Univ. j. zool. Rajshahi Univ. Vol. 31, 2012 pp. 13-18
http://journals.sfu.ca/bd/index.php/UJZRU
ISSN 1023-6104

Assessment of the production performance and economic efficiencies of available chicken breeds (*Gallus domesticus* L.) in Rajshahi, Bangladesh

Ripon Kumar Dutta, M. Saiful Islam* and Md. Ashraful Kabir[1]
Department of Zoology, University of Rajshahi, Rajshahi 6205, Bangladesh
[1]Present address: Department of Biology, Holy Land College, Dinajpur 5200, Bangladesh;
*Corresponding author: saifulzoo@yahoo.co.uk

Abstract: Production performance and economic efficiencies of broiler of Cobb 500, cockerel of ISA Brown, Fayoumi, and RIR (Rhode Island Red) and *Sonali* (derived from RIR♂ × Fayoumi♀) available in Rajshahi were investigated. Identical care and management practices were provided to chickens of all genetic groups reared for meat and egg production. Performance of four meat purpose chickens *viz.*, Cobb 500, ISA Brown, Fayoumi and *Sonali* were evaluated in terms of such important parameters as initial body weight (IBW), 5-wk rearing period (RP), achieved body weight (ABW), feed intake (FI), body weight gain (BWG) and feed conversion ratio (FCR). Performance of three egg purpose chickens *viz*. Fayoumi, RIR and *Sonali* included weight of day-old chick (WDOC), growth rate (GR), death rate (DR), fertility (FR), hatchability (HT), first laying age (FLA) and monthly egg production (MEP). Economic efficiency parameters *viz*., total cost (TC), gross return (GRR), net return (NR) and cost-benefit ratio (CBR) were calculated for both types. In terms of FI, FCR and BWG values, broiler of Cobb 500 was the best preferred and cockerel of ISA Brown the least preferred chicken. Conversely, in terms of the CBR values for meat producers, the cockerel of ISA White (1.58) was the best and the broiler of Cobb 500 (1.15) the worst. Taking the FLA and MEP into account, RIR topped the list (19.1 wks and 23 eggs per month) whereas Cobb 500 ranked at the bottom (25.2 wks and 16 eggs per month). CBR for egg productivity, on the other hand, was highest in *Sonali* (1.11) followed by RIR and Fayoumi (1.10 each) and Cobb 500 (1.09). As regards the meat productivity, significant correlations existed between TC and NR for all chickens except *Sonali*, which exhibited a negative correlation between the traits. Negative and non-significant associations prevailed for egg productivity in all the chickens. Although broiler of Cobb 500 was found to be the most popular for meat and RIR for egg, the cockerel of ISA Brown was the chicken that earned the maximum CBR.

Key words: Production performance, chicken breeds, meat and egg producers, economic efficiency, cost-benefit ratio

Introduction

Bangladesh is an agro-based developing country in the Southeast Asian region and livestock especially poultry is a promising sector for employment generation and poverty reduction in this country (GOB, 1999). The contribution of poultry to the total animal protein was about 22 to 27 percent in the country (Ahmed & Haque, 1990). About 89% of the rural households that rear livestock were also found to rear poultry (BBS, 1996). Poultry meat and eggs are used chiefly as human food and poultry meat alone contributed 29% of the total meat production in Bangladesh (BBS, 2001). FAO (2003) estimated the status of poultry production in the country to be 140 million chickens and 13 million ducks. Studies on productive and reproductive performance of chickens under intensive management (Islam *et al*., 2003) and a comparative assessment of hatchability of different strains of broiler parent stock (Mamum, 2005) provide important guidelines for the poultry enterprise in the country.

