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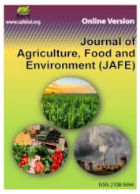

Original Article

Performance of two egg type chicken farms maintained different bio-security levels

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Keywords

Bio-security, Hisex Brown, Hisex White

A B S T R A C T

This study was aimed to determine the productive and economic performances of two different genotype egg producing chicken farms carried out with good, fair and poor bio-secured intervention in the south western region of Bangladesh. The world class Hisex White and Hisex Brown layer strainwas used as egg type chicken. According to obtain marks each of one hundred (total two hundred) surveyed farms were divided into good (≥ 80%), fair (61-79%) and poor (≤ 60%) bio-secured categories. Highest numbers of Hisex White (41%) farms but lowest numbers of Hisex Brown (29%) farms were reared under good bio-secured condition in the study area. Under good bio-secured level Hisex White and Brown was taken highest amount of feed and produced highest number of eggs. The average egg weight and egg mass of both Hisex White and Brown was not differed significantly (P>0.05) under good, fair and poor bio-secured farms respectively. Under good bio-secured farms FCR value was better than fair and poor farms respectively. Highest percentage of survivability occurs in good and lowest in poor bio-secured condition, both white and brown layer strain. The BCR of Hisex White was found highest (1.13) under good but similar (1.12) under fair and poor bio-secured farms and did not differed significantly (P<0.01). However, the BCR of Hisex Brown was found highest value (1.17) under different bio-security level. This result revealed that the Hisex Brown was less biosecurity sensitive and highly profitable than that of Hisex White farms.

Introduction

Rapid migration to urban areas, income growth, diversification in food demand patterns and a dietary shift towards high-value protein are increasing the demand for foods of animal origin. Poultry eggs are one of the most acceptable and highly digestible protein sources for many population groups in the world (Sarker *et al*., 2009). The per capita per year chicken eggs consumption in Pakistan, Sri Lanka, Indonesia and Malaysia is 60, 54, 87, and 320 eggs respectively where Bangladesh is only 41 eggs (Kabir, 2015). According to the national health strategy an adult people need 104 pieces eggs per year. However, presently the availability is only 63.65% (DLS, 2015). Although egg production has been increasing over time in the country but the per capita availability is far below the minimum requirement. Under these circumstances to meet up the deficiency of chicken eggs the government and private organizations are putting efforts together to produce commercial layer to enhance the present egg production status. Today's commercial layer means the egg producing hybrid strain that reared day old to profitable egg production stage that is up to 60%. Two varieties of layer strain that is white and brown. The white varieties produce white shell eggs at the age of seventeen to eighteen weeks of age as the body weight of 1300 to1400grams. The brown varieties produce brown shell eggs as the age of seventeen to eighteen weeks of age and the body weight of 1500 to1600 grams.

The most severe challenge facing the commercial poultry sector over the last few years has been the widespread and recurring onset of avian influenza (Al). The subtype H_5N_1 of Highly Pathogenic Avian Influenza (HPAI) was first reported in Southeast Asia in late 2003. The outbreaks of AI with spread rapidly being reported in 63 countries across Asia, Europe, Africa and the Middle-East (OIE, 2016). Since the emergence of HPAI virus in poultry in 2003, there have been 856 laboratory-confirmed human cases officially reported to World Health Organization (WHO) from 16 countries, including 452 deaths up to 3 October 2016 (WHO, 2016). The outbreaks have had serious economic impact to the affected countries, with millions of birds either killed by the disease or mandatory culled in an effort to limit the spread of virus (Rushton *et al.,* 2005; Alders *et al.,* 2014). Although, different countries have implemented various strategies aimed at preventing and mitigating infection within poultry with varying degree of success, in some countries, the virus remains entrenched within poultry populations (OIE, 2016, Alders *et al.,* 2014). One of the factors responsible for outbreaks and the persistence of the virus in domestic poultry populations are cited to be the widespread practice of small holder backyard poultry farming and associated live bird markets (Alders *et al.,* 2014; Henning *et al.,* 2009). This is mainly because basic bio-security measures are rarely implemented in backyard as well as commercial poultry farming systems allowing HPAI to circulate within poultry populations resulting in a perpetual virus source to other poultry flocks (Paul *et al.,* 2011; FAO, 2016). Therefore, one of the most effective forms of protection against HPAI and other poultry diseases is bio-security, which is principally the implementation of measures to prevent the introduction of infectious agents into the farm or environment. Bio-exclusion or containment measures to prevent spread of infectious agents from existing in the event of outbreaks (FAO, 2016).

