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RESEARCH ARTICLE

Comparative Performance and Hemato-Biochemical Profile of Jinding Ducks in Different Production Systems of Bangladesh

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ABSTRACT

Jinding ducks are newly introduced to Bangladesh in commercial and household rearing. In order to assess production and hemato-biochemical status of Jinding ducks studies were conducted on household ducks of Chatkhil (August 2005-2006) and Sonagazi duck breeding farm (August 2008-June 2009). One hundred Jinding ducks (60 Chatkhil and 40 Sonagazi duck breeding farm) were randomly selected each time of sampling from 2,300 birds (300 Chatkhil and 2,000 Sonagazi duck breeding farm). Sexual maturity and average egg production per duck was calculated. Ducks attained better ($P<0.001$) average weight at Chatkhil than at Sonagazi duck breeding farm. Annual egg production was significantly lower ($P<0.001$) at Chatkhil than at Sonagazi duck breeding farm. Lymphocyte counts, serum total proteins, aspartate transaminase and alanine transaminase were recorded significantly higher in Chatkhil ducks than in Sonagazi duck breeding farm ducks while it was reverse for monocytes and heterophils. Hemoglobin and packed cell volume in ducks differed non-significantly. Total erythrocytes counts increased with advancing age of ducks in both sites. In conclusion egg production performance of ducks was poor in Chatkhil. Hematobiochemical indices (in particular lymphocyte, aspartate transaminase and alanine transaminase) were potentially higher in ducks of Chatkhil.

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INTRODUCTION

Bangladesh has the third largest duck population, dominated by household indigenous domestic ducks, of 39.8 million in the world (Dolberg, 2009). Household duck rearing, mostly owned and managed by women and children, is an important means of reducing poverty in resource-poor household farmers with low income and livelihood conditions (Akteruzzaman *et al*., 2012). Household duck rearing is mostly based on scavenging (no supplemental food provided to ducks) or semi-scavenging (small amount of supplemental foods given to ducks during day time) systems in this country (Rahman *et al*., 2009). Household ducks forage snail, duck weed, fish and algae near by scavenging fields such as ditches, ponds, lake, river etc to meet up their nutritional requirements (Hoque *et al*., 2011a). However, the availability of these feed resources is affected by their locations, habitats and seasons (Hoque *et al*., 2010).

The scale of intensive commercial duck farming is less and these farms are mostly operated by the Government (Hoque *et al*., 2011a). The available commercially reared ducks are Khaki Campbell, Muscovy ducks and also domestic (white and black) ducks. They are raised completely with a commercial available balanced feed (Rahman *et al*., 2012).

Average annual egg production of a duck (regardless of duck breed) of commercial farm is 200, which is higher than that of a household duck (Das *et al*., 2008). However, potentiality of any of commercial ducks reared in household conditions has not been well-tested. Therefore, Bangladesh government with the financial and technical support of Smallholder Livestock Development Project-2 (SLDP-2) has introduced Jinding duck; an exotic commercial breed and well-suited to salty water, to the southern costal belt of Bangladesh through a Naraynganj government duck breeding farm in 2002. The current study, therefore, compared the production potentials (weight, sexual maturity

and egg yield) of Jinding ducks in both household and farm rearing systems. This paper suggested the areas of improvement needed for better production of Jinding ducks.

There is also limited scientific information to assess health and nutritional status of Jinding ducks through hemato-biochemical examination of blood samples. In order to measure hemato-biochemical indices the present study was, therefore evaluated blood samples obtained from the sampled Jinding ducks at household and farm rearing systems. Evaluated hemato-biochemical status of ducks in this study could help in formulating a balanced feed ration for Jinding ducks of the study areas in particular semi-scavenging rearing system.

MATERIALS AND METHODS

We considered 2 different study sites which corresponded to 2 different production systems to assess and compare production potential and hemato-biochemical indices of Jinding ducks between these systems. Chatkhil of Noakhali district was one of the sites where ducks were reared under the semi-scavenging system and Sonagazi duck breeding farm (SDBF) under the Feni district is another site where ducks were reared in intensive farming system. The SDBF is a government duck breeding farms from which day old ducklings were distributed to rural farmers through Non Government Organizations (NGOs). Community Development Centre (CODEC) was one of those NGOs, supplied day-old ducklings to the farmers of Chatkhil.

