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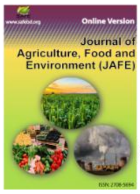

Original Article

Effect of dietary yeast and oligosaccharide on growth performances of broiler

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A B S T R A C T

This study was conducted to evaluate the effect of feeding graded levels of yeast (*Saccharomyces cerevisiae*) and oligosaccharide on broiler performance. One-day old Cobb-500 broiler chicks (n=150) were randomly allocated into five treatments. Each dietary treatment consisted of 3 replicates having 10 chicks in each replication. The dietary treatment contained no live yeast and oligosaccharide considered as control (T_0) and the other four treatments were T_1 (1g yeast and 0.5g oligosaccharide/kg feed), T_2 (2g yeast and 0.5g oligosaccharide/kg feed), T_3 (1g yeast and 1g oligosaccharide/kg feed) and T_4 (2g yeast and 1g oligosaccharide/kg feed). During the experimental periods of 4 weeks, average live weight and feed intake of the birds were recorded, and body weight gain, feed conversion ratio, survivability, flock uniformity values were calculated. Growth performance parameters were significantly ($P<0.05$) affected by experimental diets. Birds fed 1g yeast and 1g oligosaccharide/kg feed gained superior body weights compared to the control, and other dietary treatments. The mean body weight gains of different treatment groups were significantly higher ($P<0.05$) than control group. The groups fed diets containing 1g yeast and 1g oligosaccharide showed lower feed intake but better feed efficiency rate compared to the control. The inclusion of different dietary treatments had no significant ($P>0.05$) effects on survivability and flock uniformity. It is concluded that live yeast and oligosaccharide can be included in broiler diet at the rate of 1g yeast and 1g oligosaccharide/kg feed for better growth performance.

Introduction

In recent years, there has been great attention to minimize or completely avoid usage of antibiotics in animal and poultry feeding, as well as an increasing consumer concern for poultry drug resides in meat and egg. Hence, non-antibiotic alternative live probiotic, prebiotic, symbiotics and phytobiotic are being used in poultry feed to improve growth and production performance.

Feed additives were used in poultry industry for different purposes for example to increase performance and decrease of mortality rate. These additives are including antibiotics, probiotics, coccidiostats etc. (Panda *et al.,* 2009). Among these feed supplements, probiotics have drawn much great attention. *Saccharomyces cerevisiae* (SC), one of the most widely commercialized yeast and it was reported that feeding yeast to chicks improved weight gain and feed/gain ratio (Nilson *et al.*, 2004). Prebiotic usually refers to oligosaccharides which are not digested by the animal enzymes, but can selectively stimulate certain intestinal bacteria species, which have potential beneficial effects on the host health. While probiotics are meant to bring beneficial microbes to the gut, oligosaccharides are supposed to selectively stimulate the beneficial microbes that already live there (Yang *et al.*, 2007a). Prebiotic have two advantages relative to probiotics: a technological, because there are no problems with the thermal processing of the feed and the acidic conditions of the digestive system, and a safety, because there is no introduction of any foreign microbial species into the gut.

Probiotics act by competitive exclusion, lower gut pH, produce bacteriocins, of lysozyme and peroxides, and stimulate the immune system (Grashorn, 2010).

The presence of living yeast cells may also act as a reservoir for free oxygen, which could enhance growth of other anaerobes (Leeson and Summers, 2008).

Mannan oligosaccharide (MOS) is derived from the cell wall of *Saccharomyces cerevisiae*, an alternative to antibiotic growth promoters (Spring, 1999a; Spring, 1999b). It contains phosphorylated mannans, glucans and some protein intermixed. MOS have shown promising effects, such as decreasing pathogenic microflora of the gut, stimulating a strong immune response, and elevating the strength of the intestinal mucosa in studies with poultry (Spring *et al*., 2000). One of major mechanisms of actions for MOS is to act as a receptor analogue to block pathogens, which possess mannose-binding-lectin, from attaching to the gut wall (Spring *et al*., 2000). By balancing the intestinal microflora and stimulating the immune response, MOS have been shown an increase at the growth of broilers (Hooge, 2004). MOS supplementation to broiler diets improves growth performance in terms of body weight gain and feed conversion (Hooge, 2004; Rosen, 2007). Therefore, the present study was planned to investigate the efficacy of yeast (*Saccharomyces cerevisiae*) and oligosaccharide on the growth performance and flock uniformity of broiler.