In Japan, where bio-security practices are high and response to the outbreak very quick, were able to control the serious avian influenza and other infectious disease challenge more effectively. Poultry producers worldwide should now seriously consider taking steps for effective bio-security programs to exclude disease carrying vectors from entering farm environment (Alhaji and Odetokun, 2011). In Bangladesh bird flu (AI) was first outbreak in 2005 and again increased severity in 2007 and 2010. Last 2007-2008 economic year $710 million was lost for outbreak of bird flu. The epidemic of bird flu, approximately 50% of the poultry farms closed in 2007 (Kabir, 2015). On top of that 558 farms were infected in 2013 and 50% birds were died by avian influenza among 51 districts. (DLS, 2014). One person was died by avian influenza in 2013 with in seven cases (WHO, 2016). In this above scenario, government suggested against avian influenza to develop bio-security level in individual poultry farm.

Maintaining strict hygienic measure and bio-security can reduce the overall infection load in the farm and shrinks risks to least possible (Islam, 2013). So, bio-security is common word familiar to most farmers. Now it is the hot issue throughout the world for poultry production as well as human health. The early age of poultry farming, some commercial chicken farmer are using bio security practices which result increase productive performance as well as profitability. But very little research has conducted to the measure the performance of Hisex White and Hisex Brown layer farms at three dimension of bio-security like conceptual, structural and operational system at farm level. This is the specialty of the research work.

The finding of this study will also help to develop the bio-security knowledge of chicken farmers and its application in farm level that will minimize risk factor for successful farming. However, the findings will act as a guideline for the policy makers, entrepreneurs and extension planner to make policy and strategies for profitable egg producing chicken farming. The remainder of the paper is organized as follows. The next section II presents the methodology of the study. Results concerning egg producing chicken farms under different bio-security level are presented and discussed in section III. Section IV provides conclusions.

Methodology

Population and Sampling

A list of commercial Hisex White and Hisex Brown chicken layer farms was prepared with the help of Directorate of Livestock Service (DLS) and Aftab Bahumukhi Farms Ltd (ABFL). The farms those reared same hybrid and used same feed were purposively selected. The owners of these farms were treated as population of the study. The size of the sample was determined following the formula postulated by Kothari (2004). A multi-stage sampling technique was adopted. At the first stage, a purposive sampling technique was used to select only Khulna division out of the seven divisions of Bangladesh because it was provided the second highest population of chicken farms in the country (DLS, 2014). The second stage employed random selection of three (03) out of ten (10) districts of Khulna division. The third stage employed random selection of 02 upazillas from Satkhira, 03 from Khulna and 02 from Bagerhat district. Finally, two hundred different genotype layer farms were randomly selected taking each of 40, 30 and 30 farms from Khulna, Satkhira and Bagerhat district respectively (Table 1).

Table 1. Sample distribution of different genotype meat chicken farms.

Type	Strain name	Management	Feed	District sample size			Total
				Khulna	Satkhira	Bagerhat	
White layer farms	Hisex White	Litter/Floor system	Aftab ready feed	40	30	30	100
Brown layer farms	Hisex Brown	Litter/Floor system	Aftab ready feed	40	30	30	100
Total	-	-	-	80 (289)	60 (162)	60 (152)	200

Figure in the parenthesis indicates no. of total farms conform these bio-security criteria

Data collection

Data were collected by three ways firstly direct observation of the farms. Secondly observed the record register kept by the farmers and finally interviewed the respondents through the pretested questionnaire. Data were collected January to December, 2013.

