International Journal of Farm Sciences **5(2)** : 198-207, 2015

Quality evaluation of Girirani poultry eggs in comparison to local and BV-300 varieties

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ABSTRACT

Girirani is a new scavenging backyard poultry breed for high productivity. Objective of the study was to evaluate the physico-chemical, functional and organoleptic characteristics of eggs of Girirani in comparison ot farm and local poultry birds. Girirani eggs were brown in colour; the edible portion and the internal quality parameters were better compared to others. Eggs of Girirani had high crude fat (11.44%) and total minerals (0.99%) whereas BV 300 eggs had moisture and carbohydrates 75.78 and 3.73 per cent respectively. Functional parameters of eggs did not vary significantly. The sponge cake of the whole eggs of BV 300 had better cake volume. Hard cooked egg revealed better taste and flavour characteristics for Girirani and local eggs.

Keywords: Girirani; BV 300; local; poultry eggs; physico-chemical; functional; sensory

INTRODUCTION

The Indian poultry industry is growing at a rate of 8-10 per cent for egg and 15-20 per cent for broiler production due to the application of genetic improvement techniques and modern management practice of poultry industries (Johari 2000). The industry is evolved from backyard ventures of poultry farming. In rural India local or Desi (local) birds are reared in backyard under scavenging conditions contributing meagerly towards country's total egg and meat production. Newer breeds of poultry such as Girirani are released with enhanced broad activities, better disease resistance with multiple plumage and suitable for rearing under scavenging conditions. Hence an investigation was conducted to evaluate the physico-chemical characteristics and functional organoleptic storage properties of Girirani eggs in comparison to improved farm and Desi birds.

MATERIAL and METHODS

Fresh eggs of Girirani and improved farm birds (BV 300 or white leg horn) were procured from Department of

Poultry Science, UAS, Dharwad. Desi eggs were procured from local market. Shape index of eggs was calculated using the measurements of height and width of eggs. Internal characteristics such as colour, spread, height and indices of albumin and yolk were measured by standard procedures.

Albumin and yolk spread: Fresh eggs were broken on transparent glass sheet lined with a graph sheet on which concentric circles were drawn. The spread at four maximum points was noted separately for albumin and yolk. Spherometer was used to measure height of albumin and yolk. Height indices of albumin and yolk and Haugh units were estimated following the procedures of Stadelman (1986).

Chemical analysis: Moisture, crude protein, fat and total mineral matter were estimated employing standard procedure (Anon 1990).

Functional properties: Coagulation time and temperature of yolk and albumin were recorded by poaching the eggs directly in simmering water. Foaming capacity and stability of eggs were assessed by the method of Poole (1989).

Performance of eggs in the preparation of sponge cake: The functional properties in terms of cake making were evaluated using different proportions of egg constituents as shown below. A total of eight types of cakes were prepared using eggs from the three breeds. Cake height, volume and specific volume of cake were measured.

Variety	Whole egg (g)	Only albumin (g)	Equated albumin (g)
Girirani	1107	67	67
BV 300	99	72	67
Local	74	53	67

Organoleptic quality of the three types of eggs was assessed in the form of hard cooked eggs and sponge cakes. The taste and texture were evaluated using a descriptive score card using hedonic scale.

Student's t-test was used to know the difference in egg quality and analysis of variance was used for evaluation of organoleptic characteristics..

RESULTS and DISCUSSION

The morphological characteristics and composition of Girirani eggs in comparison to eggs of local and BV 300 birds are presented in Table 1. Difference in egg shell colour and appearance of the three breeds of birds were observed. Girirani eggs were light brown without any luster whereas the local birds were found

to be slightly dark with creamish brown colour and lustrous in appearance. Girirani eggs resembled the farm eggs with respect to weight of albumen and yolk contents and edible portion. Eggs of Girirani and BV 300 birds were bigger (55.30 g) with higher amount of compositional constituents. Similar observations were made by Mohan et al (1992) who reported that larger eggs contained higher proportion of egg constituents. Padhi et al (1998) reported that genetic factors determined the egg weight and the eggs characteristics in different poultry birds. Variations in albumen to yolk ratio were observed among all the three breeds of birds. This might be because of genetic variation and age of egg laying period of birds. An attempt to correlate the egg quality characteristics to plumage colour was made by Olori and Sonaiya (1995) in domestic fowls and the results indicated the influence of several other factors besides plumage colour in determining the egg quality characteristics. The internal egg characteristics such as spread, height and indices of albumen and yolk were significantly better in Girirani and BV-300 eggs (Table 1) which might be due to genetic factors or due to their diet. Similar effects of genotype impact on internal egg characteristics of poultry birds were reported by Mahapatra et al (1987). Higher Haugh unit indicated better albumen quality. In the present investigation Haugh unit was not influenced by genotypic difference in contrast to reports of Mahapatra et al (1987) who worked on guinea fowls and hens.

