Pakistan
Journal of Biological Sciences

Effect of Progesterone Secretion on Egg Production in the Grey Helmet Guinea Fowl (*Numida meleagris galleata*)

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Abstract: The effect of progesterone (P_4) on egg production was investigated using twenty female guinea fowls raised on deep litter. The birds were given feed and water *ad-libitum*. They were routinely bled by wing jab between the hours of 9.00 and 10.00 am twice a month for P_4 determination. Sera harvested from the samples were stored at -20°C until assayed for P_4 by Radio-Immuno-Assay method (RIA). Egg production had a very high (p<0.001) and positive correlation with progesterone level. A high value of coefficient of determination (R^2 value) was observed, which implies that there is a high accuracy of prediction of egg production from progesterone level.

Key words: Helmet Guinea fowls, egg production, progesterone

INTRODUCTION

The traditional source of animal protein include eggs, meat and milk. One of the major sources of eggs in the rural parts of Nigeria is the guinea fowl eggs. Its attractive plumage and value as a table bird with game-type flavour and high meat to bone ratio has led to its worldwide acceptance (Embury, 2001). They are widely consumed by a large number of Nigerians because of the meat and egg which possess distinct flavour and taste (Ayeni and Ayanda, 1982). However egg production is seasonal in guinea fowls (Ogwuegbu *et al.*, 1988). Sonaiya and Swan (2004) also reported that Guinea fowl are seasonal breeders, laying eggs only during the rainy season, under free-range conditions. This is because successful poultry species instinctively lay and incubate their eggs at a time of the year when newly hatched chicks will have a better supply of high protein and energy food provided by the environment. Saina *et al.* (2005) reported 5±1 months breeding season in Zimbabwe, Southern Africa. The laying season in the flock of guinea fowls studied were between October 2002 and March 2003.

Progesterone which is one of the most important steroid hormones affecting reproduction in livestock and poultry has been reported to be positively related to egg production in turkeys (Mashaly *et al.*, 1979). Tanabe *et al.* (1981) reported a positive correlation between circulatory levels of progesterone and egg production in laying hens in pureline. However, there is virtually no information on the effect of the progesterone level on either production or reproductive traits in guinea fowls. In this study, we have attempted to look at the progesterone levels in the indigenous guinea fowl, throughout the year and correlate it with the egg production. This is with the intention of using the information gathered to attempt to break the seasonality of egg production as currently found in the guinea fowls raised in Nigeria through a probable introduction of exogenous source of progesterone to stimulate all year round egg production.

MATERIALS AND METHODS

This experiment was carried out at the Experimental Unit of the Poultry Production Research Programme of National Animal Production Research Institute, Ahmadu Bello University, Shika, Zaria. Shika is geographically situated between latitude 11°12' N and longitude 7°33' E at an altitude of 640 M above sea level (Akpa *et al.*, 2002). It is located 22 km northwest of Zaria city and is vegetationally in the northern guinea savannah zone of Nigeria. The Shika climate is characterized by a well defined dry seasons. Details of Shika location, rainfall and climate has been described by Kabir *et al.* (2006). Twenty native female guinea fowls obtained from the local market were used in this study. The birds were raised on deep litter at the poultry unit of National Animal Production Research Institute of Ahmadu Bello University, Shika, Zaria. The birds were provided with a layer ration containing 16% crude protein and 2,594 kcal ME kg⁻¹ and water *ad libitum*. The experiment lasted from January 2001 to December 2002.

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Egg were collected within the hours of 12.00 to 1.00 pm and recorded daily and the mean monthly production was recorded. The birds were routinely bled twice a month via a wing jab using vacutainer needles and tubes between the hours of 9.00 and 10.00 am. The serum samples were stored in a freezer at -20°C until hormonal concentrations were determined by a Radio-immuno-assay (RIA) technique (IAEA/FAO kit).

The procedure of general linear model of SAS Computer software package (SAS, 1995) was used for the analysis of data generated in this study. The model used for the is study is

$$Y_{ij} = \mu + m_i + e_{ij}$$

Where Y_{ij} is the jth record of the ith month, μ is the over all mean, m_i is the effect of month and e_{ij} is the random error assumed to be randomly and normally distributed with expectation = 0.

The regression analysis to predict egg production from serum progesterone level was also fitted using the following model

$$Y_{ij} = a + bX_i + e_{ij}$$

Where Y_{ij} is the egg production, a and b are the intercept and slope, respectively and X_i is the guinea fowl's serum progesterone level and e_{ij} is the random error assumed to be randomly and normally distributed with expectation = 0.

RESULTS

There was an increase in the progesterone level (Fig. 1 and Table 1) during the months of June to August 1.05-1.16 ng mL^{-1}. Egg production commenced in this flock of guinea fowls towards the end of April. The last few eggs were collected in September. The egg production followed a similar trend with the highest total egg production of 250 recorded in August.

Egg production had a very high (p<0.001) and positive correlation of 0.89 with progesterone level (p<0.001). A prediction equation was also estimated for egg production using progesterone level as the predictor. This equation is:

$$Y = -78.66 + 80.72X$$

Where
   Y = Egg production
   a = Intercept
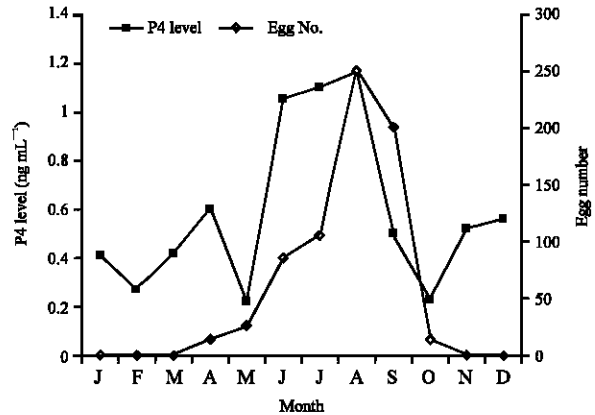   X = Progesterone level.