Bio-security level specification

The selected Hisex White and Hisex Brown layer farms were divided into three bio-security levels; poor, fair and good by using measures of bio-security standard score which are as follows:

Level	Score
Poor	<60
Fair	60-79
Good	≥80

(Source: Third meeting 12 November, 2009 of PTDDP Bio-security Standard Development Committee, Bangladesh Livestock Research Institute, Savar, Dhaka).

Table 2. The structure and marks distribution of the questions included in the questionnaire.

Types of bio-security	Characters	Marks distribution	Bio-security level
Conceptual bio-security	Educational qualification, Training condition, Year of experiences, Knowledge score about bio-security	20	Those farms got ≥ 80% marks were good 61% to 79% marks were fair ≤ 60% marks were poor bio-secured farms
Structural bio-security	Location of the farm, Design of the house, Roofing materials, Distance from high way, Distance from locality, Distance from other farm, Protection from other birds, Boundary, Manure pit, Disposable pit, Foot bath, Ventilation, 'No entrance' sign board	30	Those farms got ≥ 80% marks were good 61% to 79% marks were fair ≤ 60% marks were poor bio-secured farms
Operational bio-security	Cleaning of the shed, Cleaning the premises, Disinfection the shed, Disinfection the premises, Cleaning and disinfection of waterer, Cleaning and disinfection of feeder, Feed quality, Water quality	50	Those farms got ≥ 80% marks were good 61% to 79% marks were fair ≤ 60% marks were poor bio-secured farms
Total		100	

Source: Third meeting 12 November, 2009 of PTDDP Bio-security Standard Development Committee, Bangladesh Livestock Research Institute, Savar, Dhaka. Australian bio-security standard FAO (2008).

Data analysis

Collected data were compiled, coded, tabulated for processing and analysis in accordance with the objectives of the study. To draw a meaningful conclusion, tabular presentation of data was intensively used. The SAS 9.1.3 version was used to analyze the data (SAS, 2009). Descriptive statistics like number, percentage, mean and standard error were used in describing the selected independent and dependent variables of the study.

Results and discussion

The findings or outcomes of the research work and its logical interpretations are presented in this section. Two surveys that dealt with the findings of productive and economic performance of two egg type chicken farms under different bio-security level.

Findings of survey-01

Under the field survey 01, the numbers of good, fair and poor bio-secured Hisex White layer farms in the Satkhira, Khulna and Bagerhat district are shown in figure 1.

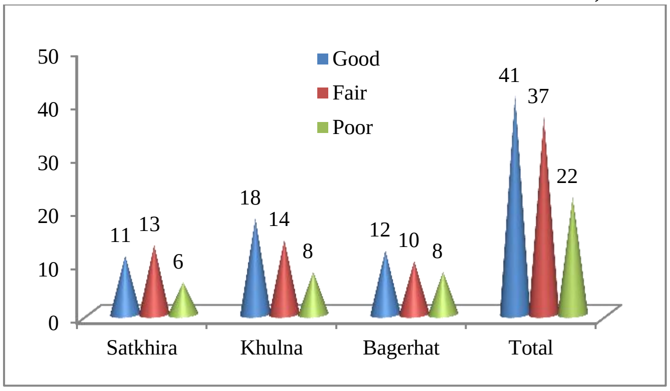

Figure 1. Numbers of different bio-secured status Hisex White layer farms in the study area.

From overall consideration the data presented in Figure 1 show that the number of good bio-secured Hisex White layer farms were highest (41) followed by fair (37) and poor (22). The numbers of poor bio-secured farms were lowest in all the three districts in the study area. But the number of good bio-secured farms was highest in Khulna followed by Bagerhat and Satkhira district. The number of fair bio-secured farms was also highest in Khulna followed by Satkhira and Bagerhat district.

