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Comparative hatching performance of normal feathered Nandanam broiler-3, Nacked Neck and Nacked Neck x Nandanam broiler-3 cross broiler breeders under intensive system of management

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Abstract
Hatching performance of 35–40 weeks old multi colour broiler breeder normal feathered Nandanam broiler-3, Nacked Neck and Nacked Neck x Nandanam broiler-3 cross was compared. A total of 6813 hatching eggs collected from Nandanam broiler-3, Nacked Neck and Nacked Neck x B3 cross were set for hatching in six consecutive batches. The per cent fertility ($P \leq 0.05$), total hatchability ($P \leq 0.05$) and fertile hatchability ($P \leq 0.01$) were significantly higher for the crosses (77.22±2.17; 64.57±4.09; 83.34±3.06) and Nandanam broiler-3 (73.05±1.52; 55.12±1.42; 75.49±1.66) than Nacked Neck (65.57±3.77; 43.94±5.35; 66.06±4.44). The per cent total embryonic mortality was significantly ($P \leq 0.01$) lesser in crosses (16.66±3.06) and B3 (24.51±1.66) than Nacked Neck (33.94±4.44). It can be concluded that significantly higher per cent fertility, total hatchability, fertile hatchability and lesser per cent total embryonic mortality were recorded in crosses. Hence, the Nacked Neck x Nandanam broiler-3 cross Nandanam broiler-3 had better hatching performance than Nacked Neck breeders.

Keywords: Nandanam broiler-3, nacked neck, nacked neck x nandanam broiler-3, hatching performance

Introduction
Backyard poultry rearing is practiced by majority of the poor and small scale rural households all over India for their livelihood and nutritional security. However, the productivity of indigenous fowls is very low due to their inherent lower genetic potential. Naked neck bird was found to be one of the best indigenous stocks in rural areas of certain regions like Bangladesh [1]. Several government institutes propagate improved varieties resulting from various types of cross breeding of native chicken with exotic breeds and distribute them to the farmers for backyard rearing. Recently (2017-18), Poultry Research Station, a unit of Tamil Nadu Veterinary and Animal Sciences University released a multi coloured chicken broiler strain named Nandanam broiler-3 so as to improve the productivity of the small scale broiler production. Nandanam broiler -3 was developed by crossing two strains such as Ven Cobb (male) with Nandanam broiler 2 (female) through artificial insemination and the resultant population was pooled for the development of synthetic strain through sustained selection and breeding for more than seven generations. Good disease resistance, attractive multi coloured plumage, higher body weight, adaptability to substandard managemental conditions, desirable flavour of meat and massive appearance of adult are the special features of this strain and are being well preferred by poultry farmers in Tamil Nadu. Poultry are not well adapted to high ambient temperatures because they lack sweat glands. Heat stress is a seasonal challenge in tropical countries during summer at higher environmental temperatures, which causes economic losses through low productivity and high mortality in poultry. Nacked Neck is one of the light type Indigenous chicken breeds of East Coast region of India which has higher adaptability to tropical climatic environments. Attempts have been made at the Poultry Research Station, to develop Nacked neck x Nandanam broiler-3 cross to increase the heat tolerance potential of normal feathered Nandanam broiler-3(female) by crossing with Nacked Neck chicken (male) which will greatly help in increasing the productivity of the birds in rural areas even during summer seasons. Main aim of the breeder farm and the hatchery complex is to get maximum fertility and hatchability for the better propagation of any breed. Several factors that affect hatchability include strain, health, nutrition and age of the flock, egg size, weight and quality, egg storage duration and conditions.

The effect of the genetic strain on poultry hatchability has been well documented [2, 3]. However, information on studies on the comparative hatching performance of coloured broiler breeders, Nacked Neck and its crosses under intensive system in India is very scanty. Hence the aim of this study was to compare the hatching performance of broiler breeder Nandanam broiler - 3, Nacked Neck and Nacked neck x Nandanam broiler-3 cross to identify the suitable colored broiler breeder birds with good fertility and hatchability which will be very useful for the farming community.

