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Influence of post hatch *Saccharomyces cerevisiae* supplementation on performance, slaughter traits and serum biochemistry of broiler chicken

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ABSTRACT

Day-old Vencobb broiler chicks (180) were randomly allocated to 2 treatment groups with 9 replicates of 10 chicks in each to study the effect of post hatch *Saccharomyces cerevisiae* supplementation on growth performance, slaughter traits and biochemical profile. The trial lasted for 5 weeks. Two types of diet were formulated for first week which contained 0% and 0.5% *S.cerevisiae* respectively. After first week post-hatch period chicks were fed *ad lib.* with the normal basal diet as per Bureau of Indian Standard (BIS 1992) recommendations till completion of experiment. Maximum conversion of feed into gain was recorded in *S. cerevisiae* supplemented birds. The chicks attained relatively higher dressing percentage in the same group. Birds fed yeast had more protein in breast and thigh muscle whereas serum HI titre was nonsignificant among treatments. Maximum triglyceride was recorded in control group while other biochemical constituents did not differ significantly among treatments. It may be concluded that post hatch *S. cerevisiae* supplementation in the diet improves the overall FCR, dressing percentage and reduces triglyceride level in broiler chicken.

Key words*:* Broilers, Performance, *Saccharomyces cerevisiae,* Serum biochemistry, Slaughter traits

Feeding of broilers during the first week post-hatch is of paramount importance for broiler industry. Various physiological changes occur in the gastrointestinal tract during the first week post hatch and nutrient utilization increases steadily afterwards (Garcia *et al*. 2006). Therefore this stage of development is very critical in the modern broiler production. The goal of feeding the first week post-hatch diet is to provide a higher concentration of nutrients (Garcia *et al*. 2006, Rutz *et al*. 2007). Researchers showed that final body weight of chicken had the linear relationship with their first week of rearing (Pezeshkian 2002, Saki 2005). In the newly hatched chick, yolk sac transfers the immunoglobulins from the yolk and albumin to the newly hatched chick, but an early excess or deficiency of nutrients can harm the expansion of the immune response (Klasing 1998). For this reason various feed additives such as probiotics, prebiotics, enzymes and antioxidants may be included in the post hatch birds diet (Leeson 2008).

Probiotics are live microbial culture that has positive effects on the birds by the improvement of the gut micro flora (Fuller 1989, Ayasan 2013). *Saccharomyces cerevisiae* is widely used probiotic in broiler ration to improve the microbial balance in host and improves the birds performance. *S.cerevisiae* is a rich source of protein, minerals and vitamin B complex (Vahdatpour *et al*. 2011) and also reduces the serum triglycerides and cholesterol (Shareef and Al-Dabbagh 2009). It also helps in stimulating immune system thereby reducing the risk of diseases (Firon and Ofek 1983). It is reported that supplementation increases nutrient utilization by increasing villus height during the 4 days of chicken life (Santin *et al*. 2001). Furthermore, little is known concerning the regulation of feed intake during the initial post-hatch period. Therefore the present investigation was carried out to determine the influence of post hatch dietary *S.cerevisiae* supplementation on growth performance, carcass characteristics and serum biochemistry of broiler chicken.

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MATERIALS AND METHODS

The experiment was conducted in the Department of Animal Nutrition, College of Veterinary Science and Animal Husbandry, Anjora, Durg (Chhattisgarh).

Housing and management: Day-old Ven Cobb broiler chicks (180) were randomly assigned into 2 treatment groups of 90 chicks in each (9 replicates of 10 birds / treatment). The trial lasted for 35 days. Chicks were reared in deep litter system under standard housing and management condition. Birds were vaccinated against Ranikhet disease (F strain) and Infectious Bursal disease on day 7 and day 14, respectively. A booster dose for Ranikhet disease was given on day 28. Broiler starter and

finisher rations were offered to the birds in mash form. Fresh and clean drinking water was always made available to the birds during study. Artificial light was provided during night hours in order to extend 24 h photoperiod.

Treatments and additives: Two types of diet were formulated for first week which contained 0% and 0.5% *S.cerevisiae* respectively. After first week post-hatch period chicks were fed *ad lib.* with the normal basal diet as per Bureau of Indian Standard (BIS 1992) recommendations till completion of experiment (8–35 days). Ingredient and nutrients composition of broiler diets are presented in table 1 and 2 respectively.