Total feed intake (Kg/b/90wks), Egg production (hh), Average Egg weight (g), Egg mass, kg (hh) Marketed body weight (g), FCR value and Survivability of Hisex White commercial layer farms in different bio-security level are shown in Table 3. Total feed intake (Kg/b/90wks) was found 61.12, 60.19 and 59.57 kg among good, fair and poor bio-secured farms and was differed highly significant (P<0.001). Similar result was recommended by ISA breeding company (www.isapoultry.com).

Table 3. Productive performances of Hisex White layer farms in different bio-security level.

Variables	Level of Bio-security			P value and Significance level
	Good (41) Means ± SE	Fair (37) Means ± SE	Poor (22) Means ± SE	
Total feed intake (Kg/b/90wks)	61.12^{a}±0.11	60.19^{b}±0.14	59.57^{c}±0.21	(0.0001)***
Egg production (hh)	412.02^{a}±0.21	408.29^{b}±0.27	405.18^{b}±0.43	(0.002)**
Avr. Egg wt (g)	62.06±0.13	61.85±0.21	60.68±0.10	(0.11)NS
Egg mass,kg (hh)	25.57^{a}±0.55	24.56^{b}±0.29	24.06^{b}±1.09	(0.03)*
Spent hen weight (g)	1.76^{a}±0.07	1.69^{b}±0.12	1.63^{b}±0.09	(0.029)*
FCR	2.39^{c}±.005	2.45^{b}±0.009	2.47^{a}±0.01	(0.0001)***
Survivability (%)	96.00^{a}±0.22	93.84^{b}±0.23	91.36^{c}±0.19	(0.0001)***

[abc] Mean values having different superscripts in a raw within three different bio-security level differed significantly ***, P<0.001;**, P<0.01; *, P<0.05; NS = P>0.05

Egg production (hh) was highest under good (412.02) and more or less similar under fair (408.29) and poor (405.18) bio-secured farms. Average egg weight was not significantly (P>0.05) differed among good (62.06), fair (61.85) and poor (60.68) bio-secured farms in the study area. Egg mass was found 25.57, 24.56 and 24.06 under good, fair and poor bio-secured farms. There was no significantly differed between fair and poor but under good bio-secured level it was differed significantly (P<0.05). Spent body weight was highest under good (1.75 kg) but more or less similar under fair (1.69 kg) and poor (1.63kg). FCR value was higher trends under good (2.39), fair (2.45) and poor (2.47) and differed highly significantly (P<0.001). Survivability was found 96%, 93.84% and 91.36% under good, fair and poor respectively and it also differed highly significantly (P<0.001). These results revealed that incase of FCR and survivability the null hypothesis was strongly rejected.

Total cost, Gross return, Gross margin, Net return and Benefit Cost Ratio (BCR) of Hisex white commercial layer farms under different bio-security level are shown in Table 4. Total cost was found BDT 2393.59, 2365.39 and 2351.36 per bird among good, fair and poor level farms. There was no significant different between fair and poor but under good it was differed significantly (P<0.05). Gross return was highest under good (BDT 2706.24) medium under fair (BDT 2652.78) and lowest under poor (BDT 2351.36). The different of Gross return among good, fair and poor was highly significant (P<0.001).

Table 4. Economic performances of Hisex White layer farms in different bio-security level.