It was found that the eggs of Girirani birds contributed significantly higher amounts of crude fat and total minerals and both on per cent and per egg basis (Table 2). The contribution of higher amounts of fat by Girirani eggs might be mainly due to genetic factors. Though the yolk weight of both Girirani and farm bird eggs was the same the fat contributed by Girirani was more. Similarly the total mineral factor in Girirani eggs was significantly more because of higher proportion of yolk and albumen and low moisture content. The eggs of improved powder breed viz Girirani and BV-300 birds had significantly higher proportions of protein on per egg basis but on percentage basis local eggs contributed more protein. This might be due to small size of local eggs or due to nutrition received by the farm birds. The difference in nutrient composition of the three types of eggs might also be due to egg laying period of hen, feed and several other factors. Similar observations were reported by Mahapatra et al (1987).

It was observed that the coagulation time and temperature of the three types of eggs were almost same after poaching (Table 3). However significant variations in coagulation time and temperature of yolk were observed among the three types. The time and temperature for coagulation of yolk are slightly more than that for albumen which might be due to the proximity of albumen to the source of heat, higher fat content of yolk and nature of protein.

Table1. Morphology and composition of eggs of three variety birds

Characteristic	Variety			Mean	't' value		
	Girirani	Local	BV 300		Girirani v/s local	Local v/s BV 300	BV 300 v/s Girirani
External characteristics							
Appearance	Light brown	Creamish brown, lustrous	White, dull	-	-	-	-
Weight (g)	56.24±3.45	42.17±3.65	55.61±1.98	51.34	6.86**	7.92**	0.39NS
Edible portion (g)	50.93±3.23 (90.58)	38.02±3.45 (90.16)	49.7±2.05 (89.37)	46.22 (90.02)	6.67**	7.10**	0.79**
Albumen weight (g)	33.25±3.89 (58.96)	23.99±2.92 (56.76)	32.26±1.88 (57.97)	29.83 (58.10)	3.37**	5.73**	0.68NS
Yolk weight (g)	17.69±1.33 (31.68)	14.03±0.71 (33.37)	17.45±0.93 (31.40)	16.39 (31.92)	5.94**	7.13**	0.36NS
Albumen/yolk ratio	1.87±1.41	1.71±1.41	1.85±1.41	1.81	1.53NS	1.71NS	0.18NS
Shape index	73.05±1.14	74.11±1.82	71.34±1.56	72.83	0.47NS	1.11NS	0.82NS
Internal characteristics of albumen							
Color	Transparent, green tinge	Transparent, green tinge	Transparent, green tinge	-	-	-	-
pH	9.46±0.04	9.74±0.01	9.28±0.05	9.49	17.03**	20.36**	6.49**
Height (mm)	6.15±0.49	5.4±0.26	6.32±0.29	5.96	3.37**	5.73**	0.68NS
Spread (mm)	70.54±5.37	76.13±2.05	71.65±2.41	72.77	2.38*	3.47**	0.46NS
Albumen Index	0.087±0.01	0.07±0.01	0.088±0.01	0.082	3.13*	5.76**	0.05NS
Haugh unit	78.98±3.03	79.08±2.25	80.31±2.51	79.46	0.06NS	0.89NS	0.83NS
Internal characteristics of yolk							
color	Yellow	Deep yellow	Pale yellow	-	-	-	-
Height (mm)	16.25±0.52	15.50±0.45	15.67±1.75	15.82	2.67*	0.23NS	0.78NS
Spread (mm)	40.63±1.55	38.70±1.12	39.08±1.24	39.47	2.47*	0.56NS	1.91NS
Yolk index	0.40±0.02	0.40±0.00	0.40±0.05	0.40	0.07NS	0.04NS	0.04NS

*Significant at P≤ 0.05 level, **Significant at p≤ 0.01, NS= Non-significant
Figures in parentheses indicate percentage

Table 2. Nutrient composition of three varieties of eggs on per 100 g and per egg basis (edible portion)

