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Reproductive Ability of Selected F1 Crossbred Turkey Hens (Nigeria Indigenous x Exotic Turkey) at Early Stage of Production

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Abstract

Egg production, fertility and hatchability rate at early stage of production remains reliable markers to predict the reproductive genetic potentials of turkey poultry species. This study is therefore conducted to examine and evaluate the reproductive potential of eight selected cross bred hens. A total of eight (8) hens were housed individually in each cell in a battery cage system. 180g of feeds was fed to hens at laying stage and 250g of feeds were fed to each tom. Two best toms with the best semen quality after evaluation were selected for artificial insemination practices after 25weeks of age. The F1crossbred hens were inseminated with their tom's counterpart pooled semen twice a week. Eggs were identified, recorded and taken to the hatchery weekly for incubation. Data such as number of eggs laid, fertility, hatchability egg sets and hatchability of fertile eggs rate were collected and recorded. Data collected were subjected to statistical analysis using SPSS. The result showed no significant difference ($p<0.05$) in the quantity of eggs recorded per week, number of infertile eggs, percentage fertility and infertility except for number of fertile eggs/week which was significantly higher in Hen6 and Hen2 but was not significantly different from Hens 5, 7, 9 and 10. However, lowest significant ($p>0.05$) number of fertile eggs was recorded for Hen 12 among all the hens assessed. It can therefore be concluded that crossing of exotic turkey breed popularly known as imported turkey with Nigeria indigenous turkey is beneficial and could enhance fertility and hatchability rate in the hybrid progeny.

Keywords: F1 hybrid hen, laying rate, Fertility, Hatchability, Early stage

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1. Introduction

Most of the developing countries, especially the sub-Saharan Africa are still faced with the challenges of provision of adequate supply of animal protein [1-2]. Which may be traceable to inferior genetic makeup of the native breeds or non-practices of artificial selection [3] nor breeding plan on our native breeds. Asides genetic factor, environment and nutritional practices among other factors, is also perceived as major hindrance [4]. These problems are usually addressed through anthropogenic hybridization between Indigenous and exotic breeds, which are thought to be of superior genetic makeup by some breeders, the result is sometimes not favorable as it leads to loss of most country germplasm [5] usually due to emergence of some hybrids that may exhibit lower acclimatization and subsequently adaptation or even sterile F1 offspring, which may not be able to contribute to the next generation [6]. In many countries, including Nigeria, Turkey production is a significant component of poultry industry. Indigenous turkey breeds in Nigeria well-adapted to local conditions & have unique characteristics suited to the environment. However, their productivity in terms of fertility and growth can be limited compared to exotic breeds, which often selected for higher performance traits [7-8].

The crossbreeding of indigenous and exotic turkeys aims to combine the resilience of indigenous breeds with the superior growth and reproductive traits of exotic breeds [9]. F1 crossbreeding usually denoted as first filial progeny emerging from the mating of two different parent breeds.

These crossbred offspring often exhibit hybrid vigor, or heterosis, which can lead to improved performance traits including fertility, growth rate, and disease resistance [10]. The Nigerian indigenous turkey, known for its adaptability and hardiness, when crossed with exotic breeds, may potentially enhance reproductive traits, leading to more efficient turkey production [11]. The integration of exotic breeds into local breeding programs aims to harness hybrid vigor, which can lead to improved fertility, growth performance, and overall productivity [9]. F1 crossbreeding approach is intended to combine the hardiness of indigenous turkeys with enhanced reproductive characteristics of exotic varieties, potentially resulting in a hybrid that benefits from best traits of both parent lines [9]. The concept of hybrid vigor, or heterosis, suggests that first-generation crossbreeds often outperform their parent breeds in terms of various performance metrics, including fertility and survival rates [8].

This principle underpins the rationale for crossbreeding programs, as hybrids may exhibit improved reproductive efficiency and resilience, which are critical for sustaining and enhancing turkey production systems in Nigeria [11]. Enhancing turkey fertility and reproductive performance at early stage of production is pivotal for boosting productivity and ensuring the sustainability of turkey farming operations. By exploring the fertility potentials of F1 crossbred turkeys, this study will provide empirical data that can inform breeding practices and production strategies at early stage of production. The outcomes of this research could have significant implications for turkey producers, offering guidance on how to optimize breeding programs for better fertility and higher production efficiency in Nigeria and similar regions [12]. Understanding how hybrid vigor influences fertility will enable producers to make informed decisions, potentially leading to more robust and productive turkey breeds that can meet the demands of both local and international market. This study therefore aimed at determining the reproductive potentials of some selected f1 crossbred turkey hens (The Nigeria indigenous turkey x and exotic turkey) at early stage of production.

