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EFFECT OF SUPPLEMENTATION OF DIETARY YEAST *SACCHAROMYCES CEREVISIAE* ON PRE-SLAUGHTER WEIGHT, CARCASS WEIGHT AND INTESTINAL MICROBIAL COUNT IN JAPANESE QUAILS

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ABSTRACT

An experiment was conducted with Japanese quails to investigate the effects of supplementing yeast (*Saccharomyces cerevisiae*) on their performance. A total number of 300-day old quail chicks were distributed to three dietary treatments with four replicates per each treatment group. i.e. basal diet fed T1 (control)), basal diet supplemented with 1gm of yeast/ kg of feed (T2) and basal diet supplemented with 2 gm of yeast/ kg of feed (T3). At the end of experimental period of 35 days, slaughter weight, carcass weightand intestinal microbial count were recorded. Data were statistically analyzed using SPSS version 21. Both pre-slaughter weight and carcass weight did not show any significant differences (P<0.05) among the treatment groups. Pre-slaughter weight (gm) of T2 (212.67±16.75) and T3 (217.33 ± 11.33) were numerically higher than the control group T1 (195.00± 16.05). The carcass weight (gm) of T2 (125.83±9.04) and T3 (128.17 ± 9.04) were numerically higher than the control group T1 (123.50±8.84). Analysis of data showed significant difference (P<0.05) between T1 and other two groups (T2 and T3) for Enterobacteriaceae spp. count in ileum (T1 (4.08± 0.31), T2 (3.68± 0.22), T3 (3.53± 0.12)), colon (T1 (4.23± 0.24), T2 (3.92± 0.50), T3 (3.62± 0.13)) and ceaca (T1 (4.03± 0.24), T2 (3.70 ± 0.15), T3 (3.55± 0.05)). The results of the study showed that dietary supplementation of Saccharomyces cerevisiae @ 1g/kg feed helps to improve the pre-slaughter weight and carcass weight of the quails and to reduce the colonization of the pathogenic bacteria in intestine. Hence, the study suggests the potential use of yeast as replacement for antibiotic growth promoters in poultry feeding.

Keywords: Yeast, Antibiotic Resistance, Probiotics, Pathogenic Bacterial Count

INTRODUCTION

There is consideratble research evidence on the beneficial effects of antibiotics on livestock growth performance. Increased growth rate, improved feed efficiency and prevention of subclinical diseases are the main reasons why dietary antibiotic growth promoters (AGP) have been used in poultry production. However, the constant use of these growth promoters leads to the development of resistance in bacteria and also leaves antibiotic residues in animal products. Despite the remarkable progress in this area, concerns have been raised with regard to the safety and quality of chicken products due to the risk of transferring these antibiotic-resistant bacteria to humans *via* the food chain (Vineetha *et al.,* 2015). Increasing concerns regarding the use of in feed antibiotics as growth promoters has stimulated extensive investigation into the use of alternatives such as probiotics, prebiotics, postbiotics and feed acidifiers etc. Probiotics, prebiotics and postbiotics are promising "biotic" feed additives for improving the growth and health of birds. They function by inhibiting pathogenic bacterial adhesion, boosting innate immunity, reducing infection-induced inflammation and promoting intestinal epithelial cell survival, barrier function, and protective responses through molecular and cellular pathways.

Japanese quails have recently attracted attention in the poultry sector for being economically viable (Bolacali and Irak, 2017). The development of intensive poultry industry has made the role of feed additives in poultry diets more important. The proper use of feed additives can increase feed utilization, improve production and promote gut health. Gut health is one of the major factors governing the performance of birds and thus the economics of poultry production and the profile of intestinal microflora play an important role in gut health. Yeasts are an important source with probiotic and prebiotic activity, either live strains or derivatives of their cell walls. Yeast strains are well known in their use as probiotics belonging to the genera Saccharomyces, Kluyveromyces, Hansenula, and Candida, and within these genera, *S. boulardii, S. cerevisiae, K. fragilis, K. lactis and C. pintolopesii* are the most commonly employed probiotic species (Coenen 2000; Bovill *et al.,* 2001; Kumura *et al.,* 2004). The most prominent yeast used as a feed additive in livestock is *S. cerevisiae*. It is rich in digestible proteins, vitamins (vitamin B6, thiamin, biotin, riboflavin, nicotinic acid and pantothenic acid), magnesium and zinc (*Elghandour et al.,* 2020). The polysaccharides α D-mannan, chitin and β D-glucan are the main constituents of the *S. cerevisiae* cell wall, which have prebiotic