Fig. 1: Hormonal profile of the native guinea fowl kept on deep litter

Table 1: Progesterone (P₄) level and monthly total egg production by the native Guinea Fowl (*Numidia meleagris galeata*)

Months	Mean monthly P_4 level ng mL^{-1}	Total egg production
January	0.41	0.00
February	0.27	0.00
March	0.42	0.00
April	0.60	14.00
May	0.22	25.00
June	1.05	85.00
July	1.10	105.00
August	1.16	250.00
September	0.50	200.00
October	0.23	14.00
November	0.52	0.00
December	0.56	0.00
SD	0.336	86.21

The regression equation has an R-square value of 0.80. The regression coefficient is highly significant (p<0.01).

DISCUSSION

There were seven months of egg production coinciding with the raining season. This is similar to the report of Saina *et al.* (2005) who reported 5 months of egg production among guinea fowls kept semi intensively in Zimbabwe. It also supported the fact that guinea fowls' egg production in Nigeria is limited to rain season (Saina *et al.*, 2005; Sonaiya and Swan, 2004). The increase in progesterone level in the native guinea fowl coincides with an increase in egg production during the months of June-September (breeding season). This is similar to an earlier report on pheasant (Mashaly *et al.*, 1979) and on native guinea fowl (Ayorinde and Okaeme, 1984). Johnson and van Tienhoven (1984) suggested that progesterone may directly regulate the fundamental functions of growing follicular cells and ovulation. The current findings in this study also indicates that progesterone is

an important factor in egg production in guinea fowl hens. This result supports the suggestions of Bluhm *et al.* (1983) who noted that the cessation of egg laying induced by stress was associated with low levels of progesterone and estradiol in mallard ducks. Mashaly and Wentworth (1974) has earlier concluded that eggs production appears to be more strongly associated with circulatory progesterone rather than with oestrogen.

The high value of coefficient of determination represented by the R^2 value implied that there is a high accuracy of prediction of egg production from progesterone level. It is concluded from the results of this study that serum progesterone level is a good estimator of egg production in the grey helmet guinea fowl. It has been demonstrated in this study that since progesterone level is highly related to egg production, the seasonality of egg production in helmet guinea fowls in the tropic may be broken and the number of egg produced increased by giving progesterone in food or in water whichever is convenient and stable. However, investigation into the possibility of an all year round egg production through exogenous administration of progesterone is recommended.

REFERENCES

Akpa, G.N., J.O. Ifut and F. Mohammed, 2002. Indigenous management of dystocia in ruminant livestock in northern guinea savanna of Nigeria. Nig. J. Anim. Prod., 29: 264-270.

Ayeni, J.S.O. and J.O. Ayanda, 1982. Studies of the husbandry practices and social acceptance of guinea fowl in Nigeria. Bull. Anim. Health and Prod. Africa, 30: 139-148.

Ayorinde, K.L. and A.N. Okaeme, 1984. All Year Round Guinea Fowl-how Feasible? West African and Food Process. March/April 1984, pp: 21-22.

Bluhm, C.K., E. Philips and W.H. Burke, 1983. Serum levels of luteinizing hormone, prolactin, estradiol and progesterone in laying and non-laying mallards (*Anas platyrhynchos*). Biol. Reprod., 28: 295-305.

Embury, I., 2001. Raising Guinea Fowl. Agfact, A5.0.8, New South Wales Agriculture Publications, USA., pp: 4

Johnson, A.S. and A. van Tienhoven, 1984. Effect of inoglutehimide on luteinizing hormone and steroid secretion and ovulation in the hen, Gallus domesticus. Endocrinology, 114: 2276-2283.

Kabir, M., O.O. Oni, G.N. Akpa and I.A. Adeyinka, 2006. Heritability estimate and the interrelationships of body weight and shank length in Rhode Island Red and white chickens. Pak. J. Biol. Sci., 9: 2892-2896.

Mashaly, M.M. and B.C. Wentworth, 1974. A profile of progesterone in turkey sera. Poul. Sci., 53: 2030-2035.

Mashaly, M.M., J.A. Proudman and B.C. Wentworth, 1979. Reproductive performance of turkey hen during the ovulatory cycle. Poul. Sci., 55: 1226 B 1234.

Ogwuegbu, S.O., T.A. Aire and O. Adeyemo, 1988. Egg-laying pattern of the semi-domesticated helmeted guinea fowl (*Numida meleagris galeata*). Br. Poult Sci., 29: 171-174.

Saina, H., N.T. Kusina, J.F. Kusina, E. Bhebhe and S. Lebel, 2005. Guinea fowl production by indigenous farmers in Zimbabwe. Livestock Research for Rural Development, 17: 2005.

SAS., 1995. SAS Institute. SAS7 Procedure Guide for Personal Computers: Statistics Version. 6th Edn., SAS Institute Inc., Cary, NC.

Sonaiya, E.B. and S.E.J. Swan, 2004. Small-scale Poultry Production. Technical Guide. FAO Animal Production and Health Manual. Rome, 2004

Tanabe, Y., T. Nakamura, H. Tanase and O. Doi, 1981. Comparisons of plasma LH, progesterone, testosterone and estradiol concentrations in male and female chickens (*Gallus domesticus*) from 28 to 114 days of age. Endocrinol. J., 28: 605-613.