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Comparative performances of indigenous, Vanaraja and crossbred (PB2xIndigenous) chicken under different systems of rearing

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Abstract
A study has been conducted on a total 1200 no. of chicks out of which 600 numbers (200 each of Indigenous, Vanaraja and Crossbred) were reared under intensive system. All the types of chicken were fed uniform diet of Chick (0-8 weeks), Grower (9-20 weeks) and Layer (above 20 weeks) rations. Remaining 600 numbers (200 each of Indigenous, Vanaraja and Crossbred) were distributed among 30 beneficiaries for backyard system of rearing. Significant ($P \leq 0.05$) differences in body weights were recorded among the different types of chicken at all the specified ages. The overall mean body weight was found to be significantly ($P \leq 0.05$) higher in Vanaraja (2816.80 ± 26.05 g) followed by Crossbred (2333.70 ± 16.11 g) and Indigenous (1412.70 ± 12.61g) chickens at 52 weeks of age. Irrespective of types of chicken, significantly ($P \leq 0.05$) higher body weight was recorded under intensive system (2356.03 ± 30.02 g) than that of backyard system (2019.43 ± 27.65 g) of rearing. The average total feed consumption was significantly ($P \leq 0.05$) higher in Vanaraja than Crossbred and Indigenous chicken up to 20 and 52 weeks of age. The FCR was found to be better in Vanaraja (4.30 ± 0.12) followed by Crossbred (4.69 ± 0.15) and Indigenous (6.02± 0.40) chickens.

Keywords: body weight, intensive, scavenging, indigenous, Vanaraja, crossbred

Introduction
The poultry industry in India represents a major success story in the present era in agricultural production arena. Poultry production has been a household activity in India since time immemorial. Indian poultry sector has been growing at around 8-10% annually over the last decade with annual growth rates of 5.57% and 11.44% in egg and broiler production, respectively driven by increased domestic consumption (Wakcaure *et al.*, 2016) [30]. Despite this tremendous growth, the per capita availability of eggs is only 61 and that of poultry meat is 3.9 kg which is far below the recommendation of National Institute of Nutrition which suggests that per capita consumption should be 180 eggs and 11kg poultry meat per person per year (Thaper, 2018) [29]. Livestock and poultry activities play an important role in national economy and in socio-economic development of the country. These activities have contributed to the food basket, nutritional security and household income of the farmers and play a significant role in generating gainful employment in the rural areas, particularly among the landless, marginal and small farmers and women, besides providing cheap and nutritious food. Much of the eggs and meat produced are consumed by the urban or semi urban population while the rural and tribal areas have little access therefore the villages must have to be independent in the poultry production to meet their needs. The demand of eggs and meat of rural areas to be met by backyard poultry rearing (Gayathri *et al.*, 1998; Nandi *et al.*, 2007; Panda *et al.*, 2008) [9, 21, 22]. Backyard poultry rearing also finds an important role to fulfill the need of stress free and harmful residues free birds (Khandekar, 2003; Mandal *et al.*, 2006) [16, 20].

Traditional poultry farming plays a major role in the rural economy and women empowerment. Though, still it is contributing 30% to the national egg production, the rural backyard poultry is the most neglected one (Tajane and Vasulkar, 2014) [28]. The major limiting factor in the way of increasing consumption of egg and poultry meat in the rural area is the poor availability. Growth in the small-scale chicken production system, production per bird may be low, but support the landless and distribution of benefits will be more equal and have great effect on human development. Consumer and farmer preference to native chickens due to the better taste and flavor of meat and eggs and higher disease resistance compared to commercial broilers has been reported in various countries (Wattanachant *et al.*, 2004 and Cheng *et al.*, 2008) [32, 4].

Therefore, the present study was undertaken to explore the comparative performance of Indigenous, Vanaraja and Crossbred (PB2 × Indigenous) chickens under intensive and scavenging systems of rearing.

Materials and Methods

The present study was conducted in the experimental poultry shed under the project AICRP on Poultry Breeding, Department of Poultry Science, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, Assam, India. 1200 numbers chicks (400 each of Indigenous, Vanaraja and Crossbred) were procured and brooded in battery brooder for a period two weeks and then in the third week 600 chicks (200 each of Indigenous, Vanaraja and Crossbred) were distributed in the respective pens for rearing in deep litter under intensive system. Remaining 600 chicks (200 each of Indigenous, Vanaraja and Crossbred) were distributed among 30 poor beneficiaries of Bijoynagar area of Rural Kamrup district, Assam for rearing under scavenging systems. Under intensive system, all the types of chicken were fed uniform diet of Chick (0-8 weeks), Grower (9-20 weeks) and Layer (above 20 weeks) rations prepared with conventional feedstuffs as per BIS (1992) [2] throughout the rearing period up to 52 weeks of age. The ingredient and chemical composition of different diets are given in Table1. All the three types of birds were reared under similar condition following standard managemental procedures. The birds were offered measured quantity of feed twice daily with sufficient plain drinking water. All the birds under both the systems were vaccinated and medicated following standard schedule. The body weight was taken at 0th day, 4th, 8th, 12th, 20th, 40th and 52nd weeks of age for birds reared under both the systems. The feed consumption and FCR was recorded only for intensive system. The FCR was calculated upto 20th weeks. The data were analyzed statistically as per Snedecor and Cochran (1994).

