# EFFECT OF CRYSTALLINE PROGESTERONE LEVELS ON OVARIAN CHANGES OF LOHMANN BROWN HENS

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## ABSRACT

The experiment was conducted at the Teaching and Research Farm of the Department of Animal Science, Bayero University, Kano to determine the effect of crystalline progesterone on ovarian changes of eighteen Lohmann Brown hens between March to July, 2017. A single factor completely randomized design was used with each treatment replicated three times. Six different doses (0, 5, 10, 15, 20 and 25 mg/bird) of crystalline progesterone were administered intramuscularly via the keel muscle twice a week for a total period of six weeks. Data obtained were analyzed using GraphPad InStat® statistical package. Results revealed that median ovulation rate (33.3%) in the 5 mg crystalline progesterone group decreased significantly by a magnitude of 66.7% when compared to its corresponding value (100%) in control birds.No significant changes were observed in median weights of ovarian stroma and oviduct across crystalline progesterone treatment groups.Significant decrease was recorded in median count of large yellow follicles across crystalline progesterone treatment groups.There were no significant differences in median counts of small yellow, large white and medium white follicles. In conclusion, crystalline progesterone has effect on the birds ovulation rate, large yellow follicle count, laying pause days, egg sequence length, egg shell weight and egg yolk and albumen volumes in Lohmann Brown hens. It is therefore commended that crysteline progesterone could administerd on laying birds up to 20 mg.

**Key word:** Crystalline Progesterone, Ovarian, Lohmann Brown Hens

## INTRODUCTION

The term poultry is used on birds domestically raised primarily for the economic purpose of producing eggs and meat. Poultry production involves egg and meat production from egg type and broiler chickens (Kumaravel, Hema & Kamaleshwari, 2012). Poultry meat and eggs offer considerable potential for meeting human needs for dietary supply of animal protein (Folorunsho & Onibi, 2005). Egg production in laying hens is a process that takes around 24 to 27 hours (Akbas, Unver, Oguza & Altan, 2002). The Lohmann Brown strain of chicken is an early maturing hybrid bird which is among the best egg producers with good quality eggs and excellent feed conversion rate (Lohmann Tierzucht, 2015). The Lohmann Brown strains are easy to manage and are adaptable to all types of production systems with laying commencing at about 18 weeks of age, producing about 300 to 320 eggs in a year (Lohmann Tierzucht, 2015). Eggs are the major business output in commercial egg production and the higher the egg production the better will be the profit (Farooq, Mian, Ali, Durrani Asghar, & Mugarrab, 2001). Hormones are very essential for poultry reproductive functioning (Johnson & Tilly, 1990). Progesterone is a hormone secreted by granulosa cells of large mature hierarchical follicles (F1) in birds (Bahr, Wang, Huang & Calvo, 1983). It acts at the level of the ovary to stimulate the luteinizing hormone surge for ovulation. Its production by F1 follicle peaks 6 to 8 hours prior to ovulation (Johnson & van Tienhoven, 1984). Progesterone triggers release of gonadotropin-releasing hormone (GnRH) by the hypothalamus. This in turn is followed by an increase in luteinizing hormone and follicle stimulating hormone release from the anterior pituitary (Bahr *et al*., 1983). The luteinizing hormone stimulates an even greater output of progesterone by the granulosa cells of the F1 follicle, completing the positive feedback loop and producing the LH peak 4 to 6 hours prior to ovulation (Tanabe, Nakamura, Tanase & Dior, 1981). The present study aimed at determining the effect administration of exogenous progesterone on ovarian changes of loman Brown hen.

### Experimental Location and Duration of Study

The study was conducted at the Poultry Unit of the Teaching and Research Farm of the Faculty of Agriculture, Bayero University Kano (GPS coordinates: N11.97643°, E008.42995°) for a duration of six weeks.

**Experimental Design and Treatment**

The experiment was laid in a Single Factor Completely Randomized Design, comprising six treatments replicated three times. The six treatments were 0, 5, 10, 15, 20 and 25 mg crystalline progesterone/bird. These doses were administered via the breast muscle between 10 and 11 am on Mondays and Thursdays throughout the experimental period.

**Oviposition Pattern**

Oviposition pattern comprising number of egg sequences, egg sequence length, pause days and intersequence pause length were determined according to the procedure described by Blake, Balander, Flegal and Ringer (1987).

**Statistical Analysis**

To determine the effect of crystalline progesterone on ovarian changes, oviposition pattern, laying performance and egg quality parameters, Kruskal-Wallis Test was used. Where significant effects exist, mean rank differences were compared using Dunn's Multiple Comparisons Test. Graphpad Instat package (Graphpad InStat®, version 3.05, 32 bit for Win 95/NT, Graphpad Software Inc., 2000) was used for the statistical analysis.

