ISSN - 2277 - 2755


Journal of Agricultural Science and Environment

# EFFECTS OF ADMINISTERING A COMBINATION OF VITAMINS A AND E ON FERTILITY AND HATCHABILITY OF ANAK 2000 BREEDERS

**[1]O.G. FASANMI, [2]*E.S. AJIBOLA, K.T. BIOBAKU, O.L. AJAYI, B.S. OKEDIRAN, S.A. OLURODE, F. C. THOMAS AND A.O ADEBAYO**

[1]Federal College of Animal Health and Production Technology, Ibadan, Nigeria.
[2]College of Veterinary Medicine, University of Agriculture, Abeokuta, Nigeria.
***Corresponding author:** ayekoto2005@yahoo.com.

## ABSTRACT

The ameliorative effect of a combined regime of vitamins A and E on fertility and hatchability was investigated in Anak 2000 breeders. Vitamin A and E individually administered at a dose rate of 0.125 ml/kg body weight intramuscularly produced an improvement in hatchability, fertility, and sperm quality. The percentage fertility (46%) and hatchability (40.5%) before vitamin A&E administration was compared to those of fertility (76.9%) and hatchability (76.8%) after vitamin administration and found to be statistically significant at $p<0.05$. From the findings of this study, we can therefore postulate that intramuscular administration of vitamin A and E during acute episode of nutritional hypovitaminosis provokes a quick and prompt response in birds

**Keywords:** Vitamin A, vitamin E, Anak 2000 breeders, fertility, hatchability, hypovitaminosis and sperm quality.

## INTRODUCTION

Vitamins are involved in most metabolic processes and are integral part of fetal development; therefore the consequences of suboptimal levels of those nutrients in commercial diets are known to result in negative responses to both parent and offspring performances.

Dietary supplements to enhance and maintain performance are routinely used in poultry production (Siegel *et al.*, 2001).vitamin E is a term used to describe two compounds; tocopherols and tocotrienols. These compounds occur naturally in vegetables oil, eggs, liver, legumes, and in general green plant (Amiri-Andi *et al.,* 2006).vitamin E has a number of different but related functions. The most important function is its role as an intracellular antioxidant (Tappel, 1970; Bartov and Frigg, 1992; Zuprizal *et al*., 1993).

The positive effects of vitamin E on hatchability, fertility, and both breeder and day old chicks immunity has been reported (Amiri-Andi *et al.,* 2006). Danikowski *et al.* (2002) also reported the negative correlation between the reproductive performance of cocks and high doses of vitamin E. Although a review of fat soluble vitamins have shown that vitamin E has the largest impact on progeny, vitamin A also has reproductive functions and are responsible for the maintenance of epithelial integrity. Deficiency of

vitamin A & E will result in nutritional deficiencies which will manifest as poor growth (of tissues/organs), testicular degeneration, increased embryonic mortality and decrease in hatchability.

The nutritional relationship between vitamin A and E has been a subject of many investigations. (Comb, 1976). Subsequent studies have demonstrated that high dietary levels of vitamin A lead to decreased tocopherol concentration in the liver, kidney, and heart of rats and in plasma and liver of chicks (Surai *et al*., 1998). Since the basis of the antagonistic effect of high levels of vitamin A on vitamin E appears to be at the level of the gut (Comb, 1976), this study will examine the nature of the relationship of the vitamins when administered parenterally. Also quite unlike other studies on vitamins, which indirectly evaluated reproductive performances by examining egg fertility and hatchability, this work intend to investigate the direct consequences of vitamin A and E administration on sperm quality which is an index of reproductive performance.

In many breeder farms in Nigeria, where quality of vitamin premixes cannot be guaranteed because of erratic power supply, the problem of poor hatchability and fertility and its attending consequences on profitability has remained a perennial one. This has thus necessitated the need to explore the periodic use of inject-able vitamin preparation in order to complement or supplement the vitamin requirements of the breeders.

This study was conducted on Anak 2000 breeder, a heavy breed of broiler which is developed by Anak breeders, Israel. The breed is highly tropicalised and has excellent live ability and good meat yield.

## MATERIALS AND METHODS

This study was undertaken in a commercial breeder farm located in Abeokuta North of Ogun state, Nigeria. The farm lies on a longitude $7^0$ 10'N and latitude $3^0$ 2' E with an average annual rainfall of about 1037mm. The mean ambient temperature ranges from 28°C in December to 36°C in February with a yearly relative humidity of about 82%.

### *Housing and Management*

25 cocks, 250 hens were randomly selected from an initial stock of five hundred cocks and five thousand hens respectively reared from day old which at commencement of study had a fertility of 45% and hatchability of 40%. Birds were housed in an open sided pen and reared on deep litter system, during both the rearing and productive phases of lives. During rearing, birds were placed on a restricted feed regime and exposed to a 12hr light & 12hrs dark lighting programme. Breeders were fed on a commercial feed with a crude protein content of 19% once daily.

### *Semen Collection*

Semen samples were obtained from cocks before and after double administration of vitamins A&E. The semen was collected by gentle massage of (stroking) the back feathers, the abdomen being massaged towards the tail with the other hand according to the method of Lake and Stewart (1978). The semen was delivered to the veterinary reproduction department of the university of Ibadan for semen analysis. Mass activity of sperm was evaluated on a four point scale, as follows. Waves not present, sperm cells are immotile=0. Sperm cells are immotile but no wave=1, Sperm cells are motile with barely distinguishable wave motion=2.