Measurements: Feed intake and body weight was measured and then feed conversion ratio (FCR) was calculated weekly. Three days metabolism trial was conducted from 33–35 days to determine nutrient balance in broilers during which net feed intake by the birds was recorded and the excreta voided over the same period were collected quantitatively. The composite droppings from each lot was dried, ground and stored in air tight containers for nitrogen (AOAC 1995), calcium (Talapatra *et al*. 1940) and phosphorus (Fiske and Subbarow 1925) estimation. At 35 days of age, 3 birds of identical body weight from each replicate were sacrificed. The birds were fasted overnight, bled, defeathered and eviscerated with sufficient care. Different carcass parameters like defeathered weight, eviscerated weight, and weight of liver, heart and gizzard were recorded. Each of carcass components such as breast, legs, wings and back with neck was recorded and presented as a percentage of live body weight.

Muscle lipid and protein: On day 35, total lipid in breast and thigh muscles was determined as per Bligh and Dyer (1959) with minor modification. Muscle protein was determined by AOAC (1995).

Humoral immunity: Humoral immune response was assessed by Haemagglutination inhibition (HI) test. The blood was collected from 3 birds of each replicate in non-heparinized clean test tube on 28 and 35 day of experiment. The serum was collected as per standard procedure and mean serum HI titre were evaluated against Newcastle disease virus according to method described by Allan and Gough (1974).

Organ weight factor: Weight of bursa of Fabricius, spleen and thymus were taken at the end of experiment from the sacrificed birds of each group to calculate the relative organ weights as per the following formula:

$$\text{Organ weight factor} = \frac{\text{Organ weight}}{\text{Whole body weight}} \times 1000$$

Serum biochemistry: Blood was collected from jugular vein in non heparinised and clean test tubes from 3 birds of each replicate on 35 day of experiment. The serum was separated as per the standard procedure and stored under deep freezing temperature awaiting analysis. These samples were analyzed for total protein, globulin, albumin, albumin: globulin ratio, total cholesterol, HDL cholesterol, LDL cholesterol, triglyceride, calcium and phosphorus in semi automated analyzer by using diagnostic kits.

Statistical analysis: For interpretation of results, data were subjected to independent t test for analysis of variance as per method described by Snedecor and Cochran (1994).

Table 1. Ingredient composition of experimental broiler starter and finisher diet (on % DM basis)

Feed ingredients	Broiler starter	Broiler finisher
Yellow maize	50.5	55.5
Soya DOC	41	32.75
Deoiled rice bran	-	1
Soyabean oil	-	3.5
Dicalcium phosphate	3	1.2
Limestone powder	1.2	0.5
DL-methionine	0.7	1.2
Lysine	1.4	0.3
Soda-bi-carb	0.3	0.1
Choline chloride	0.14	1
Salt	0.8	0.95
Premix*	0.96	0.96

* Trace mineral premix mg/kg diet: Mg 300, Mn 55, Fe 56, Zn 30, Cu 4; vitamin premix per kg diet: vit. A 8250IU, vit. K 1mg, vit. E 26.84 mg, vit. B_1 2 mg, vit. B_2 4 mg, vit. B_{12} 100mg, Niacin 60 mg, pantothenic acid 10 mg; choline 500 mg and 30 ppm salinomycin (Coxistac 12%), 55 ppm bacitracin methylene di salicyclate (BMD110).

RESULTS AND DISCUSSION

The effect of post hatch *S. cerevisiae* supplementation on body weight, feed intake and FCR is given in the Table 3. Regarding feed intake no significant difference was noticed during first and second week and afterwards significant ($P< 0.05$; $P< 0.01$) decreased feed intake was observed in birds fed *S. cerevisae*. The result indicated that yeast supplementation in the diet improved FCR and weight gain (Fig. 1) better than control group during the entire periods of feeding. The observation of present experiment were similar with Santin *et al*. (2001), Patterrson and Burkholder (2003), Thongsong *et al*. (2008), Awad *et al*. (2008), Koc *et al*. (2010) and Abdelrahman (2013) who reported that the addition of probiotics in broiler diet, lead

Table 2. Analysis results of experimental broiler starter and finisher diet (on % DM basis)

Diet	Moisture (%)	CP (%)	CF (%)	EE (%)	ME (kcal/kg)	Total ash(%)	AIA (%)	NFE (%)	Ca (%)	P (%)
Broiler starter	9.78	23.01	3.99	2.67	2803.00	10.30	1.35	60.03	1.14	0.57
Broiler finisher	11.50	20.02	3.09	3.76	2906.00	10.93	1.44	62.20	1.16	0.58

Table 3. The effect of post hatch *S. cerevisiae* supplementation on feed intake (g), body weight (g) and FCR of broiler chicken