Materials and methods

Experimental chicks, treatments and management

The research was carried out on littered floor for a period of four weeks at Sher-e-Bangla Agricultural University Poultry Farm, Dhaka, Bangladesh. A total of 150 day old broiler chickens (Cobb-500) obtained from a local hatchery (Kazi Farms Ltd, Dhaka, Bangladesh) were used in the current study. Average body weight per bird was 43.2g and they were kept in electric brooders equally by maintaining standard brooding protocol. At day 7, broiler chicks were randomly divided into 5 experimental group of 3 replicates each with 10 chicks per replicate. Birds were housed in 3ft x 2ft floor pens on fresh rice husk litter with a 24-h lighting plan. The height of litter was 3 cm. Before being used in the experiment, birds were adapted for 7 days in order to acclimatize in the environment. The experimental diets were prepared by supplementing the control diet with different levels of yeast *Saccharomyces cerevisiae* (Levucell- SB) at concentration of 1.0 x 10^{10} CFU/gm and oligosaccharide (Original XPC™). The control diet was pellet feed without supplementation of yeast and oligosaccharide. The experimental treatments were the followings: T_1 = 1g yeast and 0.5g oligosaccharide/kg feed, T_2 = 2g yeast and 0.5g oligosaccharide/kg feed, T_3 = 1g yeast and 1g oligosaccharide/kg feed, T_4 = 2g yeast and 1g oligosaccharide/kg feed, T_0 (control) = Normal feeding & watering without any addition of yeast and oligosaccharide.

The chicks were vaccinated with commercial Newcastle disease vaccine and Infectious bronchitis vaccine through eye drops at 4 days and 21 days. The Gumboro vaccines were given through drinking water at days 9 and 17 days of the experiment respectively. Throughout the study period, the chicks were raised in an open-sided broiler house with rice husk-littered floor pens. *Ad libitum* feeds (Table 1) and water were provided for rapid growth of broiler chicks up to the end of the four weeks. Average room temperature was 33°C at beginning and 28°C at the later stage, whereas, average humidity were recorded 65%.

The experiment was conducted according to the standard procedures of rearing and treating of farm animals approved by ethical committee of Sher-e-Bangla Agricultural University. Feed were supplied 4 times daily by following Cobb 500 Manual and *ad libitum* drinking water 2 times daily.

Collection of live yeast and oligosaccharide

Levucell SB is the probiotic live yeast *Saccharomyces cerevisiae.* Levucell SB was collected from SMC Poultry and Hatchery Ltd and Oligosaccharide (Original XPC™) was collected from EON Group Company. Nutritional composition of live yeast and oligosaccharide were presented in Table 2.

Table 1. Ingredients and nutrient composition (as-dry basis) of basal diet

Ingredients	Composition (%, unless otherwise noted)
Maize	45.5
Soybean meal (CP 46%)	17.0
Wheat flour	10.0
Bread flour	5.00
Rice bran	4.45
Crude palm oil	3.50
Corn gluten meal (CP 62%)	3.60
Distiller dried grains (CP 27%)	3.00
Meat bone meal (CP 49%)	2.80
Chicken feather meal (CP 79%)	2.00
Bone meal (CP 22%)	1.50
Lysine	0.55
Methionine	0.37
L-threonine	0.08
Salt	0.15
Premix[1]	0.50
Analysed composition	
Metabolizable energy (kcal/kg)	3,300
Dry matter	89.6
Crude protein	21.9
Crude fat	6.40
Crude fiber	5.62
Ash	6.39

[1]Mineral-vitamin premix per kg of diet: Ca 2.250 g, P 0.625 g, Fe 3.570 mg, Cu 0.640 mg, Mn 5.285 mg, Zn 0.003 mg, Co 0.001 mg, Se 0.013 mg, I 0.016 mg, vit A 375 IU, vit D 150 IU and vit E 0.080 mg

Table 2. Composition of yeast and oligosaccharide

Live yeast (Levucell SB)
Saccharomyces cerevisiae contain 1.0 x 10^{10} CFU/gm (Microencapsulated formulation for premix & concentrated formulation for premix and pelleted feed)

