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Upliftment of socio-economic status of farmers through rearing of Kadaknath, Giriraja and Black Australorp birds under free-range, semi-intensive and intensive system of housing in Maharashtra state of India

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Abstract

The present study was conducted in 240 Poultry farmers of Maharashtra state, India. Selection of poultry farmers were on the basis of well-structured interview schedule with the criteria of Age, Education, Family size, Land holding, Occupation, Flock size, Poultry farming experience and Annual income of the farmer. The experimental parameters studied during the 16th week of age were growth performance and economics of three breeds of birds Kadaknath, Giriraja and Black Australorp in freerange, semi-intensive and intensive system of housing. All the birds from three breeds showed highly significant ($p < 0.01$) differences in studied parameters. But, the performance of Giriraja birds were superior followed by Black Australorp and Kadaknath. It is concluded that Giriraja and Black Australorp seems to be most economical breeds to be reared under intensive and semi-intensive systems of housing.

Keywords: Black Australorp, economics, free range, Giriraja, intensive, Kadaknath, Maharashtra, proximate analysis, semi-intensive

Introduction

India with a population of 1.35 billion people is highly focusing on “Development” i.e. Good Food, Better Health and Living conditions for everyone. With the increase in the incomes, people can now afford better nutrition. Hence, since last two decades the demand for eggs and chicken meat is growing (Bujarbaruah and Gupta, 2005) [3]. India is the home for many breeds of native chicken like Aseel, Kadaknath, Tellicherry, Haringhata Black, Nicobari, Danki etc., which are still popular among the rural and tribal areas for backyard or free range farming (Chatterjee and Rajkumar, 2015) [25]. For the commercial farming, high yielding crosses developed under the public sector like Giriraja, Vanraja, Krishilayer, Krishibro (multicolored broiler etc.) are popular in certain areas (Chatterjee and Rajkumar, 2015) [5] for their meat. Also, The Black Australorp is a dual purpose chicken breed of Australian origin which was developed with the intension of increased eggs production. The breed achieved world-wide popularity in the 1920s after the breed broke numerous world records for number of eggs laid and has been a popular breed in the western world [25].

Livestock and poultry sector provide a major contribution to India's economy (Nath *et al.*, 2012) [13]. It carries a pivotal position in current Indian economy and has evolved as an extremely business oriented enterprise (Sreenivas *et al.*, 2013) [24]. Poultry industry has been transformed into a strong, dynamic agro-based farming activity (Islam *et al.* 2016) [8]. Rural poultry farming involves rearing of improved chicken varieties under free range, semi-intensive or intensive conditions (Buragohain *et al.*, 2007) [4]. The rural poultry production system especially in delta areas is typically a smallholder free ranging system. Under free-range conditions the necessity of supplementary feed/feed ingredients mostly depends on the free area available in the backyards, intensity of vegetation and availability of waste grains, insects, grass seeds etc (Pathak and Nath, 2013) [16]. Backyard poultry rearing requires hardly any infrastructure setup and is a liquid asset that can be sold quickly to meet any emergency cash needs of poorer's families (Sarap, 2017) [18]. Also, Intensive system of housing the poultry birds includes rearing of birds under confined housing system with proper managerial and feeding regime with feeds and water under one roof only. Among the available rearing systems for birds, the semi-intensive system consists in keeping the birds in an area with a shed and

pasture i.e., the birds are kept in a poultry house and have free access to a pasture area. An alternatives to confinement housing and cages for sustainable poultry production, such as access to range which is considered an environmentally sound and economically viable approach (Appleby *et al.*, 1992) [2]. The system has been increasingly used in the last years, mainly due to aspects related to the greater concern with food quality by consumers. Besides, production costs might also be reduced, since the birds will have access to a pasture area and the costs with diets would be decreased (Silva and Nakano, 1998; Silva, 2001) [20-21]. The utilization of semi-intensive systems minimizes the effects of stressing factors and contributes to bird welfare (Barbosa Filho *et al.*, 2005). Considering all this facts of housing systems and variety of birds, the present research work was designed with the aim of Upliftment of Socio-Economic status of farmers through rearing of Kadaknath, Giriraja and Black Australorp birds under Free-range, Semi-Intensive and Intensive system of housing in Maharashtra state of India.