Islam (2005) described the comparative performance of the broiler parent stocks of Fayoumi and studied their fertility and hatchability, while Rashid *et al.* (2005) studied the reproductive and meat yield parameters of crossbred chickens. Further reports on the production performance of Fayoumi (Khan *et al*., 2006), commercial broiler (Nahar *et al.*, 2007) and the hybrid *Sonali* (Sarkar, 2007) verified that these breeds are suitable for the environment of Bangladesh. Quantitative data on the White Leghorn (WLH), Rhode Island Red (RIR) and indigenous chicken revealed that RIR was the superior breed where the egg was heavier in size and the indigenous breed was famous for its flavour and meat quality (Islam & Nahar, 2008).

The most popular poultry genetic resources of the country include chicken, duck and pigeon (Faruque *et al.*, 2009) and broiler is a specially preferred breed for commercialization in Bangladesh (Islam *et al*., 2010). From the current situation of small-scale production units, it has become essential to get some clear-cut conception on financial statement of poultry production scenario in the country. So, the present study was designed to evaluate the production performance and economic efficiencies of different genetic group of chickens available in Rajshahi. These findings would be valuable to the policy makers and extension workers in order to guide policies towards increasing efficiency of the poultry enterprise in Bangladesh.

Materials and Methods

Experimental design: Day-old chicks of Cobb 500, ISA Brown and Fayoumi were procured from the hatchery of Index Group, Rajendrapur, Gazipur and were reared at Basit Poultry and Hatchery, Tetulia, Darusa of Rajshahi District. For obtaining day-old *Sonali* chicks, RIR cocks

and Fayoumi hens were reared at the ratio of 1:6, crossed and eggs were incubated for hatching at the Regional Poultry Farm, Rajabarihat, Rajshahi. Stratified random sampling technique was followed to collect data on meat and egg production performance of the chicken breeds under study.

Selection of chicken breeds: Four meat producers (Cobb 500, ISA Brown, Fayoumi and *Sonali*) and three egg producers (Fayoumi, RIR and *Sonali*) were considered for this study. Cobb 500 is the parental broiler stock in Bangladesh which is raised specifically for meat production. It was introduced in the sub-continent from USA during 1930s and became a dominant breed now-a-days. Before the development of commercial poultry breeds, the males were slaughtered for meat and the female were kept for egg production. The standard body weight of cock is 2.3-3.0kg and hen 1.5-2.0kg. The cockerels of ISA Brown are characterized by their white plumages. Average weight of the chicks is 0.55kg. Fayoumi, originated in Egypt and has been present in the West since 1940, is a light-weight fowl which has upright tail and forward breast and neck. Fayoumi cock is around 2kg and hen 1.6kg, which produces about 200 eggs per year. The RIR originated from New England of the USA by hybridization of Leghorn (Malay wild fowl) and Asian local variety. RIR cocks weigh approximately 4kg, hens 3kg, cockerels 3.4kg and pullets 2.5kg. The hybrid *Sonali* is derived from the cross between RIR cock and Fayoumi hen. The average body weight of the cock is 2.5kg and hen is 2kg. This breed is popular for its light weight, body colour and taste resembling that of indigenous chicken.

Selection of study area: A total of six private farms situated in the urban, semi-urban and rural areas of Rajshahi District were selected randomly from six Upazillas *viz.,* Boalia, Godagari, Motihar, Mohonpur, Poba and Rajpara. The average flock size of each farm was 500 chickens. All the five breeds had considerable customer demand either for meat or egg characteristics and are available in the selected farms and local markets. Data were collected during the period of July 2009 and June 2010.

Poultry management system: The poultry management of the selected farms varied according to prevailing weather conditions of the locality and system of poultry rearing. However, poultry keepers practice three general systems (Prasad, 2000) that include (i) free-range system, (ii) semi-intensive system and (iii) intensive systems *viz*. cage or battery system and deep litter system. However, the cage system is the latest invention for the poultry entrepreneurs. In this system, the birds are confined in a cage just large enough to permit very limited movement and allow the bird to stand and sit comfortably. The usual floor space of the cage is 14 by 16 inches and the height is 17 inches. The floor is made with strong galvanized wire and a tray is fixed underneath the floor for collection of droppings. The feeder and waterier remain outside of the cage. Cage system can be used for birds of all age groups and in all climate conditions while, the deep litter system is widely used for scientific and successful poultry farming in all over the world. Here the poultry birds are kept in large pen up to 250 birds each in a house, whose floor is covered with dry litter up to a depth of 20 to 30 cm. Rice husk, saw dust, dried leaf, chopped straw and ground nutshells, depending upon their availability, can be used as litter materials. Since deep litter resembles dry compost, ammonia gases come out of this litter so it needs to be cleaned regularly.

