INFLUENCE OF IN OVO INJECTION OF SELENIUM NANOPARTICLES AND SELENOMETHIONINE ON GROWTH, DEVELOPMENT OF EMBRYOS, PHYSIOLOGICAL AND IMMUNE RESPONSE OF CHICKENS

By

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B.Sc. Agric. Sci. (Animal Prod.), Fac. Agric., Cairo Univ., 2002

M.Sc. Agric. Sci. (Poultry Prod.), Fac. Agric., Cairo Univ., 2010

A Thesis Submitted in Partial Fulfillment

Of

The Requirements for the Degree of

DOCTOR OF PHILOSOPHY

in

Agricultural Sciences

(Poultry Physiology)

Department of Poultry Production

Faculty of Agriculture

Ain Shams University

2018

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ABSTRACT

Mohamed Mokhtar Abd El-Fatah: Influence Of In Ovo Injection Of Selenium Nanoparticles and Selenomethionine on Growth, Development Embryos And Physiological And Immune Response Of Chickens. Department of poultry Production, Faculty of Agriculture, Ain Shams University, 2018

This study aimed to investigate the effect of in ovo injection of broiler eggs with different levels and forms of selenium on growth performance, some physiological traits and blood parameters of posthatch broiler chicks. A total of 300 eggs obtained from a commercial Arbor Acres broiler breeder flock, were used in the present study. They were divided randomly into six treatment groups, 50 eggs each. The first one was kept as a control – non injected group, the second group was injected with phosphate buffer saline (PBS) , the 3rd and 4th groups were injected with organic selenium (Se-Methionine) at 50 and 100 ug/egg , while the 5th and 6th groups were injected with selenium nanoparticles (SeNPs) at 10 and 20 ug /egg, respectively . All eggs were incubated in a forced draught incubator at the recommended temperature, relative humidity and turning patterns. The in ovo injection procedure was done at the 16th day of incubation.

The results showed that supplementation of different sources of Se did not significantly affect growth performance traits. Supplementation of Nano-Se increased plasma concentrations of total protein, albumin, high-density lipoprotein glutathione peroxidase, superoxide dismutase, triiodothyronine, triiodothyronine /Tetra-iodothironin and plasma immunoglobulins concentration (IgG. IgM and IgA), and decrease glucose and ALT. However, no significant differences in globulin, A/G ratio, cholesterol, triglyceride, AST, alkaline phosphatase, total antioxidant capacity and Tetra-iodothironin levels. Nano-Se-injected groups had higher relative weights of spleen and heart than control. It can be concluded that the use of 20 ug /egg of Nano-Se caused an

improvement in growth performance and immune response without negative effects on blood constituents.

Keywords: Nano selenium, growth performance, blood parameters, immune response, broiler chicks.

ACKNOWLEDGEMENT

Thanks to AllAH, the most gracious, beneficent and merciful for his induced blessing to achieve goals and make them possible.

The author heartily wishes to express his deepest thanks and gratitude to **Dr. Ibrahim El-Wardany El-Sayed Hasan** Prof. of Poultry Physiology, Department of Poultry Production, Faculty of Agriculture. Ain Shams University, for his close supervision, suggesting the problem, encouragement, keep follow up of the work and great help in writing, revising and preparation the thesis.

Deep thanks are due to **Dr. Ehab Ahmed Abdullah**, Head Researcher of Poultry Physiology, Department of Poultry Breeding, Animal Production Research Institute, for his kind supervision, great help in writing and fruitful advice during the whole experimental period.

My deepest thanks to **Dr. Marwa Shaaban Sayed Abdo**, Lecturer of Poultry Physiology, Department of Poultry Production, Faculty of Agriculture, Ain Shams University, for her close supervision, keen help, valuable advices and suggestions during the field work and in revising the manuscript.

I am grateful to the staff members of the Department of Poultry Production, Ain Shams University, and those of the Department of Poultry Breeding, Animal Production Research Institute, Agriculture Research Center for their support and help during my study. I also offer my regards and blessing to all my friends and those who assistance and supporting me in any respect during the completion of this thesis.

Special thanks and gratitude are expressed to **Prof. Dr. Sayed Shalash**, Consultant and Professor of Poultry Nutrition for his great help in suggesting the problem and for providing the facilities of the present study. Thanks are also expressed to **Dr. Wahib Metri**, AGRI-VET for Manufacturing Vitamins and Feed additives, for his help in providing feed additive for the experimental work.