activity which further aids in growth of beneficial bacteria in the gut. Rodriguez *et al.,* 2000 and Baptista *et al.,* 2002 also observed that live yeast cells can be used as detoxification agents against mycotoxins and other bacterial toxins like vibrio cholera toxin. *S. cerevisiae* thus reduce severe damage to organs when exposed to toxins through diet because of their ability to bind with these toxins and reduce stress to the animal by providing vitamins, enzymes and proteins (Baptista *et al.,* 2005). The use of probioticsin the case of yeast is on account of their their bio regulatory action, which occurs by various mechanisms including microbial antagonism, suppression of pathogenic bacteria, stimulation of the animal's immune system, attachment and removal of pathogens. The immunological specificity of yeasts is determined by mannoproteins and β D-mannan (Ruiz-Herrera 1992; Li *et al.,* 2006).

The present study was undertaken to ascertain whether *S.cerevisiae* can be utilized as a potential growth promoting agent in Japanese quails. The study had the objective of investigating the comparative efficacy of two different dietary concentrations of *S.cerevisiae* in Japanese quails.

MATERIALS AND METHODS

The experiment was conducted at the Japanese quail farm unit of Avian Research Station, Kerala Veterinary and Animal Sciences University, Palakkad, Kerala using a completely randomized design. A total of 300 day-old Japanese quail chicks were randomly assigned into three treatment groups (T1 –T3) of 100 birds per group. Each group was divided into four replicates of 25 birds each. During the entire experimental duration of six weeks, treatment groups were provided with different dietary treatments (T1-basal diet (Negative control), basal diet supplemented with 1g of yeast/ kg of feed (T2) and basal diet supplemented with 2 g of yeast/ kg of feed (T3). Administration of *S. cerevisiae* (Y@ALL- Each gram containing 2 billion CFU of *S. cerevisiae* marketed by Alembic pharmaceuticals Ltd, India) was done throughout the experimental period. Birds were reared in the cage system under standard uniform management conditions. Birds were fed a standard corn-soybean meal-based diet meeting the requirements for macro and micronutrients (NRC, 1994) (Table 1). At the end of experimental period of 35 days, slaughter weight, carcass weight and intestinal microbial count were recorded.

At fifth week of age, a total of eight birds per dietary group were randomly selected (2 birds from each replicate) and body weight was recorded. The birds

were starved for 12 hours with access to water and then humanely slaughtered. After defeathering, feet and shanks were removed at the tibio-tarsus joint and the head at the atlanto-occipital articulation. The viscera were removed as usual dressing of poultry carcasses. The parameters, *viz.* pre-slaughter weight (g), carcass weight without giblet weight (g) were recorded.

Mucosal scrapings from gastro-intestinal tract (GIT) were collected separately from ileum, colon and caeca of eight quails per treatment group (2 birds from each replicate) at the end of experiment for bacterial enumeration *i.e., Enterobacteriaceae* count. GIT contents were diluted two and three-fold with normal saline and vortexed for 2 minutes; 100 microliters of supernatant were smeared onto MacConkey agar media in duplicate plates and incubated for 24 hours at 37°C. After incubation period, bacterial counts were recorded as colony forming units, CFU/mL.

The data collected from *in-vivo* experiments for the supplemental effects of treatment diets were statistically analysed ($P < 0.05$) for intergroup differences by one-way ANOVA using SPSS version 21 and then the Duncan's multiple-range test was used to separate the means.