Parameters studied: Meat production performance of the chickens were investigated in terms of several important production parameters (Jull, 1952) such as initial body weight (IBW in g), 5-wk rearing period (RP in wks), achieved body weight (ABW in g), feed intake (FI in g), body weight gain (BWG in g) and feed conversion ratio (FCR). Egg productivity was evaluated, according to Ketelaere *et al*. (2002), in terms of weight of day-old chick (WDOC in g), growth rate (GR in g), death rate (DR in %), fertility (FR in %), hatchability (HT in %), first laying age (FLA in wks), and monthly egg production (MEP in numbers). The economic efficiencies (all in Tk.) for the rearing of meat and egg purpose chickens were evaluated following Nair & Ghadoliya (2000) and Alabi & Aruna (2005) by estimating total cost (TC), gross return (GRR), net return (NR) and cost-benefit ratio (CBR). Expenses involved for dead birds were also included in TC, whereas NR was calculated on the basis of live weights of the birds ready for selling.

Statistical analyses: For computing analysis of variance (ANOVA), a completely randomized design involving 5 chicken breeds, each with three replications was used. Treatment means for each parameter were compared using the least significant difference (LSD) tests. Moreover, co-efficient of correlation (r) values between the economic efficiency parameters excepting CBR were also calculated for both meat and egg productivity. SPSS version 11.0 for Windows was used for the statistical analyses.

Results and Discussion

Meat productivity: Results clearly demonstrate that broiler of Cobb 500 attained the highest BWG as well as FCR (Table 1, Fig. 1) compared to the rest of the breeds whereas Fayoumi showed the lowest value for BWG and ISA Brown for FCR. However, a similar trend was reflected in terms of FI where Cobb 500 showed the highest and ISA Brown the lowest. The gain in body weight was statistically significant between the breeds ($F_{3, 11}$=7.96; P<0.001), although insignificant difference in BWG existed between *Sonali* and ISA Brown.

The present findings are logical as rearing temperatures and genotypes influenced the productive performance of broilers chickens (Aengwanich, 2007). The supplementary feed like blood meal not only increased the growth performance of broiler chicks but also enhanced the growth and feed conversion efficiencies significantly (Shahidullah *et al*., 2008; Habib *et al*., 2009).

Table 1. Production performance parameters of the chicken breeds in Rajshahi reared for meat.

Breeds	IBW	ABW	FI	BWG
Cobb 500	41.5±0.85[a]	1390.4±5.24[a]	2347.7±8.86[b]	1348.9±4.86[a]
ISA Brown	32.2±1.47[c]	417.9±3.78[c]	1177.9±15.04[c]	385.7±5.24[c]
Fayoumi	32.1±1.55[c]	359.5±7.44[d]	1405.7±10.06[b]	327.4±6.78[d]
Sonali	33.3±2.36[c]	407.5±23.17[c]	1395.3±8.56[b]	374.2±24.86[c]

Rearing period of 5 wks for all breeds; values are mean±SD of three replicates; IBW= initial body weight (g); ABW= achieved body weight (g); FI= feed intake (g); BWG= body weight gain (g); different superscripts for a parameter in the same column differ significantly by LSD (P<0.05).