Parameter	Variety			Mean	't' values		
	Girirani	Local	BV300		Girirani v/s local	Local v/s BV 300	BV 300 v/s Girirani
Composition (g/100 g)							
Moisture	73.13±0.23	74.34±0.03	75.78±0.49	74.42	12.19**	7.07**	16.62**
Crude fat	11.44±0.36	10.87±0.09	9.76±0.20	10.69	3.74**	12.35**	9.95**
Crude protein	12.29±0.07	12.58±0.91	9.80±0.14	11.56	3.59**	28.90**	39.05**
Total minerals	0.98±0.03	0.93±0.02	0.93±0.03	0.95	4.57**	0.41^{NS}	2.95*
Carbohydrates	2.12±0.421	1.28±0.24	3.773±0.64	2.38	4.04**	8.75**	5.06**
Energy (Kcal)	161±1.41	153±1.41	142±1.41	152	7.02*	9.65**	16.67**
Composition per egg basis							
Moisture	37.27±2.32	28.26±2.58	37.67±1.65	34.40	6.35**	7.51**	0.35^{NS}
Crude fat	5.83±0.51	4.13±0.41	4.85±0.21	4.94	6.37**	3.82**	4.36**
Crude protein	6.26±0.38	4.79±0.46	4.87±0.22	5.31	6.05**	0.42^{NS}	7.67**
Total minerals	0.50±0.03	0.35±0.03	0.46±0.03	0.44	8.23**	6.47**	2.26*
Carbohydrates	1.07±0.22	0.48±0.08	1.85±0.29	1.13	6.16**	10.84**	5.12**
Energy (Kcal)	82±1.41	58±1.41	74±1.41	70	21.05*	11.40**	9.65**

*Significant at P≤ 0.05 level, **Significant at p≤ 0.01, NS= Non-significant
Figures in parentheses indicate percentage

Table 3. Functional properties of eggs of three bird varieties

Parameter	Constituent /period	Variety			Mean	't' value		
		Girirani	Local	BV 300		Girirani v/s local	Local v/s BV 300	BV 300 v/s Girirani
Coagulation time (sec)	Albumen	192.50±17.54	190.00±12.25	191.67±15.71	191.39	0.29^{NS}	0.21^{NS}	0.09^{NS}
	Yolk	285±13.41	322±24.65	297.50±6.12	301.67	3.37**	2.41**	2.08^{NS}
Coagulation temperature (^{O}C)	Albumen	62.17±1.17	62.00±0.89	62.67±0.82	62.28	0.28^{NS}	1.35 ^{NS}	0.86^{NS}
	Yolk	69.67±1.21	68.33±0.52	68.83±0.75	68.94	2.48 *	1.34^{NS}	1.43^{NS}
Foam volume	Initial	47.50 ±8.80	40.50± 8.69	52.67± 2.34	46.89	1.39^{NS}	3.31**	1.39^{NS}
	After beating	234.17±14.72	205±41.23	261.67±14.72	23.61	1.26^{NS}	3.17*	1.62^{NS}
Time for stable foam	Seconds	571.67±25.63	576.67±23.38	633.33±27.24	593.67	0.35^{NS}	3.16*	3.34**
Foam expansion	Percentage	394.44±13.61	407.72±12.12	396.74±12.76	399.63	1.78^{NS}	1.52^{NS}	0.30^{NS}
Foam liquid stability	After 10 min	20.00	27.80	20.00	22.60	-	-	-
	After 20 min	34.00	39.58	30.77	34.78	-	-	-
	After 30 min	42.00	57.04	47.54	48.66	-	-	-

*Significant at P ≤ 0.05 level, **Significant at p≤ 0.01, NS= Non-significant
Figures in parentheses indicate percentage