Particulars	7 d	14 d	21 d	28 d	35d
Feed intake (g)					
0 % *S. cerevisiae*	109.79±0.86	442.29±3.01	959.42±2.43 [a]	1750.78±3.47 [a]	2893.71±5.45 [a]
0.5% *S. cerevisiae*	109.99±0.73	436.75±2.42	947.10±3.14 [b]	1736.67±4.51 [b]	2873.64±5.98 [b]
Sig	NS	NS	**	*	*
Body weight (g)					
0 % *S. cerevisiae*	151.09±0.82 [b]	396.80±3.53 [b]	744.97±3.40 [a]	1166.99±4.59 [a]	1698.32±9.13 [a]
0.5% *S. cerevisiae*	145.92±1.36 [c]	387.73±3.15 [c]	734.78±3.88 [b]	1153.16±6.54 [b]	1678.76±8.19 [b]
Sig	**	**	*	*	*
FCR					
0 % *S. cerevisiae*	0.74±0.01 [a]	1.13±0.00 [a]	1.31±0.01 [a]	1.52±0.00 [a]	1.73±0.00 [a]
0.5% *S. cerevisiae*	0.73±0.00 [b]	1.09±0.01 [b]	1.27±0.01 [b]	1.48±0.00 [b]	1.68±0.00 [b]
Sig	*	**	**	**	**

Superscripts are read column wise for comparison of means. Means in the same column with different superscript a, b, c are significantly different (P*< 0.05) or (P**< 0.01), NS, nonsignificant.

Table 4. The effect of post hatch *S. cerevisiae* supplementation on various carcass cuts as percentage live weight of broiler chicken

Particulars	Dressing %	Liver	Heart	Gizzard	Breast	Thigh	Wing	Back and neck	Giblet
0 % *S. cerevisiae*	70.11±0.39 [b]	2.30±0.07	0.71±0.04	2.11±0.08	9.73±0.18	19.05±0.25	19.16±0.31	16.45±0.32 [b]	5.12±0.13
0.5 % *S. cerevisiae*	72.26±0.42 [a]	2.34±0.07	0.75±0.05	2.11±0.06	10.38±0.36	19.19±0.25	19.36±0.45	17.45±0.25 [a]	5.20±0.13
Sig	**	NS	NS	NS	NS	NS	NS	*	NS

Superscripts are read column wise for comparison of means. Means in the same column with different superscript a, b, c are significantly different (P*< 0.05) or (P**< 0.01), NS, nonsignificant.

to improved growth performance due to balanced intestinal gut microflora, increased lactic acid fermenting bacterial population and overall absorption of nutrients. Hamid *et al*. (1994) and Silva *et al*. (2000) observed improved FCR due to yeast supplement in chicken which is in accordance with present findings. Improved performance of birds fed *S. cerevisiae* might be due to to improved intestinal health and increased absorption of nutrients. It is also associated with reduction of pathogenic micro-organisms influenced by *S. cerevisiae*. In addition, supplementation contributes to the improvement of health of birds by reducing ammonia production in the gut (Chiang and Hseih 1995).

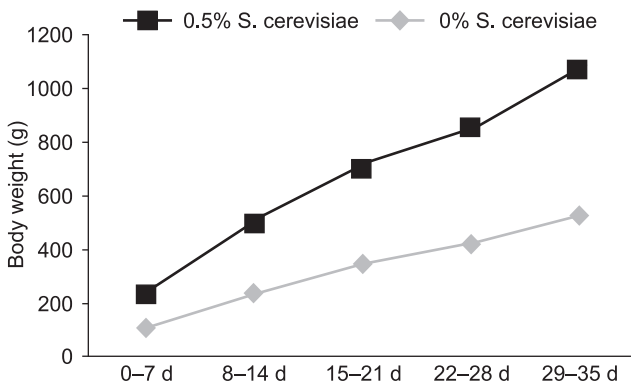

Fig. 1. The effect of post hatch *S.cerevisiae* supplementation on body weight gain (g) of broiler chicken.

The effect of post hatch supplementation of yeast on various carcass cuts as live weight percentage is presented in the table 4. Significantly (P<0.01) increased dressing percentage was recorded in yeast supplemented group whereas other carcass cut such as liver, heart, gizzard, breast, thigh, wing, and giblet revealed no significant difference among treatments. Current findings were corroborated with Kannan *et al*. (2005) and Paryad and Mahmoudi (2008) who reported higher dressed weight and back and neck weight due to yeast supplementation. Kabir *et al*. (2004) reported higher carcass yield when probiotic is supplemented in the broilers diet. The result is also in accordance with many researchers (Mahajan *et al*. 1999, Singh *et al*. 1999). During the first week post-hatch chicks were highly susceptible to pathogenic infections. *Saccharomyces* have a great potential on modulation of gut micro flora and pathogenic inhibition.

Yeast supplementation revealed significantly (P< 0.05; P< 0.01), increased moisture and protein content of thigh and breast muscle, whereas lipid content was nonsignificant (Table 5). Similar findings also reported by Gheisari and Kholeghipour (2006).