Duck households of Chatkhil under the duck model were chosen as a source population. From August 2005-2006, 30 of 300 households, 10 day-old birds/household were randomly selected for 1 year study. The duck model was designed by SLDP-2 and implemented by CODEC (Hoque *et al*., 2011a). Jinding ducks at SDBF were considered as source population for the on-farm study. 40 ducks (N=2,000 approximately) were randomly selected each time of sampling during August 2008-June 2009. Initial age of sampled ducks of SDBF was 30 days. Ducks under the study were reared on ordinary routine practice of the SDBF or household rearing without providing any special treatment.

Body weight was measured by a balance (AR2140, USA) at 1 month interval between 30-240 days old birds. Sexual maturity and average egg production/duck at Chatkhil were calculated as described by Hoque *et al*. (2011a) and recorded through farm registry at SDBF. Blood samples were taken from randomly sampled birds at 1 month interval between 90-240 days old birds. 2-3 ml blood sample was drawn/bird using wing vein.

Blood slide smear was prepared immediately after collection and stained with Wright's stain for differential leukocyte counts. 0.5-1.0 ml of blood with anticoagulant was kept and processed later on for hemoglobin (Hb) estimation and packed cell volume (PCV) (Tvedte and Lilliehook, 2011). A portion of sampled blood of individual duck was used to count Total erythrocyte counts (TEC) by Auto Hemato-Analyzer (Abacus Junior Vet-120111, Austria). The rest of the blood sample placed in a tube without anticoagulant was stored at 4°C for overnight before serum separation. Serum samples were separated and stored at -80°C until the further testing being performed. Serum samples were evaluated for calcium (Ca), phosphorous (P), total protein (TP), aspartate aminotransferase (AST) and alanine aminotransferase (ALT) by a biochemical analyzer (PLD-951/951A/951B; Netherlands) according to the protocol of Randox Laboratories Ltd (CA 590, CA592 and colorimetric method).

The field and laboratory data were analyzed using STATA®, version 11 (StataCorp 2010). The results of weight gain, egg production and hemato-biochemical parameters of sampled ducks were compared between rearing systems using unpaired t- test assuming unequal variance. The results were expressed in mean±SD, at $P<0.05$ and 95% confidence interval (CI).

RESULTS

Physical parameters: The weight gain of Jinding ducks were higher in Chatkhil (semi-scavenging) ($P<0.001$) than that of SDBF for the first 4 age groups between 30-120 days. At comparative age groups between 150-240 days except 210 days, the average weight gains of ducks were better in SDBF ($P\leq0.005$) than in Chatkhil (Table 1). The average days required to attain the sexual maturity (onset of egg laying) of ducks were 184.2 days (Chatkhil) ($P\leq0.001$) and 150 days (SDBF). The average annual egg production/duck was 138 in Chatkhil ($P\leq0.001$) and 225 in SDBF.

Table 1: Average weight gain of Jinding ducks according to age groups between Chatkhil (N=60) and Sonagazi duck breeding farm (N=40)

Days	Chatkhil		Sonagazi	
	Mean±SD	95% CI	Mean±SD	95% CI
30	462.8 ±165.7[a]	420.0-505.6	253.9±45.9	239.2-268.6
60	863.7±259.9[a]	796.6-930.9	441.0±151.8	392.4-489.6
90	987.3 ±210[a]	932.9-1041.7	531.7±164.3	479.2- 584.3
120	1112.3±188.2[a]	1063.7-1160.9	765.4±154.6	715.9-814.9
150	1187.2±164.5	1144.8-1229.7	1485.6±143.9[a]	1439.6-1531.7
180	1408.0±209.4	1353.5-1462.6	1505.2±125.9[b]	1464.9-1545.5
210	1471.0±209	1416.9-1525.0	1528.7±107.0[b]	1494.5-1562.9
240	1520.2±176.0	1474.5-1565.9	1608.0±127.1[b]	1567.4-1648.7

Values (mean±SD) bearing different superscripts in a row differ significantly (a: $P<0.001$; b: $P<0.05$).