Materials and Methods

This study was conducted at the Poultry Research Station, Tamil Nadu Veterinary and Animal Sciences University. Chennai. Three multi colour broiler breeders of 35–40 weeks old namely normal feathered Nandanam broiler - 3, Nacked neck and Nacked neck x Nandanam broiler-3 cross maintained under intensive system were utilized for this study. All the experimental birds were maintained with standard nutritional and managemental conditions. The male to female ratio of 1:6 was maintained for all the strains. A total of 6813 hatching eggs collected from T1- normal feathered Nandanam broiler-3, T2- Nacked neck and T3- Nacked neck x B3 cross were cleaned, fumigated, stored for 7 days and then set for hatching in six consecutive batches. The eggs were collected every morning, graded, fumigated and stored at 18ºC with 75-80% relative humidity. After 7 days storage, they were brought into room temperature by keeping them for one hour and then set for incubation after proper cleaning and disinfection. The temperature of 99.5ºF in dry bulb and relative humidity of 55% were set to incubate the eggs for 18 days during which they were turned at hourly interval by automatic turner. Thereafter, these eggs were transferred to the hatcher wherein a temperature of 98.5ºF in dry bulb and relative humidity of 72% were maintained. Hatching was completed by the end of the 21st day. At the end of hatching process, number of infertile eggs, number hatched, embryonic mortalities (early and late) were recorded. The per cent fertility, total hatchability, fertile hatchability and total embryonic mortality were worked out. Total embryonic mortality was worked out with the sum of dead germs and dead in shells in proportion with the total fertile eggs. The data were analyzed statistically by following standard procedures [4].

Results and Discussion

The data on comparative hatching performance of normal feathered Nandanam broiler-3, Nacked neck and Nacked neck x Nandanam broiler-3 cross broiler breeders under intensive system of management was furnished in table 1. Statistical analysis revealed that the genetic groups exerted highly significant ($P \leq 0.05$) influence on mean per cent fertility, total and fertile hatchability and total embryonic mortality. The mean per cent fertility ($P \leq 0.05$) was significantly higher for the Nacked neck x Nandanam broiler-3 cross (77.22±2.17) and normal feathered Nandanam broiler-3 (73.05±1.52) followed by Nacked neck (65.57±3.77). This was in line with previous studies [5, 6]. Similarly, Indonesian naked neck chicken had fertility in the range of 43.33 to 75% [7]; indigenous chicken of Assam had 76.33% fertility [8]. However, Vanaraja birds had 71.13% fertility under traditional system of rearing in Manipur [9]. Fertility value reported in the present study was lower than the values reported by earlier findings of various authors in S-14 generation of Naked Neck (Na) line [10]; in Vanaraja and indigenous birds [11] and in Nandanam broiler-3 [12]. The variations in the fertility values observed in this study might be caused by the diversity of genetic groups.

Table 1: Mean (±S.E.) comparative hatching performance of normal feathered Nandanam broiler - 3, Nacked neck and Nacked neck x Nandanam broiler-3 cross broiler breeders under intensive system of management.

Genetic groups	Nandanam broiler -3	Nacked neck	Nacked neck x Nandanam broiler -3 Crosses
Fertility %*	73.05 ^{a} ±1.52	65.57^{b} ±3.77	77.22 ^{a} ±2.17
Total hatchability%*	55.12^{a} ±1.42	43.94^{b} ±5.35	64.57^{a} ±4.09
Fertile hatchability%**	75.49 ^{a} ±1.66	66.06^{b} ±4.44	83.34^{a} ±3.06
Total embryonic mortality% **	24.51^{a} ±1.66	33.94^{b} ±4.44	16.66^{a} ±3.06

*Mean bearing different superscripts within the rows differ significantly ($P<0.05$)