Materials and Method

The present study was conducted in 240 Poultry farmers in 24 villages of four districts; Kolhapur, Solapur, Sangali and

Satara of Maharashtra state, India over the period of 15 months (April 2019 to July 2020). Selection of poultry farmers were on the basis of well-structured interview schedule with the criteria of Age, Education, Family size, Land holding, Occupation, Flock size, Poultry farming experience and Annual income. The experimental parameters studied during the 16 week duration were growth performance and economics of rearing three types of birds Kadaknath, Giriraja and Black Australorp under the free range, semi-intensive and intensive system of housing, respectively. All the birds of these three breeds were maintained under common feeding and water regime in three systems. The data of the birds was collected and recorded from 0th day to 16th week of age at biweekly interval and the results were expressed as Mean \pm S.E. The statistically analysis of the data was done using Complete randomized design as per method described by Panse and Sukhatme, (1967) [15] using Statistical Package for Social Science (SPSS, version-26, IBM Corporation, Armonk, NY, USA).

Results and Discussion

Criteria's of scoring and categorization for the selection of poultry farmers is presented in Table no. 1.

Table 1: Criteria's of scoring and categorization for the selection of poultry farmers.

Particulars	poultry farmers	Percentage
1) Distribution of poultry farmers according to age.		
Young (<30 years)	68	28.33
Middle (31-50 years)	124	51.67
Old (> 50 years)	48	20.00
2) Distribution of poultry farmers according to education level.		
Illiterate	87	36.25
Primary level	39	16.25
High School	65	27.08
Graduate and above	49	20.42
3) Distribution of poultry farmers according to size of family.		
Small (< 5 members)	79	32.92
Medium (6-7 members)	106	44.16
Large (> 8)	55	22.92
4) Distribution of poultry farmers according to land holding.		
Poultry farmers (< 2.5 acre)	120	50.00
Poultry farmers (land 2.5 – 5 acre)	120	50.00
5) Distribution of poultry farmers according to occupation.		
Labour	32	13.33
Agriculture	157	65.42
Animal Husbandry	33	13.75
Business	12	5.00
Service	6	2.50
6) Distribution of poultry farmers according to annual income.		
Low (up to Rs. 50K)	72	30.00
Medium (Between Rs. 50- 100K)	136	56.67
High more than Rs. 100K)	32	13.33
7) Distribution of poultry farmers according to type of poultry housing.		
Free- range	83	34.58
Semi - intensive	96	40.00
Intensive	61	25.42
8) Distribution of poultry farmers according to poultry farming experience.		
Low (< 2 years)	78	32.50
Medium (2 - 5 years)	107	44.58
High (>5 Years)	55	22.92
9) Distribution of poultry farmers according to flock size.		
Free range 5 - 10	83	34.58
Semi-intensive 10 - 25	96	40.00
Intensive More than 25	61	25.42

10) Distribution of poultry farmers according to information source.		
Low (No contact)	32	13.33
Medium (Some contact)	144	60.00
High (Always)	64	26.67

Based on the various selection criteria's, 240 farmers were selected from 24 villages of four districts; Kolhapur, Solapur, Sangali and Satara of Maharashtra state, India which might be a landmark foot print for the future further socio-economic studies in the urban and rural areas on various species and breeds of livestock and poultry.

Growth performances

The results on individual and comparative study on growth performance in Kadaknath (KD), Giriraja (GR) and Black

Australorp (BA) under free range (FR), Semi-intensive (SI) and Intensive (IN) systems of housing is discussed as follows

In Kadaknath

The data of comparative growth performances at biweekly interval on body weight of Kadaknath birds upto 16th week of age in the free range, semi-intensive and intensive housing systems were 827.49, 907.25 and 1014.53g, respectively and is presented in Table 2.

Table 2: Comparative biweekly body weight (g) of Kadaknath (KD) in Free range (FR), Semi-intensive (SI) and Intensive (IN) systems of housing.

KD	Age (In weeks)								
	Day old	2 nd	4 th	6 th	8 th	10 th	12 th	14 th	16 th
FR	27.63±0.20	71.25 ^b ±1.06	138.86 ^b ±2.12	227.51 ^c ±2.72	299.03 ^c ±3.59	416.77 ^c ±3.32	542.20 ^c ±3.50	689.33 ^c ±3.57	827.49 ^c ±3.90
SI	28.48±0.24	74.06 ^b ±2.03	144.23 ^b ±4.05	288.52 ^b ±3.76	330.24 ^b ±5.04	447.19 ^b ±4.79	602.42 ^b ±5.14	762.96 ^b ±5.00	907.25 ^b ±5.16
IN	28.64±0.18	84.41 ^a ±1.80	186.27 ^a ±3.59	316.86 ^a ±2.79	458.21 ^a ±3.61	582.47 ^a ±3.94	717.98 ^a ±4.95	851.96 ^a ±4.90	1014.53 ^a ±5.45
F' Cal. Value	6.59	17.29**	57.95**	198.16**	326.55**	391.38**	366.01**	322.94**	364.85**

Means bearing different superscripts (^{a,b}) differ significantly (** $p < 0.01$) in a column.