Performance	Level of Bio-security			P value and Significance level
	Good (41) Means ± SE	Fair (37) Means ± SE	Poor (22) Means ± SE	
Total cost (BDT/bird)	2393.59^a± 3.71	2365.39^b± 4.98	2351.36^b± 7.59	(0.04)*
Gross Return (BDT/ bird)	2706.24^a± 2.28	2652.78^b± 1.64	2634.09^c± 2.63	(0.0001)***
Gross margin	468.85^a± 3.74	443.59^b± 4.83	441.95^b± 6.42	(0.0014)**
Net return (BDT/bird)	312.65^a± 1.22	287.39^b± 3.18	282.73^b± 3.92	(0.033)*
BCR	1.13^a±0.002	1.12^b±0.002	1.12^b±0.003	(0.0023)**

[abc] Mean values having different superscripts in a raw within three different bio-security level differed significantly ***, P<0.001;**, P<0.01; *, P<0.05

Gross margin was found BDT 468.85, 443.59 and 441.95 under good, fair and poor bio-secured farms respectively. Gross margin was more or less similar under fair and poor but under good it was differed significantly (p<0.01). Net return was highest under good BDT 312.65 but more or less similar under fair (287.39) and poor (282.73). This result inconsistent to the report of FAO (2015) working paper they were found the Net return of all area average was BDT 179.2 only. Benefit Cost Ratio (BCR) was found 1.13 in good and 1.12 under fair and poor bio-secured farms in the study area. This result was revealed that good bio-security practice increase the benefit of the farms.

Findings of survey-02

Under the survey-02, the numbers of good, fair and poor bio-secured Hisex Brown layer farms in the Satkhira, Khulna and Bagerhat district are shown in figure 02.

Overall consideration of the data presented in Figure 2 revealed that the number of fair bio-secured brown layer farms was highest (39) followed by poor (32) and good (29). In Khulna district the good bio-secured brown layer farms were highest followed by fair and poor whereas similar in Bagerhat district. The number of good bio-secured farms was lowest in Satkhira than that of Khulna and Satkhira district.

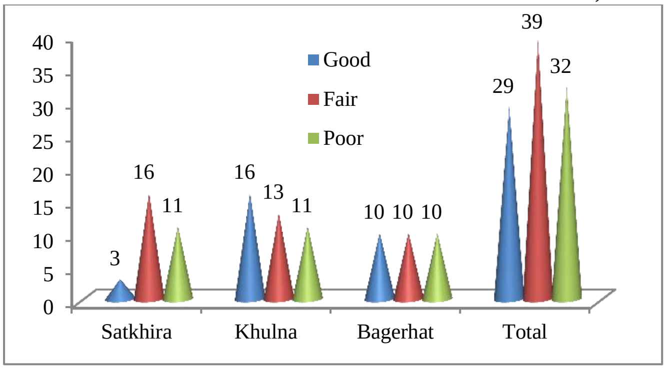

Figure 2. Numbers of different bio-secured status Hisex Brown layer farms in the study area.

Total feed intake (Kg/90wks), Egg production (hh), Average Egg weight (g), Egg mass (kg /hh) Marketed body weight (g), FCR and Survivability of Hisex Brown commercial layer farms in different bio-security level are shown in Table 5. Total feed intake was found 62.74, 61.86 and 61.72 Kg under good, fair and poor bio-secured farms that were similar as ISA breeding company (www.isapoultry.com). The result revealed that the feed intake did not vary significantly between fair and poor but differ significantly (P<0.001) under good bio-secured farms. Egg production was found 408.72, 405.61 and 403.12 under good, fair and poor bio-secured farms and differed significantly (P<0.001). Average egg weight and egg mass did not differed significantly (P>0.05) under good, fair and poor bio-secured farms in the study area.

Table 5. Productive performances of Hisex Brown layer farms in different bio-security level.

Performance	Level of Bio-security			P value and Significance level
	Good (29) Means ± SE	Fair (39) Means ± SE	Poor (32) Means ± SE	
Total feed intake(Kg/90wks/b)	62.74^a±0.11	61.86^b±0.14	61.72^b±0.16	(0.0001)***
Egg production(hh)	408.72±0.25	405.61±0.29	403.12±0.40	(0.0001)***
Avr. Egg wt(g)	63.06±0.08	62.55±0.22	62.49±0.16	(0.24)NS
Egg mass, kg (hh)	25.01±0.04	24.96±0.06	24.88±0.07	(0.10)NS
Spent hen weight (kg)	1.85^a±0.01	1.74^b±0.011	1.70^c±0.007	(0.023)*
FCR	2.44^c±.005	2.48^b±0.007	2.53^a±0.009	(0.0001)***
Survivability (%)	96.58^a±0.40	93.79^b±0.29	91.04^c±0.23	(0.001)**