Significantly higher mean per cent total hatchability ($P \leq 0.05$) was recorded for the Nacked neck x Nandanam broiler-3 cross (64.57±4.09) and normal feathered Nandanam broiler B3 (55.12±1.42) than Nacked neck (43.94±5.35). Similarly, Indonesian naked neck chicken had total hatchability in the range of 29.73to 61.11% [7]. The mean per cent total hatchability recorded in this study was lower than the previous studies in Nigerian indigenous naked neck chickens [13]; in indigenous chicken of Assam [8]; in Vanaraja birds (72.6%) under traditional system of rearing in Manipur [9]; in Vanaraja birds (68.7%) under hill agro-ecosystem of North Eastern region [14]; in S-14 generation of Naked Neck (Na) line (64.2%) [10] and in Nandanam broiler-3 [12]. On contrary, there was no significant ($P \leq 0.05$) difference in hatchability percent between Vanaraja and indigenous groups under natural incubation [15]. Higher hatchability in terms of total eggs set (72.17%) was reported in Nacked neck x Polish cap chicken cross [16]. However, the mean per cent total hatchability recorded for Nacked neck x Nandanam broiler-3 cross (64.57±4.09) in this study was similar to the value reported in S-14 generation of naked neck (Na) line [10].

Statistical analysis revealed that the genetic groups exerted highly significant ($P \leq 0.01$) influence on mean per cent fertile hatchability. The mean per cent fertile hatchability of Nacked neck x Nandanam broiler-3 cross breeders (83.34±3.06) and normal feathered Nandanam broiler-3 (75.49±1.66) was significantly ($P \leq 0.01$) higher than naked neck breeders (66.06±4.44). This result is in agreement with the previous findings [5, 6]. The mean per cent fertile hatchability recorded in this study was lower than the previous studies in indigenous chicken of Assam [8]; in Vanaraja birds (72.6%) under traditional system of rearing in Manipur [9]; in Vanaraja birds (68.7%) under hill agro-ecosystem of North Eastern region [14]; in S-14 generation of naked neck (Na) line [10] and in Nandanam broiler-3 [12]. Higher hatchability in terms of fertile eggs set (83.43%) was reported in Nacked neck x Polish cap chicken cross [16] which was in line with the value obtained for Nacked neck x Nandanam broiler-3 cross

breeders (83.34%) in this study. The higher fertile hatchability recorded in Nacked neck x Nandanam broiler-3 cross breeders and normal feathered Nandanam broiler-3 might be due to lesser total embryonic mortalities recorded for these birds.

There were significant ($P \leq 0.01$) differences observed among different genetic groups on mean per cent total embryonic mortality. The mean per cent total embryonic mortality was significantly ($P \leq 0.01$) lesser in Nacked neck x Nandanam broiler-3 cross breeders (16.66±3.06) and Nandanam broiler-3 (24.51±1.66) than Nacked neck (33.94±4.44). Indonesian naked neck chicken had total embryonic mortality in the range of 7.69 to 21.62% [7]. Nigerian indigenous naked neck chickens had 28.66% embryonic mortality [13]. Bangladeshi indigenous naked neck chickens had 16% embryonic mortality [17]. However, Nandanam broiler-3 had total embryonic mortality of 22.51% [12]. The embryonic mortality of naked neck can be caused by incorrect embryo positions by a reduction of feathers on the neck, or metabolic abnormalities [18]. Variations in embryonic mortality may be due to genetic factors, thin eggshell, poor egg holding period, imbalanced nutrition, stressful conditions the parent flock was exposed to, or any other fault in incubation and hatching requirements/equipments. Poor egg-shell weight has also been reported to result in higher embryonic mortality [19].

Conclusion

Previous studies concluded that birds with normal feather genes were better in terms of fertility and hatchability traits than other genes of normal feather and naked neck chickens [20, 21, 22]. However, the results of the present study showed that both the Nacked neck x Nandanam broiler-3 cross and normal feathered Nandanam broiler-3 breeders had significantly higher per cent fertility, total hatchability, fertile hatchability and lesser per cent total embryonic mortality than Nacked Neck broiler breeders. Hence, the Nacked neck x Nandanam broiler-3 cross and normal feathered Nandanam broiler-3 could be the suitable colored broiler breeder birds which can be exploited for rearing under intensive system of rearing for obtaining improved hatching performance in terms of higher fertility and hatchability in the tropical climatic conditions.

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