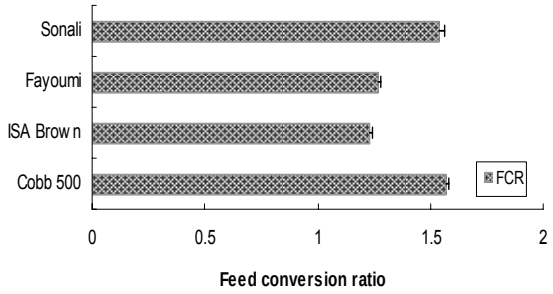

Fig. 1 Feed conversion ratio (FCR) for different chicken breeds reared for meat production in Rajshahi.

Moreover, Paul (2010) observed that multivitamin and enzyme supplementation significantly increased body weight in broiler chickens and the deficiency of vitamin C was related to meat yield reduction of broilers in a hot humid environment (Ali *et al*., 2010). Under intensive management system, on the other hand, chicken genotypes showed distinct physical variations for both qualitative and quantitative traits (Faruque *et al*., 2010). Growth parameters were also significantly affected by genotypes where male breeds exhibited higher average body weights than the female breeds and on average, hybrids consumed more feed compared to the purebreds (Ilori *et al*., 2010). The present variations in meat productivity parameters were likely due to the differences in genetic make-up and feeding and management practices of the chicken breeds under study.

Egg productivity: In terms of GR, RIR showed the highest value whereas *Sonali* exhibited the highest DR and HT values (Table 2). With respect to FLA, a highly significant difference existed between the chicken breeds ($F_{3, 11}$ = 14.74; P<0.001) but *Sonali* and Fayoumi showed almost similar FLA characteristics. Data on overall egg productivity parameters revealed that RIR had the shortest FLA but the highest MEP while Fayoumi attained the highest FLA and *Sonali* the lowest MEP (Table 2, Fig 2). These inconsistencies in egg productivity might be due to genetic make-up and housing system (Aernia *et al*., 2005) as they also affect laying performance in poultry breeds (Sonaiya, 2009; Wang *et al*., 2009; Banga *et al*., 2010). Stocking density has been shown to influence egg production and performance of broiler breeder hens as higher density produced fewer eggs (Mtileni *et al*., 2007). In addition, egg storage periods may affect fertility and hatchability in poultry chicken species (Babiker & Musharaf, 2008; Caglayan *et al*., 2009), and feed restrictions (Sarica *et al*., 2009) season, flock age and disease-vaccination conditions (Turkyilmaz *et al*., 2010; Holt *et al*., 2011) were also found to interact growing and laying performance in chickens. Recent studies have demonstrated that although maternal dietary protein level had no effect on hatchability and growth rate (Kingori *et al*., 2010), but age (Bekele *et al*., 2010) and phenotype (Haunshi *et al*., 2011) affected production performances of laying hens. These crucial parameters need to be taken into account for commercial poultry egg productivity in the country.

Table 2. Production performance parameters of the chicken breeds in Rajshahi reared for eggs.

Breeds	WDOC	GR	DR	FR	HT	FLA
Fayoumi	32.6±1.06[c]	11.7±0.04[c]	1.68±0.20[d]	91.2±0.64[a]	82.9±0.40[b]	22.4±0.20[b]
RIR	33.8±1.34[b]	13.8±0.10[b]	2.82±0.15[c]	89.5±2.65[b]	83.1±1.66[b]	19.1±0.33[c]
Sonali	33.8±1.86[b]	13.7±0.10[b]	3.82±0.15[a]	91.2±0.30[a]	83.3±1.41[b]	21.1±0.61[b]

Rearing period of 72 wks for all breeds; values are mean±SD of three replicates; WDOC= weight of day-old chick (g); GR= growth rate (%); DR= death rate (%); FR= fertility (%); HT= hatchability (%); FLA= first laying age (wk); different superscripts for a parameter in the same column differ significantly by LSD (P<0.05).

