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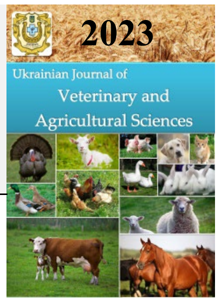



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# Evaluation of performances and selection response of three indigenous chicken genotypes at seventh-generation


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*Contents*




**Abstract**

The present study was conducted to assessed the performances of three native chicken genotypes under intensive management. A total of 1042 day-old chicks comprising of 3 types of chicken, namely Naked Neck (NN-381), Hilly (HI-313), and Non-descript Deshi (ND-348), were Hatched for this study. The seventh generation, selection was practiced at 40 weeks of age according to 40-week body weight (BW), egg production (EP) up to 40-week, egg weight (EW) at 40 weeks, and age at maturity (ASM). The data were analyzed in a CRD. Day-old chick weight was significantly ($P < 0.001$) highest in HI ($32.52 \pm 0.32$ g). Significant ($P < 0.001$) body weight differences among the genotypes were observed at the 12th week of age. Genotype had a significant effect on chick mortality. The average age at the first egg of ND 145.54days was 8.81 days earlier than that of HI 154.35days. Hatchability on fertile eggs differed significantly ($P < 0.05$) among the genotypes. The percentage of dead germ was affected ($P < 0.001$) by genotype. Feed consumption from 9 to 16 weeks showed a significant ($P < 0.001$) variation in feed intake among the native chicken genotypes. EP of ND, HI, and NN birds were expected to increase by 0.875, 1.585, and 0.255 %, respectively. The EW of ND, HI, and NN birds were expected to increase by 0.205, 0.250, and 0.015g, respectively. Responses to selection for EP and EW for three genotypes (ND, HI, and NN) were expected to be positive (increase). It is concluded that the Hilly genotype may be chosen for meat production and the Non-descript Deshi genotype for egg production.



**Keywords**: Genotype; Hilly chicken; Non-descript Deshi; Naked Neck, Performance.



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## 1. Introduction

One of the main benefits of producing chicken locally is the low input requirements and, hence, reduced risk. The fast extinction of native breeds and strains due to commercial dilution and breed replacement makes preserving these priceless genetic resources for chicken's imperative (Paul et al., 2017; Rahman et al., 2018). Local chicken can be sold to cover household expenses like prescription drugs, healthcare expenses, tuition, and village taxes. They provide a ready source of funds in this way to support rural livelihoods, deal with emergencies, and buy small household necessities. Native hens feed on kitchen trash and manage garden bug pests, providing manure for vegetable crops (Mtileni et al., 2009; Ali, 2020). They also serve critical, essential sanitary roles. In rural areas, cocks are also employed as "alarm clocks" (Kusina & Kusina, 1999). The performance of indigenous chicken can be improved by changes in husbandry, feeding, and better health cover. However, genetic improvement may be made either through selection and crossbreeding or by utilization of both selection and crossbreeding (Ali & Islam, 2021; Ali et al., 2021). Improvement through selection may be time-consuming, but the improvement will be permanent. The present study was undertaken to assess the performances of three indigenous chicken genotypes under intensive management and to select parental birds (males and females) and breed them in an assortative plan for the production of seventh-generation birds.

## 2. Materials and methods

A total of 1042-day-old chicks comprising 3 types of chicken, namely Naked Neck (NN-381), Hilly (HI-313), and Non-descript Deshi (ND-348), were hatched in one batch to produce seventh generation ($G_7$). Progeny were wing banded and reared separately according to genotypes. The birds were housed in an open-sided semi gable-type roof with a concrete floor. Fences were made from galvanizing wire net. The adult birds were reared in a cage individually. Each cage was equipped with an individual feeder and drinker. All the birds were reared in a natural-ventilated poultry house and a 16-hour photoperiod with 12 hours sunlight and 4 hours artificial lights. Concentrate mixtures that contain 20.06 % Crude Protein and 2908 Kcal ME/kg DM, 18.13 % Crude Protein and 2904 Kcal ME/kg DM, and 16.33 % Crude Protein and 2845 Kcal ME/kg DM were provided twice daily in the morning and evening during brooding, growing and laying period, respectively. Water also was provided *adlibitum* twice daily in the morning and evening. Drinkers were cleaned every day and, where feeders were cleaned twice a week. Refusals of the feed were measured every day in the morning. The selection objectives of the study were to improve the egg production and, or growth rate of indigenous chickens depending on the genotype of birds. The improvement target for egg weight is to increase by 1 g, The improvement target of the egg production rate is to increase by 2 % per generation, and the improvement target of the growth rate is to increase by 20 g per generation. In each generation, selection was practiced in two stages. Firstly, at eight weeks of age, the selection was performed based on body weight and physical appearance, and secondly, at 40 weeks of age based on an index comprising the parameters of age at first egg (days), body weight (g) at 40 weeks of age, egg production (%) (168–280 days) and egg weight (g) at 40 weeks of age. In flocks of all generations, selected males and females were mated assortative with a maximum male-to-female ratio of 1:5 using artificial insemination, avoiding mating among close relatives.

