The trial was conducted to evaluate the effect of Clomiphene citrate (Clomid®) on the egg production of Nigerian indigenous hens. The study involved 48 Nigerian indigenous cocks and 48 Nigerian indigenous hens sexually matured (24 – 26 weeks old). The birds were divided into 4 treatment groups of 12 birds per treatment, for the hens and the cocks respectively. Clomiphene citrate (Clomid®) was administered at 0mg, 10mg, 20mg and 30mg levels to the groups represented as T1, T2, T3 and T4 for cocks and T1h, T2h, T3h and T4h for hens respectively. The birds were fed ad-libitum with growers mash for cocks and breeders mash for hens. Seven days after Clomiphene citrate administration, the birds were paired accordingly to their treatment groups for natural mating. The result shows that number of eggs laid increased with 10mg Clomid inclusion for both cocks and hens respectively. The 48 cocks were divided into 4 treatment groups of 12 birds per treatment, for the hens and the cocks respectively. The birds were fed ad-libitum with growers mash for cocks and breeders mash for hens. Seven days after Clomiphene citrate administration, the birds were paired accordingly to their treatment groups for natural mating. The result shows that number of eggs laid increased with 10mg Clomid inclusion from 42 in the control to 63 in T2 (10mg) but decreased with 30mg Clomiphene citrate treatment. T3 also recorded the highest value in fertility (78.6%) and hatchability (90.9%), while T4 recorded the lowest value in fertility (34.9%) and hatchability (19.2%). It could be inferred that Clomiphene citrate (Clomid®) encouraged egg production, fertility and hatchability at 10mg dosage administered.

Keywords: Clomiphene citrate, Egg production, mating, indigenous birds.

INTRODUCTION
Poultry egg is one of the cheapest, most affordable and acceptable animal products. Egg possesses two characteristics that make them valuable as foodstuffs, namely, they are highly nutritious and serve important role in many food products because of their functional properties (Scott and Silversides, 2001). Thus, they are excellent means through which the animal protein of the populace can be met (Oleforu-Okoleh et al., 2016). The Nigerian local chicken has been reported to be small in size and grows slowly but possesses good potential for egg and meat production (Omeje and Nwosu 1983). However, besides genetics make-ups, growth response generally in domesticated animals to a large extent is absolutely determined by its environment (Gunn et al., 2016). Oluyemi and Robert (1979) reported that egg production i.e. fertility and hatchability of eggs are both functions of breed and environment. Peters et al., (2005) reported that strain had prominent effect on fertility and hatchability of eggs. Performance of Nigerian local chicken can be improved by avoiding acclimatization difficulties and selecting good parent stock from indigenous population and improving management techniques, hence greater chance of success (Adebambo, 2005). Apart from management system and other improved husbandry techniques, other livestock have improved their reproductive performance using fertility drugs like Clomiphene citrate (Clomid®). A lot of these treatments have evidently produced positive results in female goats, sheep and rabbits as reported by Iheukwumere et al. (2003) and Herbert et al., (2000) who reported works on the Nigerian local chicken. It is believed that the result of this study involving the above mentioned techniques would provide useful data that will facilitate better understanding of Nigerian local chicken with view to enhancing their contribution to the livelihood of farmers.

MATERIALS AND METHODS
This experiment was conducted at the poultry unit Farm Management Centre, Michael Okpara University of Agriculture Umudike located within the rain forest agro-ecological zone of south-eastern Nigeria. The area is on Latitude 05° 28.1 North, Longitude 07° 33.1 East and at an altitude of 122 m above sea level. The location has annual precipitation range of 177 – 200 mm average temperature range of 22 - 28 °C and average relative humidity of 55%. The trial involved 48 Nigerian indigenous cocks and 48 matured indigenous hens of 24 to 26 weeks of age. The 48 hens were divided into 4 treatment groups of 12 birds per group. The 48 cocks were also divided into 4 treatment groups of 12 birds per group. The birds were kept individually in a battery cage and tagged for identification purposes. Each bird was confined in a cell of about 40.6 x 40.6 cm. The levels of clomiphene citrate received as treatments were 0 mg, 10mg, 20mg and 30 mg represented as T1, T2, T3, and T4 for both cocks and hens respectively. Treatment (t1) for cocks and hens did not receive Clomiphene citrate which served as the control. Breeders mash was fed to the hens, while grower’ mash was served to the cocks ad-libitum and clean water regularly served. Clomiphene citrate was given through water for 5
days, seven days after treatment, the cocks and the hens were paired according to their treatment groups for natural mating. That is, hens in T1h were paired with cocks in T1c etc. and were monitored. Egg collection began 3 days after pairing. The eggs were collected daily to avoid evaporation of the internal eggs content due to intensity of sunshine in the tropics. Only sound egg without cracks and discoloration were collected, physically shaped and sound eggs were collected for the study. The eggs were properly labeled to indicate treatment birds that laid the eggs before sending to the hatching on weekly basis. Egg data was collected immediately to avoid loss of identification. Parameters taken include:

- Egg number = Total number of eggs laid by each treatment during the experiment period
- Percentage fertility = \( \frac{\text{number of fertile eggs}}{\text{number of eggs}} \times 100 \)
- Percentage infertile egg = \( \frac{\text{number of infertile eggs}}{\text{number of eggs}} \times 100 \)
- Percentage hatchability = \( \frac{\text{number of chicks hatched}}{\text{number of fertile eggs}} \times 100 \)
- Percentage dead in germ = \( \frac{\text{number of dead in germ}}{\text{number of fertile eggs}} \times 100 \)
- Percentage dead in shell = \( \frac{\text{number of dead in shell}}{\text{number of fertile eggs}} \times 100 \)

These parameters were obtained by procedures described by Adedeji et al. (2015). Data collected was analyzed using simple descriptive statistics comprising of percentages.

