ***(Hulet, Gladys, Hill, Meijerhof, & El-Shiekh, 2007)***. ***Hamburger and Hamilton (1992)*** showed that the entire process of chick embryogenesis can be segmented into 3 major stages: 2 early stages during which organogenesis occur and the last phase, starting at ED13, during which growth and maturation occur. Embryonic TM is a very effective protocol that improves thermotolerance acquisition that alleviates heat stress