Oligosaccharide (Original XPC™)	
Nutrient Component	**Amount (%)**
Crude Protein (min.)	15.0
Crude Fat (min.)	1.5
Crude Fiber (max.)	25.0
Ash (max.)	9.0
Starch (min.)	5.5
Moisture (max.)	11.0

Preparation of feed with live yeast and oligosaccharide

Saccharomyces cerevisiae contains 1.0 x 10^{10} CFU/g microencapsulated formulation for premix & concentrated formulation for premix and pelleted feed. Rate of use of live yeast was 1kg/metric ton feed. Recommendation dose of oligosaccharide for broiler starter is 100-125g/100 kg feed and broiler grower 50g/100 kg feed. At first 1g live yeast and 2g live yeast was measured separately and then the yeast was mixed with feed properly according to the inclusion level in different treatment. With the help of micro-balance 0.5g oligosaccharide and 1g oligosaccharide was mixed properly with the commercial broiler feed. Mixing of live yeast and oligosaccharide was done carefully so that each of the ingredients of feed can close contact with the live yeast and oligosaccharide. After mixing the live yeast and oligosaccharide with commercial broiler feed, the recommendation level of feed allowed for 1st, 2nd, 3rd and 4th week was separated in bag for feeding.

Statistical analysis

The data was subjected to statistical analysis by applying one-way ANOVA using statistical package for social sciences (SPSS- version 16). Differences between means were tested using Duncan's multiple range test and significance was set at $P<0.05$.

Results and Discussion

Production performances of broiler chicken

Final live weight

The relative final live weight of broiler chickens in the different groups was presented in Table 3. The highest live weight was found in T_3 (1g yeast and 1g oligosaccharide) and lowest was in T_0 (Control group), that was statistically significant ($P<0.05$). Results also demonstrated that the body weights also varied among the treatment groups having statistical significance ($P<0.05$) and all the treated groups had higher live weight than control group.

Mohamed *et al.* (2015) reported that live weight at different levels of yeast was not different ($P>0.05$) from either negative or positive controls. Nevertheless, overall body weight gains increased ($P<0.05$) in birds fed on 1% dietary yeast compared with the positive control during the entire period (0 to 6 weeks of age). Bozkurt *et al.* **(**2009) also reported that mannan oligosaccharide (MOS) improved broiler live performance in both the starter and through the grower period. However, Yang *et al.* (2007b) found that supplementation of MOS to the basal diet improved the growth performance of birds compared to the negative control in the first three weeks but not in the last three weeks.

Table 3. Effects of yeast and oligosaccharide on production performances of broiler

Treatment	Final Live weight (g/bird)	Average BWG (g/bird)	Total Feed Intake (g/bird)	FCR	Survivability (%)
T_0	$1469.43^c \pm 18.29$	$1427.40^c \pm 18.26$	$2421.07^a \pm 25.99$	$1.69^a \pm 0.03$	98.33 ± 1.67
T_1	$1759.53^a \pm 16.86$	$1717.53^a \pm 16.85$	$2398.27^a \pm 3.72$	$1.39^c \pm 0.01$	100.00 ± 0.00
T_2	$1596.23^b \pm 30.06$	$1554.23^b \pm 30.06$	$2380.17^a \pm 11.91$	$1.53^b \pm 0.02$	100.00 ± 0.00
T_3	$1765.90^a \pm 4.89$	$1723.90^a \pm 4.89$	$2307.30^b \pm 3.66$	$1.33^c \pm 0.01$	100.00 ± 0.00
T_4	$1601.87^b \pm 29.83$	$1559.87^b \pm 29.83$	$2377.77^a \pm 9.29$	$1.52^b \pm 0.04$	100.00 ± 0.00
Level of significance	*	*	*	*	NS

Here, T_0 = (Control), T_1= (1g yeast and 0.5g oligosaccharide), T_2 = (2g yeast and 0.5g oligosaccharide), T_3 = (1g yeast and 1g oligosaccharide), T_4 = (2g yeast and 1g oligosaccharide). Values are Mean ± SE (n=15), one-way ANOVA (SPSS, Duncan method). *Mean with different superscripts in each column differed significantly ($P<0.05$), NS: non-significant.