It was observed that the highly significant ($p < 0.01$) differences in body weight in Kadaknath birds being highest in intensive, followed by semi-intensive and lowest in free range system continuously up to 16th weeks of the age.

The findings of the study regarding the body weight gain in Kadaknath was lesser at 16th week of rearing in free range housing system is in agreement with earlier reports of Singh *et al.* (2004) [22] observed highest body weight at 15th week of age in both Kadaknath and Aseel. The reason for lower weight gain in indigenous breeds from same breeding stock can be the non-selected origin of Kadaknath (Shanmathy *et al.*, 2018) [19]. The lower Average body weight gain in free range as compare to semi intensive and intensive system of

housing in the present study is might be due to the metabolic rate of breed (Shanmathy *et al.*, 2018) [19] and mainly due the management conditions (Gondwe and Wollny, 2003) [6] specially space, water and feed availability which is deeply related with the variation in body weight gain in three different types of housing.

In Giriraja

The data of comparative growth performances at biweekly interval on body weight of Giriraja birds upto 16th week of age in the free range, semi-intensive and intensive housing systems were 1282.92, 1412.97 and 1864.90 g, respectively and is presented in Table 3.

Table 3: Comparative biweekly body weight (g) of Giriraja (GR) in Free range (FR), Semi-intensive (SI) and Intensive (IN) systems of housing.

GR	Age (In weeks)								
	Day old	2 nd	4 th	6 th	8 th	10 th	12 th	14 th	16 th
FR	35.90±0.27	113.50 ^c ±1.42	238.12 ^c ±2.84	433.09 ^b ±4.22	632.76 ^b ±6.12	818.40 ^c ±5.95	958.28 ^c ±6.51	1131.46 ^c ±6.70	1282.92 ^c ±6.95
SI	36.13±0.22	124.57 ^b ±2.41	282.54 ^b ±4.81	433.67 ^b ±7.63	636.38 ^b ±8.67	857.95 ^b ±9.99	1045.92 ^b ±11.50	1218.69 ^b ±12.89	1412.97 ^b ±14.45
IN	36.19±0.18	156.81 ^a ±3.07	374.61 ^a ±6.14	610.79 ^a ±7.43	879.47 ^a ±9.00	1124.42 ^a ±11.84	1355.58 ^a ±14.81	1611.00 ^a ±17.33	1864.90 ^a ±20.24
F' Cal. Value	0.44	91.40**	221.53**	226.76**	288.95**	301.34**	306.29**	404.47**	454.21**

Means bearing different superscripts (^{a,b}) differ significantly (** $p < 0.01$) in a column.

It was observed that the highly significant ($p < 0.01$) differences in body weight gain of Giriraja birds being highest in intensive, followed by semi-intensive and lowest in free range system continuously up to 16th weeks of the age. Better growth potential seen in present experiment in all the housing system might be due to the fact that this breed (Giriraja) had undergone series of improvement and selection for higher body weight and growth rate (Amusan *et al.*, 2013) [1]. Giriraja showed highest body weight gain throughout the study is might be due to heavy and larger breed size which is correlative with the findings of Neupane *et al.*, (2014) [14] and Somu, (2015) [23]. The lower Average body weight gain in free range as compare to semi-intensive and intensive system

of housing in the present study is might be due to the metabolic rate of breed (Shanmathy *et al.*, 2018) [19] and mainly due the management conditions (Gondwe and Wollny, 2003) [6] specially space, water and feed availability which is deeply related with the variation in body weight gain in three different types of housing.

In Black Australorp

The data of comparative growth performances at biweekly interval on body weight of Black Australorp birds upto 16th week of age in the free range, semi intensive and intensive housing systems were 1238.25, 1316.07 and 1693.32 g, respectively and is presented in Table 4.

Table 4: Comparative biweekly body weight (g) of Black Australorp (BA) in Free range (FR), Semi-intensive (SI) and Intensive (IN) systems of housing.