[abc] Mean values having different superscripts in a raw within three different biosecurity level differed significantly ***,P<0.001 **, P<0.01; *, P<0.05; NS = P>0.05

Spent hen weight was found 1.85, 1.74 and 1.70 kg under good, fair and poor farms respectively and was differed significantly (P<0.05). Islam *et al.* (2013) reported the weight of ISA brown was 1.9 kg which is close to the findings of present study (1.85 kg) at good bio-secured farms. FCR value was found 2.44, 2.48 and 2.53 among the good, fair and poor bio-secured farms and varied highly significant (P <0.0001). Survivability (%) was found 96.58, 93.79 and 91.04 under good, fair and poor bio-secured farms and differed significantly (P<0.001). These lower trends revealed that the survivability was highly bio-security response. Total cost (BDT

/bird), Gross Return (BDT / bird), Gross margin, Net return (BDT /Bird) and BCR of Hisex brown commercial layer farms in different bio-security level are shown in Table 6. Total cost (BDT/bird) was found more or less similar under fair (2420.22) and poor (2415.26) but significantly differed (P<0.001) under good (2442.58) bio-secured farms in the study area. Gross Return (BDT/ bird) was highest under good (2869.36), medium under fair (2839.5) and lowest under poor (2823.31) and varied significantly (P<0.001). Gross margin was 582.92, 575.47 and 564.5 under good, fair and poor respectively and did not varied significantly (P>0.05).

Table 6. Economic performances of Hisex Brown layer farms in different bio-security level.

Performance	Level of Bio-security			P value and Significance level
	Good (29) Means ± SE	Fair (39) Means ± SE	Poor (32) Means ± SE	
Total cost (BDT/bird)	2442.58^a±4.11	2420.22^b±4.90	2415.26^b±5.76	(0.0009)***
Gross Return (BDT/ bird)	2869.36^a±3.01	2839.5^b±1.93	2823.31^c±2.65	(0.0001)***
Gross margin	582.97±4.59	575.47±5.44	564.25±6.08	(0.07)NS
Net return (BDT/bird)	426.77±4.55	419.27±5.48	408.04±6.88	(0.07)NS
BCR	1.17±0.002	1.17±0.003	1.17±0.003	(0.30)NS

[abc] Mean values having different superscripts in a raw within three different bio-security level differed significantly ***, P<0.001; NS = P>0.05

Net return (BDT/bird) was found 426.77, 419.27 and 408.04 under good, fair and poor bio-secured farms in the study area and differed non significantly (P>0.05). Similar result of BCR (1.17) under good, fair and poor revealed that there was no effect of bio-security on Hisex Brown layer farms in the study area. So that incase of Hisex Brown layer farms the null hypotheses was accepted.

Conclusions

The productive performances in terms of total feed intake (Kg/bird) at the age of ninety weeks, egg production (hh), average egg weight (g), egg mass kg (hh) spent hen weight (kg) and survivability (%) of two egg type chickens like Hisex White and Hisex Brown farms followed similar trends being highest in good followed by fair and poor bio-secured conditions. But the Feed Conversion Ratio (FCR) was lowest under good followed by fair and poor bio-secured level in both types of layer farms. Economic performances of two egg type chicken farms also responded similarly to the measurement of bio-security levels in the farms except Benefit Cost Ratio (BCR).

The BCR of Hisex White was found highest under good but similar under fair and poor bio-secured farms respectively. However, the BCR of Hisex Brown was similar under different bio-secured level but highest than Hisex White. From the above discussion it was clearly concluded that the brown layer farms was highly profitable and less bio-security response than that of White layer farms in the south-western region of Bangladesh.

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