2. Materials and Methods

2.1. Ethical Approval

The study was based on ethical rules of the Oyo State College of Agriculture and Technology Igboora. Nigeria.

2.2. Study area

The experiment was carried out at the Tukey unit, Animal Health and Production Department of Oyo State College of Agriculture and Technology, Igboora. This location lies at the geographical coordinates of 7°15'N latitude and 3°30'E longitude. The climate of the area is characterized by a tropical monsoon climate with a distinct wet and dry season, providing a conducive environment for poultry farming and related research.

2.3. Crossing of Exotic and Indigenous breed

Two (2) extotic tom semen was collected and diluted with a natural plant based extender for the artificial insemination ten (10) hens. Eggs where collected from the hens for 1 week and were taken to the hatchery to the produce poults.

2.4. Collection of Hybrid Poults from Hatchery

0n 28th day of incubation, poults collected from hatchery and viable poults was separated for further rearing to adult stage.

2.5. Management and Rearing Poults

Poults were brooded and reared from day old to reproduction stage, toms were separated from hens at eighteen (18) weeks of age. Only eight turkeys among the reared poults were identified as hens while the remaining population are toms. Hens are housed individually in each cell in a battery cage system. 180g of feeds was fed to hens at laying stage and 250g of feeds were fed to each tom. Two best toms with best semen quality after evaluation were selected for artificial insemination practices after 25weeks of age.

2.6. Artificial insemination

Ejaculates were collected from individual viable tom by [13]. Semen collection procedure and the semen was pooled for artificial insemination of the hens. Artificial insemination was done twice/week in the evening.

2.7. Data Collection

2.7.1. Egg Number/week/ hens

The total number of eggs laid per hen per week recorded over a period 8weeks (30wks- 38wks), beginning at the expected onset of the hens' laying phase for Nigeria indigenous turkey.

2.7.2. Fertility and Hatchability Assessments of eggs from F1 crossbred Hens

- ***Incubated Egg fertility Assessment***

The F1crossbred hens were inseminated with their tom's counterpart pooled semen twice a week. Eggs were identified, recorded and taken to the hatchery weekly for incubation.The fertilizing ability of spermatozoa was assessed by intravaginal insemination of the hens with 0.05ml (200 x 10^6) viable spermatozoa for 3 weeks with fresh and extended semen. Eggs were collected daily, stored and incubated weekly. The fertility percentage (fertile/incubated eggs×100) was determined by candling 22days after the start of incubation. Using the formula below:

$$\textbf{Fertility (\%)} = \frac{no\ of\ fertile\ eggs}{total\ no\ eggs\ set} \text{ x } 100$$

- ***Incubated Egg Hatchability Assessment***

At every 22th day of incubation eggs were transferred from the setter to the hatcher through the use of hatching baskets for last 6 days were incubation and hatching take place hatching percentage will be determined by hatching of fertile eggs about 28days after start of incubation. Numbers of chicks hatched will be counted and percentage hatchability will be calculated using formula below:

$$\text{Hatchability of fertile eggs (\%)} = \frac{\text{no of egg hatched}}{\text{total no of fertile eggs}} \text{ x } 100$$

$$\text{Hatchability of eggs set (\%)} = \frac{\text{no of egg hatched}}{\text{total no of eggs set}} \text{ x } 100$$

- ***Percentage Dead in Shell***

At 28th day of incubation the chicks were separated from the unhatch eggs, and the unhatch eggs will be broken to see if there is any chicks inside. The number of the eggs

that has chicks inside will be count and percentage dead in shell will be calculated using formular below:

$$\text{Dead in shell (\%)} = \frac{no\ of\ dead\ in\ shell\ chicks}{total\ no\ of\ fertile\ eggs} \text{x } 100$$

2.8.1. Statistical Analysis

Data collected were subjected to statistical analysis using SPSS. Descriptive analysis was performed to determine significant differences among the groups. Mean differences were separated using Duncan's multiple range test at a significance level of $P < 0.05$.