Body weightgains

The mean body weight gains (g) of different treatment groups were significantly higher ($P<0.05$) than control. The average body weight gain was higher in T_3 (1g yeast and 1g oligosaccharide) group. Gao *et al.* (2008) reported that supplemental yeast, significantly ($P<0.05$) affected growth performance of broiler. However, Yang *et al.* (2007b) reported that 6% increase ($P<0.05$) in BWG were observed with birds in the high MOS group (2g/kg) compared to the negative control in the first three weeks.

Total feed intake

Total feed intake of different treated groups and control group were presented in Table 3. T_0 (control) consumed higher amount of feed (2421.07g) and T_3 (1g yeast and 1g oligosaccharide) consumed lower amount of feed (2307.30g), whereas T_1 (1g yeast and 0.5g oligosaccharide), T_2 (2g yeast and 0.5g oligosaccharide) and T_4 (2g yeast and 1g oligosaccharide) consumed 2398.27g, 2380.17g and 2377.77g feed respectively. Result in total feed intake demonstrated that treatment groups showed significant ($P<0.05$) difference.

The present study of total feed intakerevealed similar findings with the results of Shareef and Al-Dabbagh (2009) reported that dietary treatment of 1.5% and 2% live yeast had significantly higher feed intake than others ($P<0.05$). Yang *et al.* (2007b) reported non-significant effect of MOS and/or AGP addition to diets on feed intake of young broilers.

Feed conversion ratio

The result of feed conversion ratio (FCR) of broilers under different treatment groups had shown in Table 3. The better FCR was (1.33) significantly ($P<0.05$) observed in T_3 group supplemented with 1g yeast and 1g oligosaccharide than control birds (1.69). The study agreed with the results of previous researchers (Onifade *et al.*, 1999; Shareef and Al-Dabbagh, 2009; Kamran *et al.*, 2013) who observed that dietary treatment of live yeast and oligosaccharide had significantly higher in feed conversion ratio ($P<0.05$). Bozkurt *et al.* **(**2009) reported, during the 0 - 21 d period the broiler chickens fed diets supplemented with MOS had significantly better feed conversion ratios than the control group, but this pattern was not sustained during the finisher period (22 - 42 d). However, Mohamed *et al.* (2015) reported that a poorer feed conversion ratio was observed in birds fed 3% yeast and positive control compared with negative control.

Survivability

Survivability of broilers in the treatment groups were higher than control group but did not differ significantly ($P>0.05$) (Table 3). Firon and Ofek (1983) reported that mannan-oligosaccharides are thought to block the attachment of pathogenic bacteria to the animal's intestine. It is also thought to stimulate the animal's immune system, thereby further increasing the rate of survivability.

Flock uniformity

Flock uniformity of broiler chicken was higher (73.33%) in T_1 group (1g yeast and 0.5g oligosaccharide) presented in Table 4. The lower flock uniformity (63.33%) was observed in T_2group (2g yeast and 0.5g oligosaccharide). Flock uniformity of different treatment groups were statistically insignificant ($P>0.05$). Yang *et al.* (2007a) reported that diet treated MOS group birds were in a very health condition and flock uniformity was high around 90%.

Table 4. Effects of yeast and oligosaccharide on flock uniformity of broiler

Treatment	Uniformity	Level of significance
T_0	70.00±10.58	NS
T_1	73.33±3.32	NS
T_2	63.33±3.33	NS
T_3	70.00±10.0	NS
T_4	73.32±3.30	NS

Here, T_0 = (Control), T_1= (1g yeast and 0.5g oligosaccharide), T_2 = (2g yeast and 0.5g oligosaccharide), T_3 = (1g yeast and 1g oligosaccharide), $T_{4\,=}$ (2g yeast and 1g oligosaccharide). Values are Mean ± SE (n=15), one-way ANOVA (SPSS, Duncan method),NS: non-significant.

Conclusion

Analyzing the above research findings, this study concluded that the use of live yeast and oligosaccharide was best for better production performance of broiler chicken. One gram yeast and One gram oligosaccharide powder was more effective than others treatment. Hence, yeast and oligosaccharide could be decidedly used in broiler rearing for better performance.

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