## RESULTS AND DISCUSSION

**Ovarian Changes**

The effect of crystalline progesterone levels on oviduct weight in Lohmann Brown hens is presented in Table 2. There was no statistically significant ($P>0.05$, Kruskal-Wallis Statistic = 9.075) difference in median oviduct weights (74.5, 46.0, 26.0, 38.5, 30.0 and 47.0) across progesterone treatments. The minimum oviduct weights recorded were 74.5, 32.0, 20.0, 30.0, 20.0 and 46.0 g across 0, 5, 10, 15, 20 and 25 mg crystalline progesterone treatment groups, respectively. Crystalline progesterone treatments levels (0, 5, 10, 15, 20 and 25 mg) recorded respective maximum oviduct weights of 76.8, 60.0, 31.0, 47.0, 52.0 and 51.0 g.

Chronic injection of progesterone has been shown to increase baseline concentrations of progesterone and result in arrested laying and disrupted distribution of hierarchical follicles in turkeys (Liu *et al*., 2001; Bacon & Liu, 2004). High baseline concentrations of progesterone in arrested hens might negatively feedback on the ability of the hypothalamus to secrete surges of GnRH and subsequently surges of LH, or on the ability of the pituitary to respond to surges of GnRH secretion if they occur (Liu *et al*., 2001; Bacon & Liu, 2004; Liu & Bacon, 2005). This could explain the dose-dependent decrease in ovulation rate, count of large yellow follicles, number of eggs laid and egg sequence length in the current work due to low GnRH and LH which subsequently translates into low endogenously produced progesterone. Also, no egg was produced at crystalline progesterone dose beyond 5 mg probably due to strong negative effect on egg production rate and hierarchical follicular maintenance and development (Zaghari, Taherkhani & Honarbakhsh, 2009). It is also evident that, though the decrease in egg production started as early as when 5 mg crystalline progesterone was administered, reduction in egg production to the level of zero production manifested as the dose of crystalline progesterone was increased to 10, 15, 20, and 25 mg. The arrested laying and disruption in hierarchical follicles observed in the present study agrees with results of Liu *et al.*, (2001) and Bacon and Liu (2004).

In conclusion, intramuscular administration of crystalline progesterone to actively laying Lohmann Brown hens affected ovulation rate, large yellow follicle counts, laying pause days, number of egg sequence, egg sequence length, egg yolk and albumen volumes, and egg shell weight.

Table 1 Summary Statistics, KW Statistic and Selected Pairs Dunn's Multiple Comparisons Test for Ovulation Rate across Crystalline Progesterone Treatments in Lohmann Brown Hens

| Crystalline Progesterone (mg) | N | Median | Minimum | Maximum | Sum of Ranks | Mean of Ranks | Kruskal-Wallis (KW) Statistic, corrected for ties |
|---|---|---|---|---|---|---|---|
| 0 | 38 | 100.00 | 33.33 | 100.00 | 7613.0 | 200.340 | |
| 5 | 38 | 33.33 | 0.00 | 100.00 | 5474.0 | 144.050 | 134.29*** |
| 10 | 38 | 0.00 | 0.00 | 100.00 | 3298.5 | 86.803 | |
| 15 | 38 | 0.00 | 0.00 | 100.00 | 4116.5 | 108.330 | |
| 20 | 38 | 0.00 | 0.00 | 66.67 | 3153.0 | 82.974 | |
| 25 | 38 | 0.00 | 0.00 | 0.00 | 2451.0 | 64.500 | |

| Comparison | Mean Rank Difference | Level of Significance |
|---|---|---|
| 0 mg *vs*. 5 mg | 56.289 | *** |
| 0 mg *vs*. 10 mg | 113.540 | *** |
| 0 mg *vs*. 15 mg | 92.013 | *** |
| 0 mg *vs*. 20 mg | 117.370 | *** |
| 0 mg *vs*. 25 mg | 135.840 | *** |
| 5 mg *vs*. 10 mg | 57.250 | *** |
| 5 mg *vs*. 15 mg | 35.724 | * |
| 5 mg *vs*. 20 mg | 61.079 | *** |
| 5 mg *vs*. 25 mg | 79.553 | *** |
| 15 mg *vs*. 20 mg | 25.355 | ns |
| 15 mg *vs*. 25 mg | 43.829 | ** |

ns=not significant; ***P<0.001, **P<0.01, *P<0.05

Table 2 Summary Statistics (including KW Statistic) for Oviduct Weight across Crystalline Progesterone Treatments in Lohmann Brown Hens

| Crystalline progesterone (mg) | n | Median | Minimum | Maximum | Sum of Ranks | Mean of Ranks | Kruskal-Wallis (KW) Statistic, corrected for ties |
|---|---|---|---|---|---|---|---|
| 0 | 3 | 74.50 | 58.5 | 76.8 | 47.0 | 15.667 | |
| 5 | 3 | 46.00 | 32.0 | 60.0 | 30.5 | 10.167 | |
| 10 | 3 | 26.00 | 20.0 | 31.0 | 10.5 | 3.500 | $10.220^{ns}$ |
| 15 | 2 | 38.50 | 30.0 | 47.0 | 15.0 | 7.500 | |
| 20 | 3 | 30.00 | 20.0 | 52.0 | 19.0 | 6.333 | |
| 25 | 3 | 47.00 | 46.0 | 51.0 | 31.0 | 10.333 | |

n = not significant, P>0.05

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