3. Result and Discussion

3.1. Results

3.1.1. Comparative percentage fertility of selected F1 crossbred hens at early stage of Production (30-38wks)

Comparative fertility results of selected F1 crossbred hens is presented in table 1. The result showed no significant difference ($p<0.05$) in the quantity of eggs recorded per week, number of infertile eggs, percentage fertility and infertility except for number of fertile eggs/week which was significantly higher in Hen6 and Hen2 but was not significantly different from Hens 5, 7, 9 and 10. However, lowest significant ($p>0.05$) number of fertile eggs was recorded for Hen 12 among all the hens assessed.

3.1.2. Comparative percentage hatchability of selected F1 crossbred hens at early stage of production (30-38wks)

Comparative Hatchability results of selected F1 crossbred hens at early stage of production is presented in table 2. The result showed that hen 12 has significant lowest number of hatch eggs, percentage hatch of egg sets and hatch of fertile eggs among the F1crossbred chicks. However, hen 6 has the highest number of hatch chicks, while hen 10 has highest number of percentage of hatch egg sets. Hen 5 and 10 has 100% hatch of fertile eggs.

3.1.3. Comparative weekly fertility and hatchability evaluation of selected FI crossbred hens

Fertility assessment of F1 Crossbred hens at different weeks in the early stage of production is presented in Fig 1. It was observed that hen 5 did not lay till 33weeks of age, also hens 6 and 9 didn't laid until 32weeks of age. However, percentage fertility for all the hens was above 80% from 30 to 37 weeks of age except for hen 12 and hen2 at 30weeks and 32weeks of age. Also at hen 10 and hen 9 did not lay at 34 and 36 weeks of age respectively. Hatchability of egg set assessment of F1 Crossbred hens at different weeks in the early stage of production is presented in Fig 2. The chart shows that hen 12 has the lowest fertility among all the hens from 32 to 37 weeks of eggs incubation. Hatchability of fertile eggs assessment of F1 Crossbred hens at different weeks in the early stage of production is presented in Fig 3. The chart shows that hen 12 has the lowest fertility among all the hens from 32 to 37 weeks of eggs incubation.

3.2. Discussion

For profitable turkey breeding, fertility and hatchability is very pertinent to the turkey breeders. The results from this study revealed fertility and hatchability potentials among the different F1 crossbred hens, although Hen 12 has the lowest number of eggs and fertile eggs set among the hens, however, is not significantly different in percentage fertility. Also percentage fertility was observed to be high above 89.00% among all the F1 crossbred turkey at early production stage. This implies that fertility of the f1 crossbred turkey may be enhanced by crossbreeding. That is crossing exotic turkey with Nigeria Indigenous turkey doesn't have negative effects on the fertility status. Observation from this study corroborated the report of Akintunde and Ojo, [11] that hybrids may exhibit improved reproductive efficiency and resilience, which are critical for sustaining and enhancing turkey production systems in Nigeria. It was also reported by Muir and Wong, [8] that in turkeys, crossbreeding different breeds, including indigenous and exotic types, can result in offspring with improved reproductive performance. In the case of hatchability slight variation among the hens was observed for number of hatch chicks, hatchability of egg set and hatchability of fertile eggs.

Hen 12 showed significant lower hatchability compared to its other hen counterparts, reflecting her inability to consider her progeny for inclusion in the next generation flock. However, other hens depicted higher hatchability that is encouraging for turkey hens breeding program despite their crossbred hens. It has been established that hybrid vigor is a good tool that could be used to enhance performance of turkey with respect to improve egg laying, fertility and hatchability, benefiting from the increased genetic diversity and hybrid vigor [14]. And in turn positively contribute to commercial turkey production in Nigeria. Finally, it was observed that only hen 7 and hen 12 had lower percentage fertile eggs and hatch chicks in some weeks at early stage of production compared to other hens. All other hens showed encouraging fertility and hatchability records of above 80.00% from 30 to 37weeks of age indicating the positive impact of cross breeding to enhance the next generation flock performance. Mason and Bailey, [15] similarly reported that the development of hybrid layers has been instrumental in meeting the global demand for the eggs.