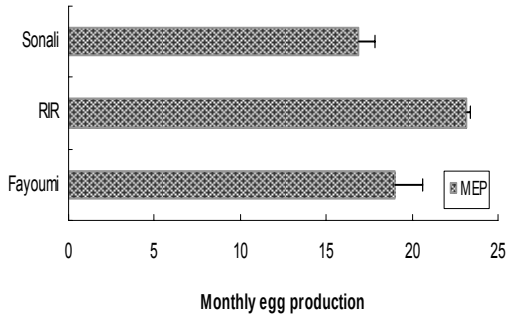

Fig. 2 Monthly egg production (MEP) of three chicken breeds reared for egg production in Rajshahi.

Economic efficiencies for meat producers: Table 3 shows the economics of meat productivity by different chicken breeds in the study area. For about a 5-wk meat purpose rearing, results specify that TC was the highest in Cobb 500 followed by Fayoumi, ISA Brown and *Sonali* whereas NR was found to be the highest in ISA Brown followed by *Sonali*, Fayoumi and Cobb 500. As a result, ISA Brown gained the highest CBR and Cobb 500 the lowest. As regards the meat productivity, therefore, significant correlations existed between TC and NR for all chickens except *Sonali*, which exhibited a negative correlation between the traits.

Table 3. Economic efficiency of chicken breeds per bird reared for meat production and their correlation values

Breeds	TC	GRR	NR	CBR	Co-efficient of correlation values (r)		
					TC *vs.* GRR	TC *vs.* NR	GRR *vs.* NR
Cobb 500	83.4±1.67^{a}	97.3±4.32^{b}	13.9±2.81^{d}	1.17^{e}	0.939*	0.850ns	0.979*
ISA Brown	49.2±3.35^{b}	77.9±2.66^{a}	28.8±0.85^{a}	1.58^{a}	0.985**	-0.851ns	-0.751ns
Fayoumi	45.8±1.85^{c}	61.0±1.38^{b}	15.2±3.22^{b}	1.33^{c}	-0.987ns	-0.997ns	0.995***
RIR	48.6±0.52^{b}	63.0±2.30^{b}	14.4±2.32^{c}	1.29^{d}	0.068ns	-0.155ns	0.974*
Sonali	41.9±2.64^{c}	64.2±3.99^{c}	22.3±6.63^{b}	1.54^{b}	-0.997ns	-0.998ns	0.999***

Values of the cost items are mean±SD of three replicates; cost items included the cost (in Tk.) of chick, feed, litter, vitamins, vaccine, labour, electricity and miscellaneous expenses; TC= total cost; GRR= gross return; NR= net return; CBR= cost-benefit ratio; different superscripts for a parameter in the same column differ significantly by LSD (P<0.05); ns= not significant; *= P<0.05; **= P<0.01 and ***= P<0.001.

Economic efficiencies for egg producers: For a 72-wk egg purpose rearing, TC was the highest in RIR the lowest in *Sonali*, consequently, NR was the highest in RIR and the lowest Fayoumi (Table 4). However, it was interesting to note that CBR became the highest in *Sonali* and identical in RIR and Fayoumi. In addition, negative and non-significant associations prevailed for egg productivity in all the chickens, suggesting that egg purpose rearing of chicken breeds was not profitable in the study area. Although broiler of Cobb 500 was found to be the most popular for meat and RIR for egg, the cockerel of ISA Brown was the chicken that earned the maximum CBR.

Table 4. Economic efficiency of chicken breeds per bird reared for egg production and their correlation values

Breeds	TC	GRR	NR	CBR	Co-efficient of correlation values (r)		
					TC *vs.* GRR	TC *vs.* NR	GRR *vs.* NR
Fayoumi	1062.4±42.76^{a}	1166.1±16.92^{b}	103.7±40.14^{a}	1.10^{b}	0.348ns	-0.919ns	0.051ns
RIR	1122.4±14.2^{c}	1243.3±35.44^{a}	120.9±48.66^{a}	1.10^{b}	-0.904ns	-0.950ns	0.992***
Sonali	1060.9±32.16^{a}	1175.4±36.32^{b}	114.5±43.96^{a}	1.11^{a}	0.180ns	-0.583ns	0.694ns

Values of the cost items are mean±SD of three replicates; cost items included the cost (in Tk.) of chick, feed, litter, vitamins, vaccine, labour, electricity and miscellaneous expenses; TC= total cost; GRR= gross return; NR= net return; CBR= cost-benefit ratio; different superscripts for a parameter in the same column differ significantly by LSD (P<0.05); ns= not significant; *= P<0.05; **= P<0.01 and ***= P<0.001.