Sperm cell motile, wave apparent=3, Sperm cells motile, wave dark and distinct, = 4.

***Determination of Hatchability and fertility***

Every week, eggs from the hens were collected and incubated in an incubator (Petersime Inc, USA) at a temperature of 37.5$^0$C and 60% relative humidity. On the 19th day of incubation, eggs were candled to determine the % fertility, which is the number of fertile eggs expressed relative to total number of eggs set. Fertile eggs were subsequently transferred to the Hatcher. After the 21$^{st}$ day of incubation, the number of chicks was recorded. Hatchability of eggs was calculated and expressed relative to the fertile eggs.

The entire period of collection, setting, and hatching of eggs was thirteen weeks. This period spanned between the ages of 33 & 43 weeks of age, covering the time before and after administering the vitamins.

***Statistical analysis***

Data on sperm motility scores was analyzed using the Mann-Whitney rank sum test. The transformed data on hatchability and fertility was also analyzed using the chi square test. Tests were declared significant at $p<0.05$.

## RESULTS

The result in Table I clearly revealed a gradual increase in both the percentage fertility and hatchability as from the 34$^{th}$ week of age after vitamins A and E administration when compared to the values of these indices of both 32$^{nd}$ and 33$^{rd}$ week of age before vitamin administration.

**Table 1: Variation in the fertility and hatchability of the Anak 2000 hens before and after vitamins A and E administration (n= 250)**

| S/No | Age/wks | Eggs set | Fertile eggs | % fertility | Chicks hatched | % hatchability |
|---|---|---|---|---|---|---|
| 1 | 32 | 1120 | 504 | 45 | 201 | 40 |
| 2 | 33 | 1137 | 534 | 47 | 128 | 41 |
| 3 | 34 | 1102 | 462 | 42 | 194 | 42 |
| 4 | 35 | 1120 | 560 | 50 | 268 | 48 |
| 5 | 36 | 1137 | 795 | 70 | 540 | 68 |
| 6 | 37 | 1120 | 817 | 73 | 637 | 78 |
| 7 | 38 | 1155 | 924 | 80 | 729 | 79 |
| 8 | 39 | 1137 | 966 | 85 | 792 | 82 |
| 9 | 40 | 1120 | 963 | 86 | 818 | 85 |
| 10 | 41 | 1102 | 947 | 86 | 814 | 86 |
| 11 | 42 | 1102 | 991 | 90 | 891 | 90 |
| 12 | 43 | 1120 | 1030 | 92 | 927 | 90 |
| 13 | 44 | 1137 | 1046 | 92 | 941 | 90 |

**Table 2: Motility scores of different treatment groups of Anak 2000 cocks (n=25)**

| | Sperm Motility Score | | | | |
|---|---|---|---|---|---|
| Treatment groups | 1 | 2 | 3 | 4 | 5 |
| Before vitamin administration (32weeks) | 14 | 8 | 1 | 1 | 1 |
| After vitamin administration (44weeks) | - | - | 3 | 7 | 15 |

A single index of % fertility (46%) and % hatchability (40.5%) before vitamin administration was obtained by pooling the % hatchability and fertility of 32nd and 33rd weeks of bird's age. The pooled % fertility (76.9%) and % hatchability (76.8%) of between 34th and 44th weeks of age is taken as an estimate of these parameters after vitamin A and E administration. When the pooled estimate of these parameters at 32nd and 33rd weeks were compared against those of between 34 and 44 weeks, it was clear that vitamin A and E administration improved the % fertility and % hatchability of the eggs at a statistical significance level of $p<0.05$.

Result of the semen analysis also showed a significant improvement in Semen quality after administration of vitamin A and E at $P<0.05$.

## DISCUSSION

At the point of lay, the breeder hen is still growing body weight while the egg production rate is increasing rapidly. To ensure adequate vitamin deposition in the eggs, a feed supplement must take into account the metabolic needs of the hen and the requirement of the developing embryo.

The poor fertility (46%) and hatchability (40.5%) observed in our study before the commencement of vitamin A and E administration might not be unrelated to inadequate vitamin supplementation in the diet of the breeders at the onset of lay.

Although Pudelkiewicz *et al.* (1964) showed that excessive high level of dietary vitamin A depresses the apparent absorption of vitamin E, result from our study clearly demonstrated an improvement in the fertility, hatchability and sperm quality of birds given a combined regime of both vitamin A and E.

Since the route of administration of vitamins in our study is parenteral, the possibility of vitamin interaction at the gut leading to antagonism is completely eliminated from this findings. We therefore postulate that intramuscular administration of vitamin A and E during acute episode of nutritional hypovitaminosis provoke, a quick and prompt response in birds.

Our current study, although has proven that a combined regime of vitamin A and E administered parenterally produced ameliorative effect on poor hatchability, fertility, sperm quality, further studies will seek to evaluate the individual contribution of the vitamins when administered alone and also shed light on the possibility of a synergistic interaction of the vitamins.

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*(Manuscript received: 13th March, 2009; accepted: 8th July, 2009)*