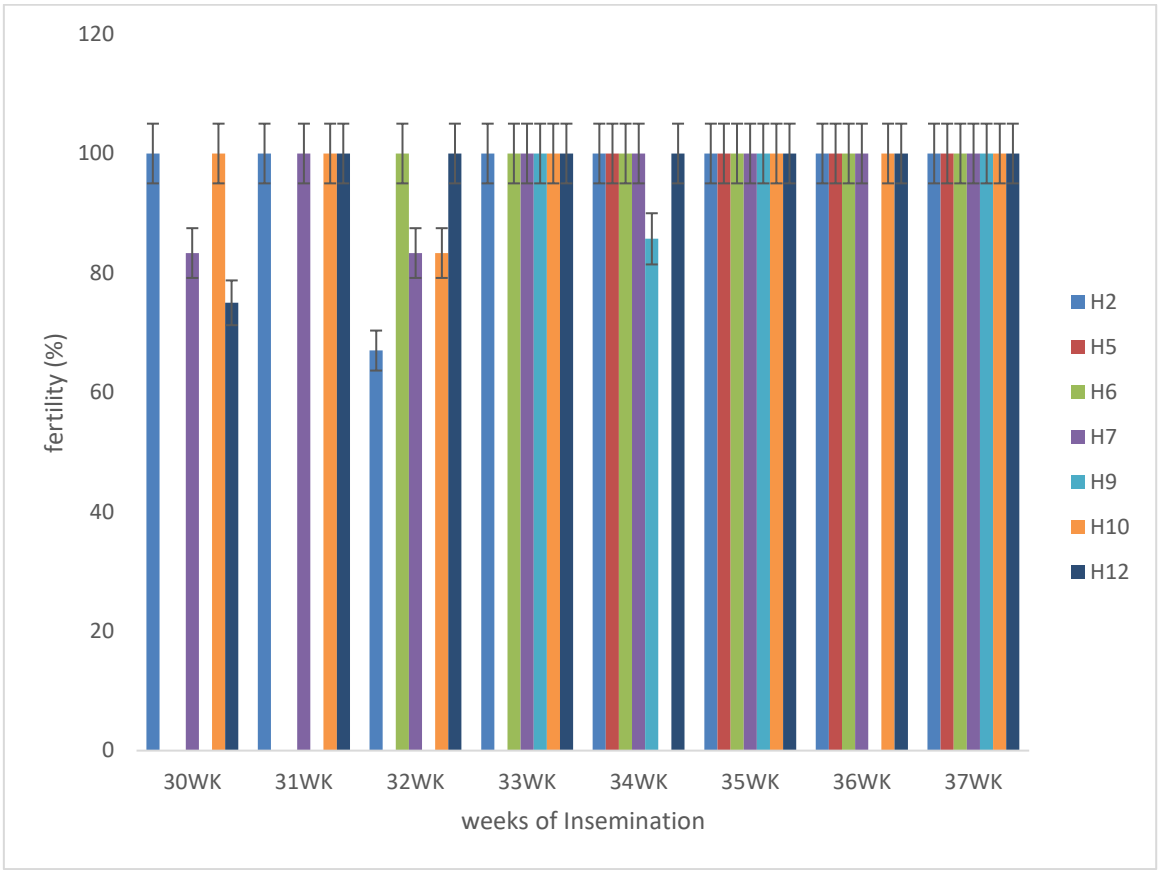

Fig 1: Comparative weekly fertility of eggs set of selected F1 crossbred turkey hens