Table 1: Composition of diets for different types of chicken under intensive system of rearing

S.N.	Ingredient	Chick (0-8 weeks)	Grower (9-20 weeks)	Layer (above 20 weeks)
1.	Maize	47	32	35
2.	De oiled GNC	12	10	12
3.	De oiled Soya cake	18	14	12
4.	Rice polish	8	12	13
5.	Wheat bran	10	17	8
6.	Broken rice	2	12	10
7.	Mineral mix.	2.5	2.5	3.5
8.	Shell grit	0	0	6.0
9.	Common salt	0.5	0.5	0.5
Total		100	100	100
Proximate composition				
DM (%)		90.12	89.56	90.42
CP (%)		19.94	15.23	16.05
CF (%)		5.44	6.34	7.83
EE (%)		2.88	1.72	1.35
Ash (%)		5.42	6.76	7.85
* ME (Kcal/kg)		2648	2367	2456

*Calculated value

A mixture of vitamins 20 g, feed additives 10 g and coocidiostates 50 g were added per 100 kg of each diet.

Results and Discussions

The mean body weight of day old chicks of different types of chicken under intensive and scavenging systems of rearing is presented in Table 2. The overall mean body weight at day old age of Indigenous, Vanaraja and Crossbred chicken were recorded as 25.60 ± 0.09, 39.28 ± 0.07 and 28.30 ± 0.08 g respectively and were found to differ significantly (P≤0.05) among the types of chicken. The overall mean body weights under intensive and scavenging systems were 31.05 ± 0.25 and 31.06 ± 0.25 g, respectively and were found to be non-significant.

The overall mean body weights in different types of chicken at 4th weeks were found to differ significantly (P≤0.05) among the types of chicken. The overall mean body weight under intensive system (310.53 ± 7.10 g) was significantly (P≤0.05) higher than that under backyard system (220.10 ± 5.54 g) of rearing. Interactions between different types of chicken and rearing systems were also found to differ significantly (P≤0.05).

The body weights at 8th weeks of age was recorded to be significantly (P≤0.05) higher in Vanaraja (888.87±7.42 g) followed by Crossbred (446.95 ± 5.33 g) and Indigenous chicken (291.65 ± 2.94 g). The overall mean body weight under intensive system (614.02 ± 12.16 g) was significantly (P≤0.05) higher than that under scavenging system (470.97 ± 10.08 g). Interactions between different types of chicken and rearing systems were also found to differ significantly (P≤0.05).

The body weight was recorded at 12th, 20th, 40th and 52nd weeks of age of indigenous, Vanaraja and Crossbred chickens reared under intensive and scavenging systems of rearing showed similar trends with significant (P≤0.05) differences as shown in 2nd, 4th and 8th weeks of age.

Significant (P≤0.05) differences in body weights were recorded among the different types of chicken at all the ages. The body weights of Vanaraja and Crossbred were recorded to be significantly (P≤0.05) higher from day-old to 52 weeks of age. The highest body weights were recorded in Vanaraja followed by Crossbred and Indigenous chicken throughout the study period up to 52 weeks of age. Similar findings were also reported by Krishna *et al.* (2007) [18] who recorded higher body weight gain in coloured layers compared to *desi* birds. Significantly (P≤0.05) higher body weight in Vanaraja compared to Indigenous chicken was recorded by few workers (Ramana *et al.*, 2010 and Gonmei, 2012) [25, 11]. Pathak (2013) [23] also recorded significantly (P≤0.05) higher body weight in Crossbred (PB2 × Indigenous) compared to Indigenous chicken. The body weight of Indigenous chicken was recorded lower than Vanaraja and Crossbred, as Indigenous chickens were known to be lighter and have

compact body to escape from predators in free range system of rearing. Also, their lower body weight might be due to lower response to improved feeding under intensive system. The higher body weight in Vanaraja is attributed to the fact that this chicken variety has been developed by crossing random bred meat control population as the female line and Red Cornish population as the male line and Crossbred may be attributed to the broiler inheritance of PB2, which is a synthetic broiler line.