**Statistical analysis.** All recorded data were analyzed in CRD by Generalized Linear Model (GLM) procedure using SPSS 11.5 for Windows. For all statistical purposes, the theory of Snedecor and Cochran (1989) was followed. The following statistical model was used to analyze the different parameters: $Y_{ij} = \mu + g_i + e_{ij}$, where, $Y_{ij}$ is the dependent variable of the experiment; μ is the overall mean; $g_i$ is the effect of *ith* genotype (i=1-3); $e_{ij}$ is the error term specific to each record.

**Prediction of expected selection response.** Expected selection response in three types of indigenous chicken for egg production (EP), egg weight (EW), age at sexual maturity (ASM), and body weight (BW) were estimated using the following equation (Falconer, 1981).

$R = 1/2h^2 \times S^i$ where, R = Expected response in mass selection; $h^2$ = heritability, $h^2$ for EP, EW, ASM and BW; S = Selection differential

## 3. Results and discussion

**Hatching egg weight.** The effect of genotype on hatching egg weight is presented in Table 1. Egg weights prior to setting were recorded from three types of indigenous chickens, namely ND, HI, and NN. The hatching egg weight did not differ significantly (P > 0.05) by genotype. Under an intensive system, birds of the ND genotype gave an average egg weight of 49.22 g, significantly heavier eggs than those of other genotypes. Lower egg weight of ND was observed by Faruque (2016) and Khatun et al. (2005), who found 43.28g and 43.83g egg weight in ND genotype. Faruque (2016) observed a significant difference in egg weights between HI and NN chickens, however overall weights were significantly lower (41.49 g vs. 41.38 g) compared to the present findings.

**Day old chick weight.** The average initial body weights of day-old chicks of ND, HI, and NN were 30.65 ± 0.29, 32.52 ± 0.32, and 32.31 ± 0.31g, respectively (Table 1). Day-old chick weight was significantly (P < 0.001) higher in HI (32.52 ± 0.32 g) genotype than those of other genotypes. Faruque et al. (2017a) found that the body weight at the hatch for ND, HI, and NN genotypes was 27.74, 28.00, and 24.96 g, respectively, in foundation stock under intensive management, which much lower than the present study. It indicates that the day-old weight of three types of indigenous chickens is increasing generation after generation through selection and breeding.

**Body weight.** The effect of genotype on body weight is presented in Table 1. Genotype had a significant (P < 0.001) effect on body weight in all stages of age. Significant (P < 0.001) body weight differences among the genotypes were observed at 12 weeks of age, with the highest body weight for the HI genotype (1212.08 ± 7.27 g) compared to the other two genotypes (Table 1) in all stages of age. The 12$^{th}$ week body weights of ND, HI, and NN were 991.94, 1212.08, and 981.05 g, respectively. Faruque et al. (2017c) observed that the 12$^{th}$ week body weights of ND, HI, and NN genotypes were 864.98, 1073.45, and 891.87 g, respectively, in their sixth generation. It clearly indicates that body weights of ND, HI, and NN genotypes at 12 weeks of age have increased in the seventh generation than in that of sixth generation. Weights at age at first were significantly (P < 0.001) affected by genotype. Weights the age at first egg were 1370.1, 1650.89, and 1233.3 g, respectively, for ND, HI, and NN genotypes. Faruque et al. (2007) reported that the heavier body weight at the age at first egg was found in HI (1461.2 g), which was much lower than the present result.