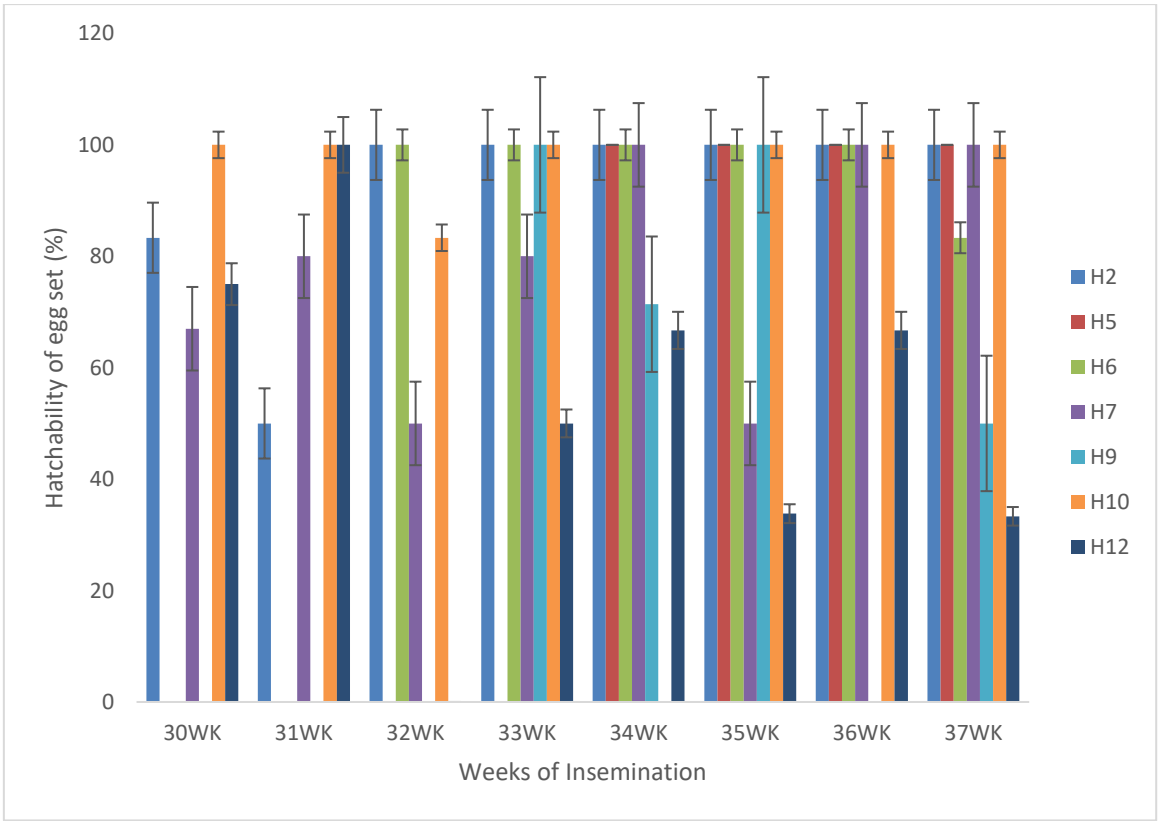

Fig 2: Comparative weekly hatchability of eggs set of selected F1 crossbred turkey hens