BA	Age (In weeks)								
	Day old	2 nd	4 th	6 th	8 th	10 th	12 th	14 th	16 th
FR	37.12±0.24	102.19 ^b ±3.78	208.85 ^c ±7.56	391.65 ^b ±8.45	577.93 ^b ±9.55	773.82 ^b ±10.98	904.20 ^c ±12.54	1065.18 ^c ±14.70	1238.25 ^c ±17.18
SI	36.25±0.36	110.97 ^b ±2.85	263.24 ^b ±5.70	406.44 ^b ±7.11	604.27 ^b ±9.64	795.23 ^b ±11.34	1002.15 ^b ±13.31	1169.48 ^b ±15.78	1316.07 ^b ±18.10
IN	36.67±0.30	126.73 ^a ±1.95	356.81 ^a ±8.24	572.99 ^a ±8.78	799.17 ^a ±9.94	1056.97 ^a ±9.77	1288.69 ^a ±9.94	1469.73 ^a ±9.21	1693.32 ^a ±8.68
'F' Cal. Value	2.29	14.83**	102.45**	138.97**	142.07**	191.97**	247.33**	211.54**	213.88**

Means bearing different superscripts (^{a,b}) differ significantly (** $p < 0.01$) in a column.

It was observed that the highly significant ($p < 0.01$) differences in body weight gain of Black Australorp birds being highest in intensive followed by semi-intensive system and lowest in free range continuously up to 16th weeks of the age. Black Australorp showed highest body weight gain throughout the study period is might be due to heavy and larger breed size which is correlative with the findings of Gondwe and Wollny, (2003) [6] and Kgwatalala and Segokgo, (2013) [11]. The highest body weight gain in BA under Intensive system of rearing is might be due to the metabolic

rate of breed and management conditions (Gondwe and Wollny, 2003) [6].

Comparative growth performance of Kadaknath, Giriraja and Black Australorp birds

The comparative growth performance of kadaknath (KD), Giriraja (GR) and Black Australorp (BA) birds in free range (FR), Semi-intensive (SI) and Intensive (IN) system of housing at 16th week performance was studied, analyzed and presented in Table no.5.

Table 5: Comparative Growth performance of Kadaknath (KD), Giriraja (GR) and Black Australorp (BA) birds at 16th week in free range (FR), Semi-intensive (SI) and Intensive (IN) system of housing

Breed Housing System	Kadaknath (g) (Mean ±S.E.)		Giriraja (g) (Mean ±S.E.)		Black Australorp (g) (Mean ±S.E.)	
	Day old	16 th Week	Day old	16 th Week	Day old	16 th Week
FR	27.63±0.20	827.49 ^c ±3.90	35.90±0.27	1282.92 ^c ±6.95	37.12±0.24	1238.25 ^c ±17.18
SI	28.48±0.24	907.25 ^b ±5.16	36.13±0.22	1412.97 ^b ±14.45	36.25±0.36	1316.07 ^b ±18.10
IN	28.64±0.18	1014.53 ^a ±5.45	36.19±0.18	1864.90 ^a ±20.24	36.67±0.30	1693.32 ^a ±8.68
'F' Cal. Value	6.59 ^{NS}	364.85**	0.44 ^{NS}	454.21**	2.29 ^{NS}	213.88**

Means bearing different superscripts (^{a,b}) differ significantly (** $p < 0.01$) in a column.

At the 16th week, body weight gain in Kadaknath; Giriraja and Black Australorp in FR, SI and IN were 827.49±3.90, 907.25±5.16 and 1014.53±5.45; 1282.92±6.95, 1412.97±14.45 and 1864.90±20.24, and 1238.25±17.18, 1316.07±18.10 and 1693.32±8.68 g, respectively. The data of comparative growth performance of Kadaknath, Giriraja and Black Australorp bird showed highly significant ($p < 0.001$) body weight gain in Intensive system of housing as compared to semi-intensive and free range system. Highly significant ($p < 0.01$) differences between the breeds was observed in all the system of housing management with respect to growth performance. The highest body weight gain throughout the experiment in all the three breeds was observed in intensive system of rearing followed by semi intensive and lowest in free range system It was observed that for most of the weeks, highest biweekly body weights was seen in Giriraja, followed by Black Australorp and lowest in Kadaknath birds, respectively. Difference in the body weight gain and Growth performance in the present study under intensive system of rearing may be due to difference of genetic makeup of Kadaknath, Giriraja and Black Australorp, and Giriraja and Black Australorp are being a heavy bird, the body weights of Giriraja followed by Black Australorp at different ages were higher than Kadaknath under all the three different types of housing systems.