S. cerevisiae supplementation did not reveal significant difference on HI titre in the broiler chicken (Table 6). Findings of present experiment were not in accordance with Gheisari and Kholeghipour (2006), Salianeh *et al*. (2011)

Table 5. The effect of post hatch *S. cerevisiae* supplementation on moisture, protein and lipid content (%) of muscle of broiler chicken

Particulars	Thigh (7 d-14 d)			Breast (28 d-35d)		
	Moisture	Protein	Lipid	Moisture	Protein	Lipid
0 % *S. cerevisiae*	71.33±0.19 [b]	18.42±0.03 [b]	1.32±0.06	75.40±0.26 [b]	20.36±0.05 [b]	1.12±0.02
0.5 % *S. cerevisiae*	71.97±0.20 [a]	18.53±0.03 [a]	1.28±0.02	76.32±0.20 [a]	20.62±0.06 [a]	1.09±0.03
Sig	*	*	NS	**	**	NS

Superscripts are read column wise for comparison of means. Means in the same column with different superscript a, b, c are significantly different ($P^{*}< 0.05$) or ($P^{**}< 0.01$), NS, nonsignificant.

Table 6. The mean serum HI titre (log2) against New Castle disease virus of 4-week and 5-week old broiler chicken fed on different experimental diet

Particulars	28 d	35 d
0 % *S. cerevisiae*	2.67±0.18	3.24±0.20
0.5 % *S. cerevisiae*	2.96±0.25	3.67±0.20
Sig	NS	NS

Superscripts are read column wise for comparison of means. NS, Non significant.

Table 7. The effect of post hatch *S. cerevisiae* supplementation on organ weight factor of broiler chicken

Particulars	Bursa	Spleen	Thymus
0 % *S. cerevisiae*	1.05±0.07 [b]	1.01±0.10	3.99±0.17
0.5 % *S. cerevisiae*	1.34±0.10 [a]	1.01±0.08	4.40±0.30
Sig	**	NS	NS

Superscripts are read column wise for comparison of means. Means in the same column with different superscript a, b, c are significantly different ($P^{**}< 0.01$). NS, nonsignificant.

Table 8. The effect of post hatch *S. cerevisiae* supplementation on serum biochemistry of broiler chicken

Particulars	Protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)	A/G ratio	Cholesterol (mg/dl)	HDL cholesterol (mg/dl)	LDL cholesterol (mg/dl)	Triglyceride (mg/dl)
0 % *S. cerevisiae*	3.85±0.10	1.66±0.06	2.19±0.05	0.76±0.02	150.20±9.02	90.96±3.64	38.14±3.89	145.97±5.72 [a]
0.5 % *S. cerevisiae*	4.04±0.10	1.78±0.06	2.26±0.09	0.80±0.04	145.49±9.34	94.70±4.60	32.44±3.97	123.66±5.96 [b]
Sig	NS	NS	NS	NS	NS	NS	NS	*

Superscripts are read column wise for comparison of means. Means in the same column with different superscript a, b, c are significantly different ($P^{*}< 0.05$). NS, nonsignificant.

and Reddy *et al*. (2013) who reported higher antibody during finisher phase due to yeast supplementation. Morales-Lopez and Brufau (2013) suggested a benefit on feed efficiency when yeast cell wall was added to diets fed to broiler chickens challenged with *E. coli*-lipopolysaccharide which might be related to better maintenance of immune status in response to pathogenic challenge.

Significantly ($P< 0.01$) increased organ weight factor of bursa was observed in birds fed *S.cerevisiae* whereas it was nonsignificant for spleen and thymus (Table 7).

The data pertaining to serum biochemical profile is given in Table 8. Significantly decreased triglyceride level was observed in birds fed *S. cerevisiae* whereas other constituents like total protein, albumin, globulin, A/G ratio, cholesterol, HDL cholesterol and LDL cholesterol were non-significant. Current findings corroborated with Shareef and Dabbagh (2009) who reported reduce triglyceride due to supplementation of yeast. In contrast with current findings, various authors (Panda *et al*. 2000, Kannan *et al*. 2005) who stated that there was a decrease in plasma cholesterol for chicks fed diets contains yeast and different probiotics. Kalavathy *et al.* (2003), reported that dietary probiotic increases serum HDL cholesterol and consequently LDL cholesterol decreases which might be due to bile salt hydrolase synthesizing ability of probiotic, which deconjugates bile salts and the excess cholesterol is removed from blood.

Based on current experiment findings, it was concluded that the post hatch supplementation of *S.cerevisiae* can improve the FCR, dressing percentage, meat quality and decrease the serum triglyceride level of broilers.

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