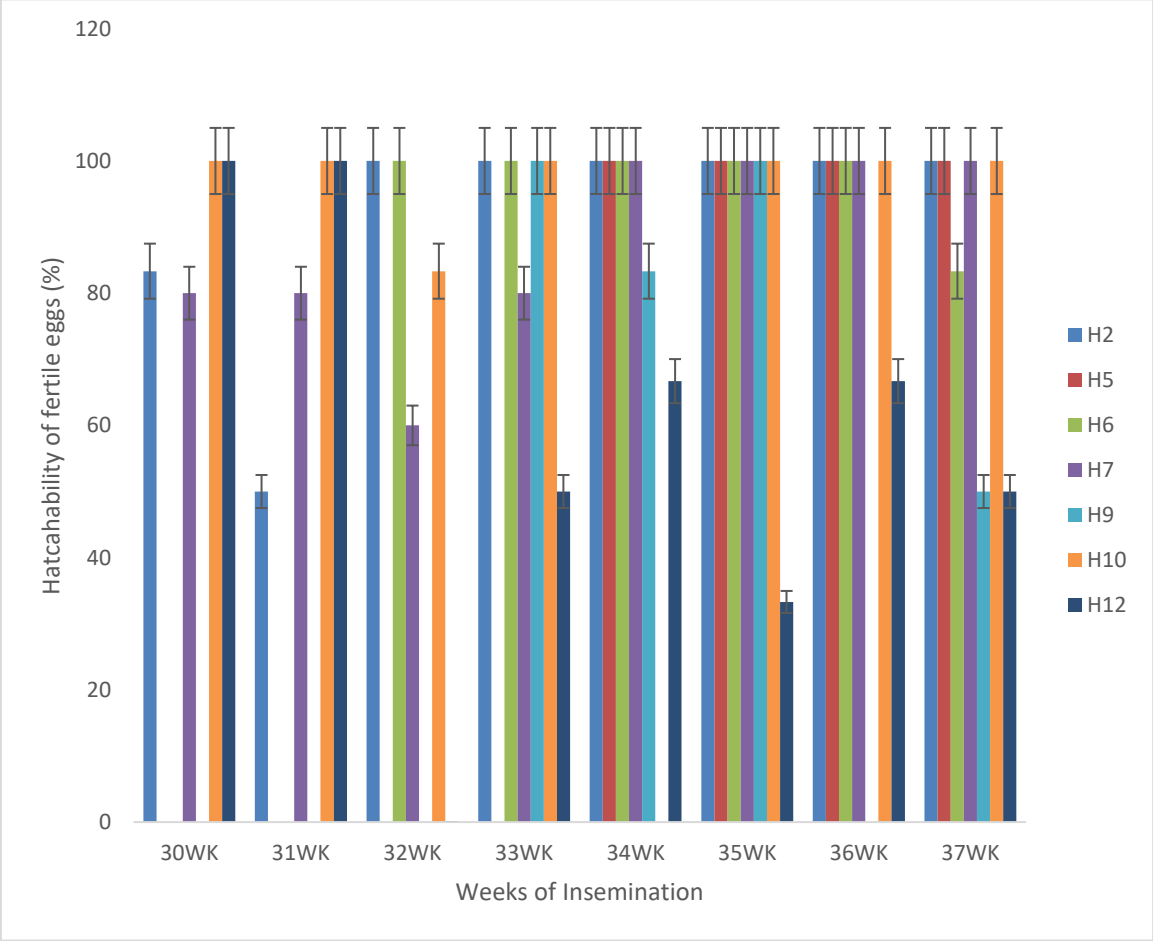

Fig 3: Comparative weekly hatchability of fertile eggs of selected F1 crossbred turkey hens

Table 1: Fertility potential of selected F1 crossbred turkey at the early stage of production

Hens	No of eggs set/week	Number of fertile eggs/week	Numbers of Infertile eggs/week	Percentage Fertile/week (%)	Percentage Infertile/week (%)
H2	5.00	5.00^{a}	0.00	100.00	0.00
H5	4.25	4.30^{ab}	0.00	100.00	0.00
H6	5.17	5.20^{a}	0.00	100.00	0.00
H7	4.50	4.13^{ab}	0.38	89.58	17.68
H9	5.0	4.80^{ab}	0.25	96.43	7.15
H10	4.29	4.14^{ab}	0.14	97.62	6.31
H12	3.44	3.22^{b}	0.22	93.52	13.02
SEM	0.20	0.20	0.05	1.49	1.53

Means with different superscripts a, b shows significant different ($p<0.05$)

Table 2: Hatchability potential of selected F1 crossbred turkey at the early stage of production

Hens	Numbers of eggs set	Numbers of hatch	Numbers of Dead in shell	Percentage Hatch of eggs set (%)	Percentage Hatch of Fertile eggs (%)	Percentage Dead in Shell (%)
H2	5.00	4.63[a]	0.13	91.67[a]	91.67[a]	3.13
H5	4.25	4.25[a]	0.00	75.00[ab]	100.00[a]	0.00
H6	5.17	5.00[a]	0.00	97.22[a]	97.22[a]	0.00
H7	4.50	3.50[a]	0.25	78.38[a]	87.50[a]	4.18
H9	5.0	4.00[a]	0.50	80.35[a]	83.33[a]	0.00
H10	4.29	4.14[a]	0.00	97.62[a]	100.00[a]	0.00
H12	3.44	1.78[b]	0.22	50.19[b]	54.83[b]	5.92
SEM	0.20	0.24	0.06	3.99	3.38	

Means with different superscripts a, b shows significant different ($p<0.05$)

4. Conclusions

It can therefore be concluded that crossing of exotic turkey breed popularly known as imported turkey with Nigeria indigenous turkey is beneficial and could enhance fertility and hatchability rate in the hybrid progeny. Crossing of exotic turkey with Nigeria indigenous turkey is therefore recommended for improved reproductive performance since majority of the hen's shows higher fertility and hatchability records. However, effective selection should be done to cull the offspring of any birds exhibiting lower fertility and hatchability traits in the flock of the next generation.

Authors' contributions

BAS design, carried out the research and first draft of the manuscript AAA and AJA contribute to the resources and review of final manuscript draft. JAI, YBL and SOM took part in data collection and management of the animals.

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Ethical Consideration

The authors confirm that all authors reviewed and submitted the manuscript to this journal for the first time.

Availability of data and materials

Datasets generated and collated during this research are available from the corresponding author upon request.

Conflict of interests

There is no conflict of interest to declare.

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