**Mortality.** Hilly genotype (1.59 %) had non-significantly (P > 0.05) higher chick mortality than those of ND (1.14 %) and NN (1.57 %) at 0-8 weeks of age, which is shown in Table 1. The mortality rate was slightly lower in NN than in ND and HI genotypes (Khatun et al., 2005). This finding is not to similar our present findings. Better survivability was observed in the ND genotype in this study. The mortality rate of indigenous chickens in the brooding period (0-8 weeks) was 3.10, 4.05, and 2.92 %, respectively, under an intensive rearing (Faruque et al., 2017b). Khan (2008) reported 70 % mortality of indigenous chickens under free-range management.

**Age at first egg.** The age at first egg laid was significantly (P < 0.001) affected by genotype. The estimated age at first egg of ND, HI, and NN were 145.54, 154.35, and 150.51 days, respectively. The hilly genotype started laying eggs at a higher age (154.35 days) compared to the ND genotype (145.54 days) in the $G_7$ generation. The average age at the first egg of ND (145.54 days) was 8.81 days earlier than that of HI (154.35 days), and the age at first egg was not consistent with the observations of Sazzad (1986), Huque et al. (1990) and Barua (1992) where they reported that NN and ND came to first egg at 234 and 175 days, respectively. Their birds were reared in a scavenging system, and nutritional deficiency could be the leading cause of late maturity. The average age at the first egg of HI (154.35 days) in the seventh generation was comparable to that of HI (152.39 days) reported by Faruque et al. (2017c) in the sixth generation.

**Fertility and hatchability.** Fertility was not significantly affected (P > 0.05) by genotype, which was shown in Table 1. The percentage of fertility ranges from 82.12 to 87.14 in different genotypes. The highest fertility was observed in the ND (87.14 %) genotype compared to the remaining genotypes. The fertility of the present study was 87.14 %, 85.29 %, and 82.12 %, respectively, in ND, HI, and NN genotypes, which was a little bit lower than that reported by Khatun et al. (2005) and more or less similar to the findings of Faruque et al. (2017c). Hatchability on fertile eggs differed significantly (P < 0.05) among the genotypes. Table 1 indicates that among the genotypes, hatchability tended to be highest in HI (82.93 %), intermediate in ND (80.85 %), and lowest in NN (75.04 %). The lowest hatchability reported in NN (75.04 %) could be due to the highest eggshell thickness and more muscular breaking strength of NN eggs. Faruque et al. (2017c) reported that the hatchability was 88.98 %, 83.72 %, and 79.99 %, respectively, in ND, HI, and NN genotypes, and was more or less similar to the present findings.

**Dead in Germ.** The percentage of Dead germ was affected (P < 0.001) by genotype. The dead in germ of three indigenous chickens agrees with the findings of Faruque et al. (2017c), who reported 3.22 %, 2.52 %, and 3.01 % dead in germ in ND, HI, and NN genotypes in their sixth generation. The Dead germs may be less dependent on genotypes but rather and more influenced by management and environment. Such a result agrees with Khalil (1960), who stated that embryonic mortality in Fayoumi eggs was 6.1, 2.7, and 14% during three weeks of incubation due to seasonal variation.

**Feed intake.** Feed consumption from 9 to 16 weeks (Table 1) showed that there was significant (P < 0.001) variation in feed intake among the indigenous chicken genotypes. At the age of 16 weeks, the lowest (66.19 g) and the highest (85.61 g) daily feed intake were recorded in NN and HI genotypes, respectively. At the age of 16 weeks, the lowest (63.87 g) and the highest (84.42 g) daily feed intake were recorded by Faruque et al. (2017c) for NN and HI genotypes, respectively.

**Hen-day egg production.** The effects of genotype on hen-day egg production (HDEP %) of indigenous chicken are presented in Table 1. Hen-day egg production (HDEP %) observed in the present study was affected significantly (P < 0.001) by genotype. In this study, the average HDEP % of ND, HI, and NN were found to be 63.34, 50.57, and 58.92, respectively. The significant effect of genotype on HDEP % found in this study confirms the result of a previous report by Ali et al. (2020), who found that breed had a significant (P < 0.05) effect on hen-day egg production. In this study, the highest HDEP % was found in the ND genotype (63.34) at 22–28 weeks of age. This finding is in agreement with the findings of Faruque et al. (2015) and Faruque et al. (2017c), who found the highest HDEP% in the ND genotype (51.4 vs. 62.85) at 24–45 weeks of age.