Hematology: At different age groups, average lymphocyte numbers in ducks were higher in Chatkhil ($P<0.001$) than in SDBF (Table 2). The average value of monocytes and heterophils were higher in ducks of SDBF ($P<0.05$) than in ducks of Chatkhil. The results of eosinophils, basophils and Hb were mostly identical at similar age groups regardless of study sites (Table 2 and 3). The average PCV values in ducks were mostly higher ($P<0.001$) in SDBF than in Chatkhil, while compared at different age groups (Table 3). The TEC in ducks ranged average $2.8\text{-}2.9\times10^6/mm^3$ (Chatkhil) and $2.0\text{-}2.9\times10^6/mm^3$ (SDBF). The result was identical at different age groups comparison.

Biochemical parameters: The mean Ca values in ducks were higher in SDBF than in Chatkhil ($P\leq0.05$). In age group comparisons, no difference of P level was observed in ducks between production systems (Table 4). At the comparative age group of 90 and 210 days, the differences of TP levels were found between 2 production systems ($P\leq0.009$) (Table 5). The AST values in ducks were higher ($P<0.001$) in Chatkhil than in SDBF at comparative age groups of 90, 210 and 240 days. The ALT values in ducks were higher ($P<0.001$) in Chatkhil than in SDBF at age group of 210 and 240 days (Table 6).

Table 2: Differential leukocyte counts (Mean ±SD) in Jinding ducks between Chatkhil (N=60) and Sonagazi breeding farm (N=40)

	Lymphocyte		Monocyte		Heterophil		Eosinophil		Basophil	
Days	Chatkhil	Sonagazi	Chatkhil	Sonagazi	Chatkhil	Sonagazi	Chatkhil	Sonagazi	Chatkhil	Sonagazi
90	64.5±6.9[a]	59.2±4.5	12.9±4.1	15.1±2.9	17.9±3.7	21.1±5.5[a]	3.9±1.8	3.9±1.8	0.8±0.6	0.8±0.4
120	65.7±8.7[a]	58.9±3.9	12.1±4.2	15.4±2.9[a]	18.3±5.9	21.4±5.8[a]	3.1±1.4	3.6±1.4	0.8±0.7	0.8±0.4
150	67.8±8.8[a]	59.4±3.7	11.7±4.6	15.2±2.9[a]	16.7±4.9	20.7±5.3[a]	3.1±1.3	3.9±1.3[b]	0.8±0.7	0.9±0.4
180	69.5±8.2[a]	60.9±6.1	10.7±3.9	13.7±2.8[a]	16.1±5.4	20.7±7.4[a]	2.9±1.2	4.0±0.9[a]	0.7±0.7	0.7±0.5
210	67.6±9.7[a]	57.9±4.5	10.8±3.9	13.8±2.9[a]	17.9±7.2	24.7±6.5[a]	2.8±1.4	2.9±1.7	0.9±0.8	0.7±0.5
240	70.2±8.3[a]	6.9±4.4	10.8±4.3	14.1±2.8[a]	14.9±4.2	20.8±5.4[a]	3.2±1.4	3.6±1.6	0.9±0.8	0.7±0.5

Values (mean±SD) bearing different superscripts in a row differ significantly (a: P <0.001; b: P<0.05); SD: Standard deviation.

Table 3: Status of haemoglobin and packed cell volume in Jinding ducks between Chatkhil (N=60) and Sonagazi breeding farm (N=40)

Days	Haemoglobin (g/dl)				Packed cell volume (%)			
	Chatkhil		Sonagazi		Chatkhil		Sonagazi	
	Mean±SD	95% Confidence Interval: CI	Mean±SD	CI	Mean±SD	CI	Mean±SD	CI
90	12.4±0.1	12.4-12.5	12.4±0.2	12.3-12.4	35.6±0.2[a]	35.6-35.7	34.4±1.7	33.9-34.9
120	12.6±0.2	12.6-12.7	12.6±0.2	12.5-12.7	36.7±0.3	36.6-36.8	37.0±0.9[b]	36.7-37.3
150	13.5±0.2	13.5-13.6	13.5±0.2	13.5-13.6	40.5±0.2	40.4-40.5	41.3±1.4[a]	40.9-41.7
180	15.5±0.4	15.4-15.6	15.5±0.3	15.4-15.6	43.7±0.2	43.6-43.7	43.6±1.0	43.3-43.9
210	14.7±0.3	14.6-14.7	14.6±0.5	14.4-14.7	39.3±6.3	37.7-40.9	39.6±7.9	37.0-42.0
240	13.5±0.2	13.4-13.5	13.5±0.4	13.4-13.6	35.6±0.2	35.5-35.6	36.0±0.9	35.7-36.3

Values (mean±SD) bearing different superscripts in a row differ significantly (a: P <0.001; b: P<0.05); SD: Standard deviation.