In agreement with the observations of Gordon *et al*. (2009), it became evident from the present results that profits associated with lighter hens like ISA Brown and *Sonali* were higher than those associated with heavy hens such as RIR and Cobb 500 and the increased profitability of lighter hens was largely due to their improved feed conversion, because lighter hens produced predominantly larger or extra large eggs. Broiler farming with Cobb 500 was reported profitable because of lower investment, less space requirement, utilization of family

labour and quick returns as examined by Islam *et al*. (2010). This contradicts with the present findings because cockerel of ISA Brown was found to be earning the maximum CBR. Substantial technical, allocative and economic inefficiency for egg purpose rearing of the poultry breeds might be the cause of loosing concern and/or marginal profits compared to that for meat purpose rearing which lend support to the findings of Begum *et al.* (2010). The present results therefore emphasize the need for adequate knowledge on poultry productivity and profitability to the government policy makers, producers and marketers, thus suggesting for an integrated approach to genetically improved chicken breeds and strict bio-security poultry farming in the country.

Acknowledgements

The authors would like to thank the Chairman, Department of Zoloogy, University of Rajshahi, for providing laboratory and technical facilities, the Deputy Director, Regional Poultry Farm, Rajabarihat, Rajshahi, and the poultry farmers in the study area for their assistance and sincere help in providing information required for this research. The work was financed by a research grant to MSI by the UGC through the faculty of Life and Earth Sciences, Rajshahi University.

References

Aengwanich, W. 2007. Effects of high environmental temperature on the productive performance of Thai indigenous, Thai indigenous crossbred and broiler chickens. *Int. J. Poult. Sci.* **6(5):** 349-353.

Aernia, V., Brinkhofa, M.W.G., Wechslera, B., Oestera, H. & Frohlicha, E. 2005. Productivity and mortality of laying hens in aviaries: A systematic review. *World's Poult. Sci. J.* **61:** 130-142.

Ahmed, S. & Haque, Q.M.E. 1990. Available feed resources for small-scale poultry and duck production. *Proc. Int. Workshop on Crop and Animal Farming System Research*, Asian Farming System Net-work, Dhaka, Bangladesh.

Alabi, R.A. & Aruna, M.B. 2005. Technical efficiency of family poultry production in Niger-Delta, Nigeria. *J. Centr. Europian Agric.* **6(4):** 531-538.

Ali, M.T., Howlider, M.A.R., Azad, A.K. & Rahman, M.S. 2010. Vitamin C and electrolyte supplementation to support growth and meat yield of broilers in a hot humid environment. *J. Bangladesh Agric. Univ.* **8(1):** 57-60.

Babiker, M.S. & Musharaf, N.A. 2008. The effects of season on hatchability and fertility of egg-type parent stock (Bovans) in Sudan. *Res. J. Poult. Sci.* **2(1):** 5-8.

Banga, M.H., Mabas, J.S. & Adzona, P.P. 2010. Effect of housing system (battery cages *versus* floor pen) on performance of laying hens under tropical conditions in Congo Brazzaville. *Res. J. Poult. Sci.* **3(1):** 1-4.

BBS (Bangladesh Bureau of Statistics). 1996. *Statistical Year Book of Bangladesh* (7th edn.). Bangladesh Bureau of Statistics, Dhaka.

BBS (Bangladesh Bureau of Statistics). 2001. *Statistical Year Book of Bangladesh*. Bangladesh Bureau of Statistics, Ministry of Planning, Government of People's Republic of Bangladesh, Dhaka.