Irrespective of types of chicken, rearing system had significant ($P \leq 0.05$) effect on overall body weight at all stages. Significantly ($P \leq 0.05$) higher overall body weights were recorded under intensive system than those under backyard system in all the ages except for day-old. The higher body weight under intensive system than those under backyard system might be due to better nutrition, care and management under intensive system. In the present study all the types of chicken under intensive system were fed balanced ration throughout the rearing period up to 52 weeks of age, whereas birds under backyard system were allowed for scavenging all around the households in farmers premises during day time and little hand feeding was done in the form of kitchen waste, broken rice and paddy. Better growth rate of Nicobari fowls were recorded under intensive system than those under backyard farming system (Chatterjee *et al.*, 2002) [3]. The body weight of Vanaraja birds was significantly ($P \leq 0.05$) lower in backyard condition than in intensive system of rearing (Kumaresan *et al.*, 2008) [19]. Doley *et al.* (2009) [9] recorded significantly ($P \leq 0.05$) higher body weight of Indigenous chickens of North-Eastern region of India under intensive system than under extensive system at all stages of growth. Wang *et al.* (2009) [31] reported that the body weight of Gushi chicken in the free range treatment were significantly ($P \leq 0.05$) lower than those under indoor treatment. Choudhuri *et al.* (2010) [5] reported higher body weight of Nicorock, Black Nicobari, White Nicobari and Nishibari under intensive system than under backyard system of rearing. Khawaja *et al.* (2012) [17] reported that Rhode Island Red breed gained maximum ($P<0.05$) weight than those of *Desi* and Fayoumi breeds at all ages of growing phase in Pakistan. The lower body weight recorded by Premavalli *et al.* (2014) [24] in native chicken breeds of Nicobari and Kadaknath under intensive system than recorded in the present study at 8 weeks of age.

Table 2: Mean body weight (g) of Indigenous, Vanaraja and Crossbred chicken under Intensive and scavenging systems of rearing

Age	Intensive system			Overall	Scavenging system			Overall
	Indigenous	Vanaraja	Crossbred		Indigenous	Vanaraja	Crossbred	
0th Day	25.50 ± 0.12	39.25 ± 0.11	28.40 ± 0.10	31.05^{a} ± 0.25	25.70 ± 0.13	39.30 ± 0.10	28.20 ± 0.11	31.06^{a} ± 0.25
4th week	145.80 ± 2.14	540.30 ± 3.91	245.50 ± 2.37	310.53^{a} ± 7.10	108.60 ± 0.64	403.20 ± 1.88	148.50 ± 1.77	220.10^{b} ± 5.54
8th week	316.30 ± 4.03	988.05 ± 9.15	537.70 ± 3.56	614.02^{a} ± 12.16	267.00 ± 3.41	789.70 ± 6.01	356.20 ± 3.97	470.97^{b} ± 10.08
12th week	575.80 ± 5.15	1352.25 ± 16.23	852.30 ± 7.25	926.78^{a} ± 14.78	451.20 ± 3.85	1029.70 ± 8.20	642.10 ± 6.34	707.67^{b} ± 11.03
20th week	1103.80 ± 10.97	1996.25 ± 24.06	1575.56 ± 14.72	1558.54^{a} ± 18.33	935.20 ± 7.08	1668.80 ± 15.59	1266.25 ± 8.53	1290.08^{b} ± 14.58
40th week	1298.50 ± 16.51	2843.25 ± 32.64	2389.40 ± 15.96	2177.05^{a} ± 30.45	1191.80 ± 8.28	2454.50 ± 41.56	1836.20 ± 18.15	1827.50^{b} ± 27.47
52nd week	1497.80 ± 18.35	3018.20 ± 28.98	2552.10 ± 19.30	2356.03^{a} ± 30.02	1327.60 ± 14.51	2615.40 ± 38.60	2115.30 ± 12.96	2019.43^{b} ± 27.65

Means with common superscript in a row or column do not differ significantly ($P \leq 0.05$)

Feed Consumption

The mean feed consumption (g/bird) at different periods and total feed consumption from day old to 52 weeks of age is presented in Table 3. The mean feed consumption up to 20 week was recorded as 7293.10 ± 42.27, 8651.70 ± 33.21 and 8207.40 ± 40.19 g, respectively for Indigenous, Vanaraja and Crossbred chicken, which differ significantly ($P \leq 0.05$) among them. The total feed consumption up to 52 weeks of age was 28135.80 ± 62.72, 35055.60 ± 57.25 and 32455.40 ± 68.90 g, respectively for Indigenous, Vanaraja and Crossbred chicken. Significantly ($P \leq 0.05$) higher feed consumption was recorded in Vanaraja followed by Crossbred and Indigenous chickens in all the periods. The feed intake recorded in 0-4 weeks of period was significantly ($P \leq 0.05$) different from each other among different types of chicken. Similar trend was also observed for all other periods and total feed intake up to 20 weeks and up to 52 weeks of age. The higher feed consumption in Vanaraja and Crossbreds might be due to higher growth rate of these birds, because the birds with more body weight and growth rate demand more energy and protein than the birds with lower body weight and growth rate. Since, the bird eat to meet their energy requirement, the birds with higher body weight and growth rate might require more energy and hence consumed more feed to satisfy their energy requirements than that of lower growth counterparts. Bharambe and Garud (2012) [1] also recorded higher feed consumption in Crossbred than purebreds.