Table 4: Calcium and phosphorous in Jinding ducks between Chatkhil (N=60) and Sonagazi breeding farm (N=40)

	Calcium (mg/dl)				Phosphorus (mg/dl)			
Days	Chatkhil		Sonagazi		Chatkhil		Sonagazi	
	Mean±SD	95% CI	Mean±SD	95% CI	Mean±SD	95% CI	Mean±SD	95% CI
90	9.4±2.0	8.9-9.9	8.7±3.7	7.5-9.9	4.6±1.7	4.2-5.0	4.2±1.8	3.6-4.7
120	10.3±2.0[b]	9.8-10.8	9.2±2.9	8.3-10.1	5.5±1.9	4.9-5.9	5.6±2.7	4.7-6.4
150	10.9±2.0	10.4-11.4	10.0±5.2	8.4-11.7	5.6±2.5	4.7-6.1	5.0±3.6	4.8-7.0
180	13.0±2.4	12.5-13.7	12.5±6.7	10.4-14.6	6.6±1.9	6.0-6.9	6.4±2.4	5.7-7.1
210	13.1±2.3	12.5-13.7	13.0±6.1	11.1-15.0	6.7±1.8	6.3-7.2	6.8±4.7	5.2-8.2
240	15.9±1.8[b]	15.4-16.4	14.2±4.5	12.8-15.7	8.0±1.9	7.5-8.5	7.9±2.9	6.9-8.7

Values (mean±SD) bearing different superscripts in a row differ significantly (a: P <0.001; b: P<0.05); SD: Standard deviation.

Table 5: Total protein (g/dl) in Jinding duck between Chatkhil (N=60) and Sonagazi breeding farm (N=40)

Days	Chatkhil		Sonagazi	
	Mean±SD	95% CI	Mean±SD	95% CI
90	5.3±0.9[b]	5.0-5.5	4.8±0.9	4.5-5.0
120	5.6±1.1	5.3-5.9	5.±1.0	5.2-5.9
150	6.3±1.0	6.0-6.6	5.9±1.3	5.5-6.3
180	5.7±1.6	5.3-6.0	5.2±1.6	4.7-5.7
210	5.9±0.9[a]	5.7-6.1	4.8±1.0	4.5-5.1
240	5.6±7.0[a]	5.4-5.8	4.5±0.9	4.2-4.9

Values (mean±SD) bearing different superscripts in a row differ significantly (a: P <0.001; b: P<0.05); SD: Standard deviation.

DISCUSSION

Jinding ducks gained significantly higher weight gain in Chatkhil than in SDBF for up to 4 months of age (July-October) in this study. This may be due to have available scavenging feed during that period in Chatkhil along with providing of commercial balanced feed for the first few weeks of rearing (Kabir *et al.,* 2007).

An opposite trend of weight gain of Jinding ducks was observed for the rest 4 months of age where ducks had significantly higher weight gain in SDBF. This is obvious due to have a consistent supply of balanced commercial feed to ducks of SDBF. The poor weight gain of ducks in Chatkhil during that period could be due to unavailability of scavenging feed because of dry season and absence of providing commercial feed during the last 4 months (Hoque *et al*., 2011b).

The delayed sexual maturity of Jinding ducks in Chatkhil with their poor annual egg production as compared to ducks in SDBF indicates the insufficiency of scavenging feed in Chatkhil during production period (dry period). In the summer season, scavengeable feedstuff was scanty and the ducks were exclusively dependent on supplied feed source. Unavailability of scavenging feedstuff for rural ducks during dry period is also supported by other studies (Chowdhury *et al*., 2006; Hoque *et al*., 2011b).

Hemoglobin level of Jinding ducks remained within the normal values regardless of study sites and age which corresponds to the results of a previous study (Alam *et al*., 2001).