Begum, A., Buysse, J., Alam, M.J. & Huylenbroeck, G.V. 2010. Technical, allocative and economic efficiency of commercial poultry farms in Bangladesh. *World's Poult. Sci. J.* **66:** 465-476.

Bekele, F., Adnoy, T., Gjoen, H.M., Kathle, J. & Abebe, G. 2010. Production Performance of Dual Purpose Crosses of Two Indigenous with Two Exotic Chicken Breeds in Sub-tropical Environment. *Int. J. Poult. Sci.* **9(7):** 702-710.

Caglayan, T., Alaahan, S., Krkc, K. & Gunlu, A. 2009. Effect of different egg storage periods on some egg quality characteristics and hatchability of partridges (*Alectoris graeca*). *Poult. Sci.* **88:** 1330-1333.

FAO (Food and Agricultural Organization) 2003. Production Year Book. 56. Rome, Italy.

Faruque, M.O., Khan, M.Y.A. & Asaduzzaman, M. 2009. Poultry genetics and breeding in Bangladesh: Past, present and future. *6th Int. Poultry Show and Seminar, WPSA-BB*, pp.163-167.

Faruque, S., Siddiquee, N.U., Afroz, M.A. & Islam, M.S. 2010. Phenotypic characterization of native chicken reared under intensive management system. *J. Bangladesh Agric. Univ.* **8(1):** 79-82.

GOB (Government of Bangladesh) 1999. The Report on the Economic Survey of Bangladesh, Ministry of Finance, Government of Peoples' Republic of Bangladesh, Dhaka.

Gordon, R., Bryant, M.M. & Roland, D.A. 2009. Performance and profitability of second-cycle laying hens as influenced by body weight and body weight reduction during molt. *J. Appl. Poult. Res.***18:** 223-231.

Habib, M.A., Shahidullah, M. & Ali, M.A. 2009. Performance of broilers fed water-soluble blood meal during growing and finishing period. *Bangladesh vet.* **26(1):** 8-12.

Haunshi, S.M., Niranjan, M., Shanmugam, M.K., Padhi, M.R., Reddy, R., Sunitha, U. Rajkumar & Panda, A.K. 2011. Characterization of two Indian native chicken breeds for production, egg and semen quality, and welfare traits. *Poult Sci.* **90:** 314-320.

Holt, P.S., Davies, R.H., Dewulf, J., Gast, R.K. Huwe, J.K., Jones, D.R., Waltman, D. & Willian K.R. 2011. The impact of different housing systems on egg safety and quality. *Poult. Sci.* **90:** 251-262.

Ilori, B.M., Peters, S.O., Ikeobi, C.O.N., Bamgbose, A.M., Isidahomen, C.E. & Ozoje, M.O. 2010. Comparative Assessment of growth in pure and crossbred turkeys in a humid tropical environment. *Int. J. Poult. Sci.* **9(4):** 368-375.

Islam, M.S., Takashi, S. & Chhabi, K.Q.N. 2010. Current scenario of the small-scale broiler farming in Bangladesh: Potentials for the future projection. *Int. J. Poult. Sci.* **9(5):** 440-445.

Islam, M.S. 2005. *Comparative performance of Sonali and Fayoumi chicken from day old to eight weeks of age with or without supplementary feeding.* MS thesis, Dept. of Poultry Science, Bangladesh Agricultural University, Mymensingh, 47+14 pp.

Islam, M.S. & Nahar, M.S. 2008. An analysis of some quantitative characters of the White Leghorn, Rhode Island Red and local chicken breeds. *16th Biennial Int. Conf. Zool. Soc.* p.70.

Islam, S., Uddin, M.S., Sarker, N.R., Faruque, S. & Khatun, R. 2003. Study on the productive and reproductive performance of 3 native genotype of chickens under intensive management Executive summaries of research report. *Ann. Res. Rev. Workshop* 11-12 May, pp: 6-8.

Jull, M.A. 1952. *Poultry Breeding* (3rd edn). John Wiley & Sons, New York. 325 pp.