Special deep appreciation is given to my mother and my sisters for their encouragement and moral support throughout my life.

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INTRODUCTION

The environmental stress can decrease production and all other important economical traits in animal husbandry. The stress is caused by free radicals and reactive oxygen species. Gaseous exchanges and high metabolic rates during embryonic development can lead to the production of reactive oxygen species (ROS) free radicals **(Halliwell, 1994)**. These free radicals can cause cellular damage leading to peroxidation. Antioxidants play an important role in combating these substances and providing protection to cells and the developing embryo overall **(Surai *et al.*, 1996)**. Rapid growth coupled with a high nutrient requirement, especially during late embryogenesis, may make in ovo feeding of supplemental nutrients beneficial to poultry. Thus supplementing the amnion with appropriate nutrients is a novel way to feed critical dietary nutrients to embryos **(Uni and Ferket, 2003).**

Selenium is known as an essential trace element for animals and humans with a variety of biological functions. It plays important roles in the regulation of thyroid hormone metabolism, cell growth and antioxidant defense systems. There is widespread concern in the animal industries that the National Research Council (NRC) minimum recommendation is not sufficient to prevent production losses due to selenium deficiency syndromes; therefore, there is continued research into alternative selenium sources and alternative selenium supplementation levels **(Surai, 2006)**.

Nanotechnology is the emerging field to study the control of matter at atomic or molecular scale, and device techniques which can use the unique behavior exhibited by matter at such small scales. This nanoparticle has produced positive responses when fed as an alternative to the conventional mineral sources. Nano minerals are having a great potential as mineral feed supplements in animals even at very lower doses than the conventional organic and inorganic sources. Since, *in ovo* administration of nanoparticles, may be seen as a new method of Nano-

nutrition, providing embryos with an additional quantity of nutrients (**Liao *et al.*, 2010)**.

With the recent development of nanotechnology, Nano selenium (Nano Se) has attracted widespread attention because nanometer particulates exhibit novel characteristics such as a large surface area, high surface activity, high catalytic efficiency, strong adsorbing ability and low toxicity **(Wang *et al.*, and Zhang *et al.*, 2008)**. Nano elemental selenium (Nano-Se), which is bright red, highly stable, soluble and of Nano defined size in the redox state of zero (Se 0), has been manufactured for use in nutritional supplements and developed for applications in medical therapy **Wang *et al*., 2007)**.

Therefore, the present study was conducted to evaluate the possible effect(s) of *in ovo* injection of broiler eggs with different levels and forms of selenium on growth performance, some immunophysiological traits and blood parameters of posthatch broiler chicks.

REVIEW OF LITERATURE

1. Nanotechnology

Nanotechnology is the emerging field to study the control of matter at atomic or molecular scale, and device techniques that can use the unique behavior exhibited by matter at such small scales. Conventionally, a nano-material is defined as having at least one dimension in length, of a feature, between 1 nm and 100 nm. Many researchers, instead, would consider a material as nano-material if it exhibits some unique properties that are different from the conventional or bulk material, and it can be applied in a novel approach, irrespective of the above limits. Historically, Indian craftsmen and artisans obliviously used nanomaterials for making wootz steel and paintings since 2000 years ago (**Ochekpe *et. al.*, 2009 and Hobson 2004).**

The first observation of colloidal gold nanoparticles was achieved by Richard Adolf Zsigmondy, in the first decade of the 20th century, using an ultramicroscope (**Zsigmondy, 1914)**. With the development of such techniques and instruments enabling the researchers to synthesize and characterize nanomaterials, nanotechnology started taking ground **(Miyazaki and Islam, 2007)**. A major boost to the field came with the invention of carbon nanotubes by Ijima in 1991, which widely generated vast interest and new ideas about the possibilities and application of this new nanomaterial and nanotechnology **(Miyazaki and Islam, 2007 and Iijima,1991)**.

Nano-materials exhibit novel properties, such as great specific surface area, high surface activity, a lot of surface active centers and high catalytic efficiency **(Gao and Hiroshi, 2005)**. Due to the advantage of size effect and high surface reactivity, nanoparticle has been already used in pharmaceutical applications to increasing the bioavailability of drugs and targeting therapeutic agents to particular organs (**Florance *et al.*, 1995 and Davda & Labhasetwar 2002)**. It has been reported that nanoparticle showed new characteristics of transport and uptake and