Black Australorp and Giriraja showed highest body weight

gain throughout the study is might be due to heavy and larger breed size which is correlative with the findings of Neupane *et al.*, (2014) [14], Somu, (2015) [23] and Sudhir, (2021) [10], in Giriraja and Gondwe and Wollny, (2003) [6] and Kgwatalala and Segokgo, (2013) [11] in Black Australorp birds. The lower Average body weight gain in Kadaknath breed as compare to Giriraja and Black Australorp in the present study is may be due to the genetic makeup of the indigenous and cross-breeds (Singh and Singh, 2004) [22]. Significant effect ($p < 0.05$) of breed on body weight was observed in Giriraja showing superiority over Black Australorp and Desi birds. The Better growth potential might be due to the fact that this breed (Giriraja) had undergone series of improvement and selection for higher body weight and growth rate (Amusan *et al.*, 2013) [1]. In poultry, age and breed are some of the many important factors influencing the rate of body weight gain (Kumar *et al.*, 2020) [12].

Comparative economics of Intensive housing in Kadaknath, Giriraja and Black Australorp birds

Considering the importance of the Intensive system of rearing, we have drawn out the comparative economics of rearing the Kadaknath, Giriraja and Black Australorp in intensive system up to the 16th week of age. The data for production economics up to the 16th week at poultry farmer's door is presented in Table 6.

Table 6: Comparative economics of Intensive housing in Kadaknath, Giriraja and Black Australorp marketed (Sold) at farmer's doorstep.

Sr. No.	Particulars	Kadaknath	Giriraja	Black Australorp
1	Cost of day old chick (Rs)	40	20	20
2	Cost of feed (Rs)	27.5	27.5	27.5
3	Total feed consumption (g)	3738.23	4797.16	4898.47
4	Cost of feed consumed per bird (Rs)	102.80	131.92	134.70
5	Average body weight (g)	1014.53	1864.89	1693.32
6	Miscellaneous cost* (Rs)	20	20	20
7	Total cost of production (1+4+6) (Rs.)	162.80	171.92	174.70
8	Average price realized/bird, Kadaknath @ 350 Rs/kg live weight, Giriraja and Black Australorp @ 250 Rs/kg live weight	355.08	466.22	423.33
9	Net profit/bird (Rs) (8-7)	192.28	294.30	248.63
10	Net profit/kg live weight (Rs)	189.53	157.81	146.83

The total cost of production of rearing kadaknath, Giriraja and Australorp under intensive system of housing was Rs. 162.80, 171.92 and 174.70, respectively and average sell price per bird, Kadaknath @ Rs. 350, Giriraja and Black Australorp @Rs.250/kg live weight. The Net profit per bird and Net profit per Kg of live weigh at 16th weeks of age for kadaknath, Giriraja and Black Australorp were Rs. 192.28 and 189.53, Rs. 294.30 and 157.8, and Rs. 248.63 and 146.83, respectively.

Considering the production economics of the study, it is conclusive that the Giriraja is the best breed of poultry reared under the intensive system of housing followed by Black Australorp and Kadaknath. The findings for rearing Giriraja is in concurrence with the findings of Neupaneet *et al.*, (2014)^[14] who observed higher saving (Rs132.39) per bird than that of New Hampshire (Rs 67.09). Gupta *et al.* (2016)^[7] observed in indigenous breed Kadaknath is well known for delicious black flesh, profitability was numerically higher in Kadaknath. Also, Rathod *et al.* (2018)^[17] observed better growth performance and lowest cost of production in Kadaknath chicken from 7th to 14th week of age. Kadaknath birds sold relatively in higher price due to its black flesh which is very delicious, high protein meat and with high medicinal value (Kumar *et al.* 2020)^[12]. Giriraja and Black Australorp birds are superior for dual purpose poultry birds, whereas Kadaknath get higher pricedue to their specific meat properties.

Conclusion

Major advantage of rearing Desi birds like Kadaknath or improved varieties of chicken like Giriraja and Black Australorp gives assured income to the poultry farmers. Furthermore, Under Indian traditional system of rearing i.e. rearing of 5-10 birds per house in rural and urban areas, Giriraja and Black Australorp may finds their way of rearing by spreading extension activities and knowledge of rearing for profitable poultry farming and upgrading sustainable socio economic status of poor and marginal farmers.

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