SEX REVERSAL IN THE DOMESTIC FOWL

By

ALY ABDEL-MOOMEN BAKIR

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APPROVAL SHEET

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By

ALY ABDEL-MOOMEN BAKIR

APPROVED BY :

M. A. Mwafi

S. Kathy

S. A. Helmy

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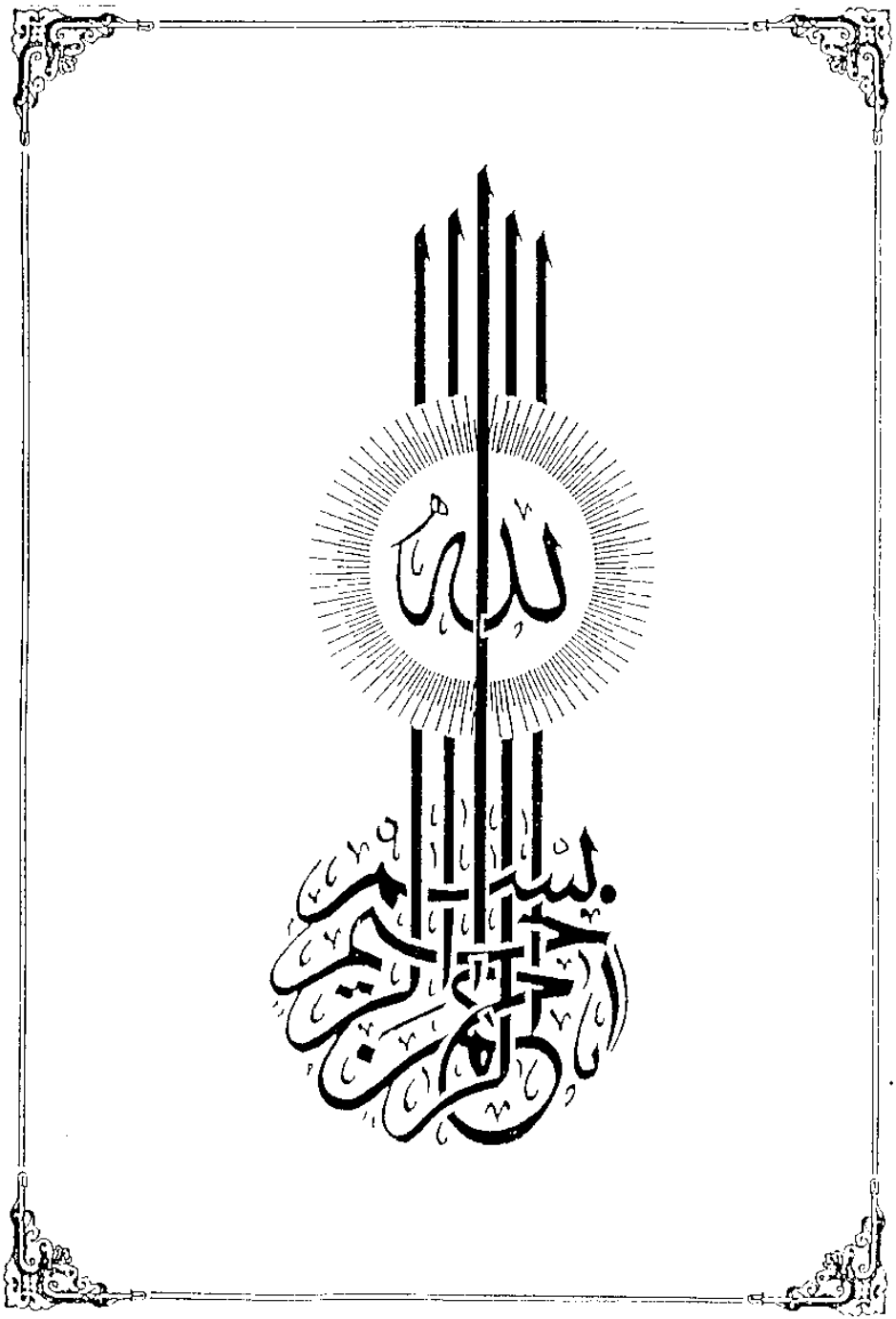

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INTRODUCTION

During the past twenty five years there had been an increasing interest in the effect of sex hormones on the embryonic sexual differentiation in domestic fowl. The biological process is of practical interest to those interested in the egg production industry because there is no commercial outlet for the roosters; consequently millions must be disposed of annually.

This study was conducted with the following objectives :

1. To determine the effect of hormonal treatment on hatchability.
2. To compare the genetic sex ratio of the treated chicks with that determined by vent sexing at hatching time.
3. To determine the effect of hormonal treatment on the post-natal body weight and mortality.
4. To determine the effect of injecting Dokki 4 fertile eggs with female sex hormone at the fourth day of incubation on the development of the reproductive organs and the secondary sex characteristics of chicks at different ages from hatching to 28 weeks of age.

5. To confirm sex modification by histological examination of the reproductive organs at different ages from hatching to 28 weeks of age.

REVIEW OF LITERATURE

The classic case of Freemartin has demonstrated beyond any doubt that sex hormones were involved in embryonic sex differentiation (Lillie, 1916 and 1917). In such case, the two embryos, one male and one female shared a common blood supply during their intra-utrine life. The ultimate result was that the newborn female, known as the free-martin; had her ovaries modified into testis and male sex ducts were developed. Such a modified female is usually sterile.