Table 4. Functionality of eggs of three variety birds in sponge cakes

Parameter	Whole egg cake			Equated albumin cake			Only albumin cake		
	Girirani	Local	BV 300	Girirani	Local	BV 300	Girirani	Local	BV 300
Batter weight (g)	460	430	420	425	420	430	445	440	450
Cake weight (g)	405	308	377	365	385	365	375	370	372
Baking loss (%)	11.96	11.63	10.24	14.12	8.33	15.12	15.73	15.91	17.33
Cake height at centre (mm)									
Batter	23.0	24.0	23.5	19.0	18.0	19.0	20.0	20.0	19.0
Cake	53.5	52.0	56.50	44.00	43.0	38.0	44.0	43.0	38.0
Per cent increase	57.01	53.85	58.40	56.82	58.14	50.00	54.55	53.49	50.00
Cake height at periphery (mm)									
Batter	23.0	24.0	23.5	20.0	19.00	19.0	19.00	18.00	19.00
Cake	24.5	26.3	26.2	28.20	24.00	27.30	27.30	24.50	27.30
Per cent increase	6.12	8.75	10.31	29.08	20.83	30.40	30.40	26.53	30.40
Cake volume (ml)									
Batter	550	575	563	480	480	456	456	432	456
Cake	820	860	900	662	702	580	680	720	662
Per cent increase	32.93	33.14	37.44	27.49	31.62	21.38	32.94	40.00	31.12
Specific volume (v/w)	2.02	2.26	2.39	1.81	1.67	1.59	1.81	1.95	1.78

Foaming characteristics of the eggs of BV-300 had better foaming capacity which was also reflected in better baking characteristics when whole eggs were used. When only albumen portion in equated amounts was used for sponge cake preparations the Girirani eggs were more suitable (Table 4). The foaming capacity was least for local eggs which also had highest foam liquid stability per se. However when only albumin of eggs was used the local eggs yielded better cakes of higher volumes and specific volumes.

The variations in the functional characteristics of three varieties of eggs did not have any impact on the organoleptic of hard cooked eggs for taste and flavour of yolk and texture of both albumin and yolk (Table 5). The appearance and colour of local eggs was superior than other two eggs. This might be due to yellow colour of yolk.

Table 5. Organoleptic scores of hard boiled eggs of three varieties of birds

Character	Portion	Variety			CD at P ≤0.5
		Girirani	Local	BV 300	
Color	Albumin	White	White	White	-
	Yolk	Light yellow	Deep yellow	Light yellow	
		2.80 (4.00)	3.93 (4.00)	1.40 (4.00)	0.39
Taste and flavour	Albumin	3.20 (4.00)	2.60 (4.00)	2.60 (4.00)	0.53
	Yolk	3.33 (4.00)	2.73 (4.00)	3.00 (4.00)	NS
Texture	Albumin	1.80 (3.00)	1.80 (3.00)	1.53 (3.00)	NS
	Yolk	1.87 (3.00)	1.60 (3.00)	1.60 (3.00)	NS
Overall acceptability	3.60 (4.00)	2.87(4.00)	2.87 (4.00)	2.80 (4.00)	0.56

NS= Non-significant

Table 6. Organoleptic scores for sponge cakes made from eggs of three varieties of birds

Character	Variety			CD at P ≤0.5
	Girirani	Local	BV 300	
Color	2.89	3.33	2.17	0.82
Taste and flavour	3.22^{a}	3.22^{a}	2.67^{b}	0.29
Texture	3.00	3.00	2.87	NS
Overall acceptability	3.30^{a}	3.56^{a}	2.60^{b}	0.76

NS= Non-significant, Figures bearing common superscripts do not differ significantly

The taste and flavour of albumen portion of Girirani eggs were superior which might be due to genotype variations or due to relatively higher content of protein. Similar results were observed in different strains of white Leghorn eggs wherein the heredity was found to influence the flavour, odour and texture profiles of albumen and yolk of hard cooked eggs (Pandey et al 1993).

The organoleptic evaluation of sponge cakes prepared from the whole eggs (as per the commercial standardized recipe) revealed no difference in appearance, colour and textural properties in the cakes prepared from the three types of eggs. However the taste, flavour and overall acceptability after cakes varied and the cakes of local eggs were preferred by the panel of judges (Table 6). This might be due to combined effect of nutrient composition, genotypic differences in physical (colour and appearance) and taste characteristics of eggs. Thus the experiment revealed that though the farm eggs (BV-300) had better cake making quality the organoleptic characteristics of cakes prepared from local eggs were better preferred followed by Girirani eggs.

CONCLUSION

The weight of eggs, edible portion, albumen to yolk ratio and yolk height were higher in Girirani eggs compared to BV 300 and local birds. Eggs of Girirani had higher crude fat and total minerals whereas BV 300 had moisture and carbohydrates in higher amounts. Organoleptic evaluation of eggs in the form of hard cooked eggs revealed that the local birds had higher scores for colour whereas Girirani for taste and flavour. Hence the superiority of eggs of Girirani was evident in terms of physical characteristics.

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Received: 12.1.2015 ***Accepted: 27.3.2015***