Comparable feed consumption was recorded by several workers (Ghosh *et al.*, 2005, Sheikh *et al.*, 2008, Zuyie *et al.*, 2011 and Jha and Prasad, 2013) [10, 26, 33] in Vanaraja Chicken up to 6 to 7 weeks of age.

Compared to the findings of the present study, lower feed consumption was recorded by Jha *et al.* (2012) [14] in Vanaraja and *desi* chicken and higher feed consumption was reported by Doley (2006) [7] in Indigenous fowl from 9th week to sexual maturity.

Table 3: Feed consumption (g/bird) of different types of chicken under intensive system of rearing

Types of chicken	Periods					Up to 52 week (Total)
	0-4 week	5-8 week	9-12 week	13-20 week	Up to 20 week	
Indigenous	432.60^{a} ± 8.77	1023.00^{a} ± 8.72	1757.10^{a} ± 9.75	4080.40^{a} ± 30.72	7293.10^{a} ± 42.27	28135.80^{a} ± 62.72
Vanaraja	996.36^{b} ± 15.21	1496.80^{b} ± 7.68	1933.90^{b} ± 12.19	4224.64^{b} ± 21.09	8651.70^{b} ± 33.21	35055.60^{b} ± 57.25
Crossbred	486.90^{c} ± 7.66	1239.80^{c} ± 5.56	1848.80^{c} ± 8.52	4631.90^{c} ± 36.11	8207.40^{c} ± 40.19	32455.40^{c} ± 68.90

Means with common superscript in a row or column do not differ significantly ($P \leq 0.05$)

The mean feed conversion ratio (FCR) of different types of chicken during different periods and up to 20 weeks of age under intensive system of rearing is presented in Table 4. The overall FCR under intensive system was recorded as 6.02 ± 0.40, 4.30 ± 0.12 and 4.69 ± 0.15 respectively for Indigenous, Vanaraja and Crossbred chicken with significant ($P \leq 0.05$)

differences among them. Better feed conversion ratio in Vanaraja and Crossbred may be due to better body weight gain in comparison to Indigenous chicken. Also, the lower body weight of Indigenous chicken might be due to lower response to improved feeding management. Similar FCR were also recorded by Ghosh *et al.* (2005) [10] and Sheikh *et al.* (2008) [26] in Vanaraja chicken up to six weeks of age, Zuyie *et al.*(2011) in Vanaraja chicken up to seven weeks of age, Jha *et al.*(2012) [14] in Vanaraja and Indigenous chicken, Jha and Prasad (2013) [12, 14] in Vanaraja Chicken.

In contrary to the findings of the present study, lower FCRs were reported by Debata *et al.* (2012) [6] in Vanaraja birds at 4, 8, 12, 16, 20 and 24 weeks of age, Kalita *et al.* (2012) in Vanaraja chicken up to 40 weeks of age, Jha and Prasad (2013) [12, 14] in Aseel bird, Jha *et al.* (2013) [12, 14] in Aseel, Hazra and Kadaknath birds and higher FCR was reported by Doley (2006) [7] in Indigenous chicken of North-East India.

Table 4: Feed conversion ratio of different types of chicken under intensive system of rearing

Types of chicken	Periods				
	0-4 week	5-8 week	9-12 week	13-20 week	Overall
Indigenous	3.59 ± 0.11	6.00 ± 0.11	6.77 ± 0.02	7.73 ± 0.06	6.02^{a} ± 0.40
Vanaraja	1.99 ± 0.04	3.34 ± 0.02	5.31 ± 0.02	6.56 ± 0.03	4.30^{b} ± 0.12
Crossbred	2.24 ± 0.08	4.24 ± 0.05	5.87 ± 0.03	6.41 ± 0.06	4.69^{c} ± 0.15

Means with common superscript in a row or column do not differ significantly ($P \leq 0.05$).

Conclusion

From the present study it can be concluded that the improved variety of rural chicken like Vanaraja and crossbred grow much faster than Indigenous chicken both under intensive as well as scavenging systems. The growth is further more under intensive system than scavenging systems. This indicates that birds under scavenging system are undernourished. Hence, they should be given supplementary feeding to compensate the growth.

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