Freemartinism was observed also in birds. Rush (1961) demonstrated that the testes of 22 male chicks hatched from double-yolked eggs showed slight feminization when they were examined at 15-18 days. He attributed this modification to the resorption of estrogenic substances in the 2 yolks which was probably double the amount of hormone in a normal embryo.

The first attempt to experimentally duplicate the freemartin condition, was undertaken by grafting experiments. Minoura (1921) grafted small pieces of testes or ovaries from birds of different ages into 9 days old embryos, growing chicks and adult fowl. In some of the successful grafts, slight modifications of the gonads were noted in

both sexes. Minoura concluded that the gonadal development and sexual differentiation of one sex was stimulated by the hormonal secretions of the gonad of the opposite sex.

With the isolation and chemical purification of sex hormones around 1930, it became relatively easy to study the normal sexual differentiation of chicks, and activity in this feild of biological investigation increased rapidly.

Kozelka and Gallagher (1934) reported that when genetic male chick embryos were treated with female hormone preparations (theelin and theelol) some degree of sex reversal was produced which varied from ovotestis in the left gonad to ovary-like structures in both gonads. The degree of reversal was found to be proportional to hormonal dosage.

Wolff and Pinot (1961) found that when chicken eggs were treated with estrogen before the 5th days of incubation the amount of cortical tissues in the right gonad of chick embryos increased.

Witschi (1965) postulated that, in tetrapod vertebrates, where the cortex of the gonad is inductor of ovarian differentiation, and the medulla induces testicular development, secretions of the hilar region of the medulla are

relatively weak in masculinizing effects, and do not induce either male or female differentiation of primary gonia throughout the fetal period. Further, he stated that in the normal adult ovary, this region seems to become a center of production of weak androgens, which are some of the precursors of estrogens.

I. Time of Injection and its Effect on Embryonic Sex Differentiation

It has been noted that the time of injection is important to the relative effectiveness of gonadal hormones on modifying embryonic sexual differentiation. In general the most effective time of treatment is prior to or during the time of sexual differentiation commencement, i.e., during the first six days of incubation. Treatment after the seventh day of incubation failed to produce any positive results (Lillie 1917, Willier 1927, Willier, et al. 1937, Kondo 1959, Hamilton 1961, Pincus and Erickson 1962 and Morgan and Greb 1963).

In ducks, Lewis (1946) found that the greatest modifications occurred when estrogen was injected on the fourth day of incubation. Injections made on the fifth or sixth day gave good results, although they were not as effective as treatments made on the fourth day.

Boss and Witschi (1947) found that herring gulls eggs which received 2.5 u.g. stilbestrol on the third day of incubation underwent more complete feminization than males which received the same dosage on the sixth day of incubation.

Lewis and Domm (1948) stated that the bulla of male White Pekin ducks underwent a transformation in the female direction following injection of hexoestrol into the incubated eggs between the fourth and tenth days of incubation. Injections made between the twelfth and sixteenth days caused the bulla to become intersexual in character. Injections on or after the eighteenth day had no noticeable effect.

Snedecor (1949) reported that in White Leghorn embryos the ability of the male to undergo feminization was much less pronounced when estrogen was injected on the sixth day as compared to injection on the second, third or fifth day of incubation.

Narbaitz and Teitelman (1965) found that the male chick embryos underwent feminization when injection was done on the fourth day of incubation.

Ali (1967) found that when chicken eggs were injected with sex hormones on the first day of incubation

produced more morphological sexual differentiation than when the injection was made on the sixth day of incubation.

II. Site of Injection and its Effect on Embryonic Sexual Differentiation

Injection of sex hormones into fertile eggs before sexual differentiation has been completed was known to affect embryonic development of the reproductive tract of both sexes (Domm 1939 and Witschi 1939).

Godfrey (1950) found that the injection of sex hormones into fertile turkey eggs via the air cell or the albumen allowed the hormones to penetrate and reach the developing embryos. However, Jaap, et al. (1951) reported that estrogen injection into the albumen near the site of the embryo resulted in more nearly complete sex reversal than into the air cell of turkey eggs.

According to Van Tienhoven (1957), who stated that Seltzer (1956) was able to control the sex of hatched chicks by dipping them in hormone solution. However, he disputed this claim and reported that dipping eggs in testosterone propionate solution produce no changes in all cases examined. This was attributed either to failure

of the testosterone propionate to penetrate the egg or to lack of persistancy of any effects produced.

Mellen (1957) using the same method of dipping the eggs, found none of the effects reported by Seltzer (1956) and concluded that dipping chicken eggs into an ethanol solution of estrogen before incubation was not an effective mean of introducing estrogens into eggs.

Haye (1959) reported traces of oviducts in genetic male chicks hatched from eggs dipped in estrogenic solution (Ger sex). No gross changes of the genitalia were found in the female.

III. Breed Response

Breed differences in response to sex hormone treatment during the period of embryonic development are of considerable interest.

Gaarenstroom (1939) reported a response difference between embryos of two breeds; Rhode Island Red and White Leghorn chickens. Rhode Island Red embryos responded less readily to estradiol benzoate, as shown by a lower incidence of Mullerian ducts, when compared with the embryos of White Leghorn.