**RESULTS AND DISCUSSIONS**

Table 1 shows the number of egg produced by each treatment group, percentage fertility, percentage hatchability, percentage infertility, percentage dead in germ and percentage dead in shell of the eggs produced. From the results of this trial, Treatment2, T2h had the highest number (63) of eggs laid followed by T2c (61) eggs, T3h (43) eggs and the lowest number was recorded in T1h (42) eggs. Highest percentage of fertility and hatchability, 78.6% and 90.9% respectively were also recorded in T2h, while the lowest percentage of 34.88% and 53.3% in fertility and hatchability respectively were recorded in T4h. Infertile eggs recorded were highest (65.1%) in T4h, followed by T3c (59.0%) and T4h (53.0%) while the lowest value (21.4%) was recorded in T2h. These reports on fertility and infertility of eggs are in agreement with the findings of Adedeji et al. (2016) who recorded similar findings in favour of Fulani ecotype. The findings in T4h (decrease fertility and hatchability) coincides with the findings of Ringos et al. (1957), who found that feed with 3.6% crude cotton seed oil reduced hatchability and increased embryonic mortality. The report on fertility recorded in this work except in T2h were lower than 75% fertility reported by Akamu et al. (2008) in β – Alpha – chicken.

The highest percentage value (19.2%) in dead-in-germ was recorded in T4h, while the lowest value (3.8%) was recorded in T1h. Treatments 3 (T3) also recorded the highest value (15.8%) in dead-in-shell while the lowest value (2.0%) in dead-in-shell was recorded in T2h. The value of percentage dead-in-shell recorded in this work was lower than values (10.4 – 38.1%) reported by Adedeji et al. (2016) except in T4 that recorded 15.8% in dead-in-shell.

Table I. Number of eggs, percentage fertility, percentage infertility, percentage hatchability, percentage dead in germ and percentage dead in shell of Nigerian indigenous Hens treated with Clomiphene citrate

<table>
<thead>
<tr>
<th>Treatment</th>
<th>T1h</th>
<th>T2h</th>
<th>T3h</th>
<th>T4h</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of eggs</td>
<td>42</td>
<td>63</td>
<td>61</td>
<td>43</td>
</tr>
<tr>
<td>Percentage fertility</td>
<td>47.0%</td>
<td>78.6%</td>
<td>41.00%</td>
<td>34.9%</td>
</tr>
<tr>
<td>Percentage infertility</td>
<td>53.0%</td>
<td>21.4%</td>
<td>59.0%</td>
<td>65.1%</td>
</tr>
<tr>
<td>Percentage hatchability</td>
<td>83.0%</td>
<td>90.9%</td>
<td>84.0%</td>
<td>53.3%</td>
</tr>
<tr>
<td>Percentage dead in germ</td>
<td>8.3%</td>
<td>4.1%</td>
<td>3.8%</td>
<td>19.2%</td>
</tr>
<tr>
<td>Percentage dead in shell</td>
<td>5.0%</td>
<td>2.0%</td>
<td>4.2%</td>
<td>15.8%</td>
</tr>
</tbody>
</table>

T1h= Treatment 1, hen, T2h= Treatment 2, hen, T3h= Treatment 3, hen, T4h= Treatment 4, hen

The low fertility and hatchability recorded in Treatment1, T1 (30 mg) could be that very high dosage of Clomiphene citrate does not encourage hatchability and fertility, and weakened the embryo. It could also be deduced from the result that Clomiphene citrate encouraged egg production, fertility and hatchability when 10mg dosage was given, since egg production, fertility and hatchability were highest in T2 (10 mg). The low fertility and hatchability recorded in T4 could be that very high dosage of Clomiphene citrate encouraged low density lipoprotein level in blood of embryo since Yafei and Nobel (1990) reported that low density lipoprotein in the plasma does not support hatchability and this is found mostly in juvenile parents as a result of low lipid absorption from the parent. It is possible that high level (30 mg) of Clomiphene citrate caused reduction in lipid absorption from parents because reduced lipid absorption from parents to embryo can lead to increase embryonic mortality.

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(Dalton, 2000). The mechanism of this impairment is uncertain (Dalton, 2000). However, this does attest to the importance of lipid metabolism on embryonic viability.

CONCLUSION
The results of the study have shown that Clomiphene citrate (Clomid®) can bring about improved reproduction in Nigerian indigenous chicken. For a higher fertility and hatchability, high dosage of Clomiphene citrate (Clomid®) should be avoided. The recommended dosage is 10mg inclusion.

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