**Expected response:** Table 2 showed that EP of ND, HI, and NN birds were expected to increase by 0.875, 1.585, and 0.255 %, respectively. The EW of ND, HI, and NN birds were expected to increase by 0.205, 0.250, and 0.015 g, respectively.

**Table 1**
Productive and reproductive performance of native chicken genotypes

| Parameter | Genotype (Mean ±SE)<br>ND (Mean ± SE) | H (Mean ± SE) | NN (Mean ± SE) | Level of Sig. |
|---|---|---|---|---|
| Hatching egg wt (g) | 49.22 ± 0.39 (400) | 48.68 ± 0.42 (370) | 48.57 ± 0.39 (450) | P > 0.05 |
| DOC weight (g) | 30.65$^b$ ± 0.29 (348) | 32.52$^a$ ± 0.32 (313) | 32.31$^a$ ± 0.31 (381) | P < 0.001 |
| 12$^{th}$ week weight (g) | 991.94$^b$ ± 7.91 (339) | 1212.08$^a$ ± 7.27(306) | 981.05$^b$ ± 7.47 (372) | P < 0.001 |
| Age at first egg (d) | 145.54$^c$ ± 1.08 (146) | 154.35$^a$ ± 1.01 (147) | 150.51$^a$ ± 1.08 (148) | P < 0.001 |
| Hen wt at maturity (d) | 1370.1 ± 13.2 (146) | 1650.89 ± 12.4 (147) | 1233.3 ± 13.1 (148) | P < 0.001 |
| Fertility (%) | 87.14 ± 2.67 | 85.29 ± 3.16 | 82.12 ± 2.32 | P > 0.05 |
| Hatchability on fertile eggs (%) | 80.85$^a$ ± 2.76 | 82.93$^a$ ± 2.44 | 75.04$^b$ ± 2.29 | P < 0.05 |
| Dead in germ (%) | 2.35$^b$ ± 0.23 | 3.32$^a$ ± 0.41 | 3.90$^a$ ± 0.70 | P < 0.001 |
| Feed Intake (g/b/d) (9–16 weeks) | 68.18$^b$ ± 2.21 | 85.61$^a$ ± 1.06 | 66.19$^b$ ± 2.31 | P < 0.001 |
| HDEP (%) (22–28 weeks) | 63.34$^a$ ± 1.69 | 50.57$^c$ ± 1.75 | 58.92$^b$ ± 1.99 | P < 0.001 |
| Mortality (%) (0–8 weeks) | 1.14 | 1.59 | 1.57 | P > 0.05 |

DOC = Day Old Chick; ND=Non-descript Deshi; HI = Hilly; NN = Naked Neck; HDEP = Hen day egg production; figures in the parentheses indicate the number of observations; Means without a common superscript along the row within a factor differed significantly (P < 0.05)

**Table 2**
Expected response to selection for EP (up to 40 weeks) and EW (at 40 weeks) in $G_7$ of native chicken

| Genotype | parameter | Before selection | | After selection | | Selection Differential (S) | Heritability ($h^2$) | Expected Response to Selection (R) |
|---|---|---|---|---|---|---|---|---|
| | | No. | Average | No. | Average | | | |
| ND | EP | 190 | 71.49 | 100 | 75.0 | 3.51 | 0.50 ± 0.03 | 0.875 |
| | EW | 190 | 45.09 | 100 | 45.94 | 0.85 | 0.49 ± 0.03 | 0.205 |
| HI | EP | 149 | 54.00 | 100 | 60.48 | 6.48 | 0.49 ± 0.03 | 1.585 |
| | EW | 149 | 45.09 | 100 | 46.18 | 1.09 | 0.46 ± 0.05 | 0.250 |
| NN | EP | 114 | 67.02 | 100 | 68.49 | 1.47 | 0.35 ± 0.10 | 0.255 |
| | EW | 114 | 44.88 | 100 | 44.94 | 0.06 | 0.49 ± 0.03 | 0.015 |

## 4. Conclusions

It is concluded that the Hilly genotype may be chosen for meat production and the Non-descript Deshi genotype for egg production. Responses to selection for EP and EW for three genotypes (ND, HI, and NN) were expected to be positive (increase). For further improvement, selection should be continued.

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**Conflict of Interest**

All authors declare there is no conflict of interest to accomplish this study.

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