Ketelaere, B.D.E.T., Govaerts, P., Coucke, E., Dewil, J., Visscher, E. & Baerdemaeker, J.D.E. 2002. Measuring the egg shell strength of six different genetic strains of laying hens: Techniques and comparisons. *British Poult. Sci.* **43:** 238-244.

Khan, M.K.I., Khatun, M.J., Bhuiyan, M.S.A. & Sharmin, R. 2006. Production performance of Fayoumi chicken under intensive management. *Pak. J. Biol. Sci.*, **9(2):** 179-181.

Kingori, A.M., Tuitoek, J.K., Muiruri, H.K. & Wachira, A.M. 2010. Effect of dietary crude protein levels on egg production, hatchability and post-hatch offspring performance of indigenous chickens. *Int. J. Poult. Sci.*, **9(4):** 324-329.

Mamum, S.H. 2005. Comparative assessment of hatchability of different strains of broiler parent stock. MS thesis, Dept. of Poultry Science, Bangladesh Agricultural University, Mymensingh, 35+14 pp.

Mtileni, B.J., Nephawe, K.A., Nesamvuni, A.E. & Benyi, K. 2007. The influence of stocking density on body weight, egg weight, and feed intake of adult broiler breeder hens. *Poult. Sci.* **86:** 1615-1619.

Nahar, K., Ahmed, S., Monir, M.M. & Rahman, M.S. 2007. Comparative evaluation of egg quality characteristics of broiler parent stock and synthetic broiler. *Bangladesh J. Anim. Sci.* **36(1-2):** 82-87.

Nair, B.C & Ghadoliya, M.K. 2000. Economic viability of RIR farming in the state of Goa. *Indian J. Poult. Sc.* **35(1):** 73-76.

Paul, R.C, Ahmad, N., Moinuddin, M.A & Hasan, N. 2010. Effects of administration of multivitamins and enzymes for broilers either singly or in combination on body weight and haematobiochemical parameters. *J. Bangladesh Agril. Univ.* **8(1):** 39-44.

Prasad, D. 2000. *Poultry Farming*. Kalyani Publishers, Ludhiana, New Delhi India. 68pp.

Rashid, M.A., Howlider, M.A.R., Alam, J., Rashid, A., Kawsar, M.H. & Azmal, S.A. 2005. Effect of dwarfism on reproductive and meat yield parameters of crossbred chicken. *Int. J. Poult. Sci.* **4(6):** 372-377.

Sarica, M., Yamak, B. & Yamak, U.S. 2009. The effects of feed restrictions in rearing period on growing and laying performances of white and brown layer hybrids in different adult body weights. *Asian J. Poult. Sci.* **3(2):** 30-41.

Sarkar, P.K. 2007. Comparative study on the productivity and profitability of commercial broiler cockerel of a layer strain and crossbreed (RIR ♂ × Fayoumi ♀). MS thesis, Dept. of Poultry Science, Bangladesh Agricultural University, Mymensingh, 32 pp.

Shahidullah, M., Uddin, M. & Habib, M.A. 2008. Growth and hematological changes of commercial birds fed on blood meal supplement with water. *J. Bangladesh Agril. Univ.* **6(2):** 321–326.

Sonaiya, E.B. 2009. Some technical and socioeconomic factors affecting productivity and profitability of smallholder family poultry. *World's Poult. Sci. J.* **65:** 201-206.

Turkyilmaz, M.K., Nazligul, A., Balkaya, M. & Dereli, E.F. 2010. Effect of human factor on fear and stress reactions and some performance parameters in broiler chickens. *Int. J. Poult. Sci.* **9(1):** 59-62.

Wang, X.L., Zheng, J.X., Ning, Z.H., Qu, L.J., Xu, G.Y. & Yang, N. 2009. Laying performance and egg quality of blue-shelled layers as affected by different housing systems. *Poult. Sci.* **88:** 1485-1492.

Manuscript received on 02.08.2012, accepted on 11.10.2012