No clear trend of increasing or decreasing of Hb values with the increase of age ducks was observed in this study. In contrast to the present study a higher level of Hb was recorded during growing age of female ducks and turkeys as compared with the older (Wagner *et al*., 2008). This difference could be due to over influence of oestrogen in reducing Hb level during laying period.

In general, the PCV in ducks was higher in SDBF than in Chatkhil which could be due to the nutritional differences. In spite of having difference of PCV level in ducks between sites, the values remained within the usual limits. This finding is coincided with the earlier studies on Nigerian ducks (Olayemi *et al*., 2006). The PCV level was recorded to be higher during growing and laying period of ducks in both sites; this was supported by Khawaja *et al*. (2012). Total erythrocytes counts also increased with the advance of age of ducks in the study which are similar to a prior study (Khawaja *et al*., 2012).

Generally, lymphocyte counts of ducks were slightly higher in Chatkhil than in SDBF. This difference in

Table 6: Aspartate aminotransferase (AST) and alanine aminotransferase (ALT) values in Jinding ducks between Chatkhil (N=60) and Sonagazi breeding farm (N=40)

Days	AST(IU/L)				ALT(IU/L)			
	Chatkhil		Sonagazi		Chatkhil		Sonagazi	
	Mean±SD	95% CI	Mean±SD	95% CI	Mean±SD	95% CI	Mean±SD	95% CI
90	37.0±7.7[a]	35.0-39.0	33.1±3.4	32.0-34.2	25.7±5.2	24.3-27.0	23.9±5.3	22.3-25.7
120	35.1±8.3	32.9-37.3	34.4±2.1	33.7-35.0	24.9±5.1	23.5-26.1	24.8±5.1	23.1-26.4
150	34.5±7.4	32.6-36.4	32.8±4.0	31.5-34.1	23.1±4.9	21.8-24.3	23.9±4.1	22.6-25.2
180	34.1±7.4	32.2-36.1	34.6±2.1	33.9-35.3	23.7±5.1	22.4 -25	25.7±3.8[b]	24.5-26.9
210	33.6±8.1[a]	31.5-35.7	26.3±4.6	24.9-27.8	23.5±5.7[a]	22.0-25.0	18.1±3.9	16.9-19.5
240	33.1±8.0[a]	30.9-35.2	24.1±4.0	22.8-25.4	22.5±4.7[a]	21.3-23.8	17.7±3.0	16.7-18.7

Values (mean±SD) bearing different superscripts in a row differ significantly (a: P<0.001; b: P<0.05); SD: Standard deviation.

lymphocytes can be observed because of the high risk of viral infection in free ranged ducks as compared to ducks of SBDF. Monocytes, heterophils and eosinophils were found to be higher in ducks of SDBF than in ducks of Chatkhil. This variation could be influenced by stressed due to capture of the farmed ducks made the hormonal variations (Huff *et al*., 2008). The Ca level was higher in ducks of SDBF than in ducks of Chatkhil which is probably caused due to nutritional variations between study sites (Alam *et al*., 2001).

An increase level of TP at growing and production age of ducks was observed in this study. This is due to the fact that young ducks need relatively more protein for development of feather and body (Tufan *et al*., 2011a). Total protein in ducks was significantly higher in Chatkhil than in SDBF at 90, 210 and 240 days. This higher level of TP could be due to having snails, fish, earthworms, duckweed, algae etc (Hoque *et al*., 2011).

The AST and ALT values of ducks were significantly higher in Chatkhil than in SDBF at 90, 210 and 240 days. This is because when semi-scavenging ducks (Chatkhil) roam freely for searching feed there are strong muscular activities involved that could enhance the value of AST and ALT. The increased AST and ALT values also suggest a muscular damage, toxic indigestion, and/or various metabolic disorders (Mondal *et al*., 2011).

Conclusion: In conclusion feed supplementation is required during growing and production period of ducks in Chatkhil for better production. Increase lymphocyte level in ducks of Chatkhil suggests birds might have subclinical viral infections. Increase levels of TP in ducks of Chatkhil suggest that they consume considerable amount of semi-scavengable protein-rich feed stuff. Elevation of AST and ALT in ducks of Chatkhil was probably due to excessive muscular movement during roaming around scavenged fields.

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