RESULTS AND DISCUSSION

The results of parameters such as pre-

Table 1. Ingredients and chemical composition of basal diet (kg/100kg feed)

Ingredients	Quantity (kg)
Maize	52
Deoiled rice bran	5
Soyabean meal	38
Calcite	0.45
Dicalcium phosphate	1.8
Dried fish	1.5
Methionine	0.13
Salt	0.4
Trace mineral	0.1
Supplevit premix	0.025
Coccidiostat	0.05
Choline chloride	0.05
Liver protectant	0.05
Toxin binder	0.1
Shell grit	0.4
Calculated chemical composition of basal diet	
CP%	23.16
ME (kcal/Kg diet)	2816.66
Calcium %	2.07
Available P %	0.49
Lysine %	1.24
Methionine %	0.49

a) Composition of trace minerals includes $FeSO_4$ 30 mg/kg of diet, $ZnSO_4$ 52 mg/kg diet $CuSO_4$ 4 mg/kg diet, $MnSO_4$ 54 mg/kg diet and KI 1.0 mg/kg diet.

b) Composition of Supplevite premix includes Vitamin B12 20.5 mcg/kg of diet, Vitamin B6 1.6 mg/kg of diet, Vitamin A 10000 IU/ kg diet, Vitamin B1 0.8 mg/kg of diet, folic acid 0.8 mg/kg of diet, Niacin 12 mg/kg of diet, Vitamin B2 5 mg/kg of diet, Vitamin D3 20000 IU kg diet, Vitamin E 5 mg/kg of diet and Vitamin K 1 mg/kg of diet.)

Table 2. Carcass traits in Japanese quails fed on different dietary treatments

Treatments	Pre-slaughter weight (g) (Mean ± SD*)	Carcass weight (g) (Mean ± SD)
T1(control)	195.00 ± 16.05	123.50 ± 8.84
T2	212.67 ± 16.75	125.83 ± 9.04
T3	217.33 ± 11.33	128.17 ± 9.04

*SD = standard deviation (n = 8 birds for each treatment)

slaughter weight and dressing yield are represented in Table 2. Both pre-slaughter weight and carcass weight of treatment groups did not show any significant difference. Pre-slaughter weight (g) of T2 (212.67 ± 16.75) and T3 (217.33 ± 11.33) were numerically higher than the control group T1 (195.00 ± 16.05) and the carcass weight of T2 (125.83 ± 9.04), T3 (128.17 ± 9.04) and the control group T1 (123.50 ± 8.84) were comparable with each other.

There was no significant improvement in body weight on supplementation with yeast in the study which is supported by the findings of Yalcin *et. al.*, (2000) who found no significant difference in terms of live body weight in quails of different treatment groups fed with probiotics. In contrast to this, Sharif *et al*., (2018) and Devarasetti *et al*., (2016) found significant improvement in weight gain in birds fed diet with yeast supplementation. The results of dietary yeast supplementation on carcass weight studied in the present study are in line with Ahmed *et al.,* (2015) who found that dietary yeast diet not have any significant effect on hot and cold carcass percentages. On the other hand, some authors have found significant improvements in carcass yield of broiler chicks on dietary yeast culture supplementation (Fathi *et al.,* 2012; Onwurah and Okejim, 2014).

The least squares analysis of variance for log10 CFU/g of *Enterobacteriaceae* spp. in ileum, caeca and colon of quails fed with different dietary treatments is presented in Table 3. Analysis of data showed significant difference ($P<0.05$) between T1 and other two groups (T2 and T3) for *Enterobacteriaceae* spp. count in ileum (T1(4.08 ± 0.31), T2 (3.68 ± 0.22), T3 (3.53 ± 0.12)), ceaca (T1 (4.03 ± 0.24), T2 (3.70 ± 0.15), T3 (3.55 ± 0.05)) and colon (T1 (4.23± 0.24), T2 (3.92 ± 0.50), T3 (3.62 ± 0.13)). A higher *Enterobacteriaceae* spp. count was observed in all parts of intestinal tract of birds fed with basal diet.

The gastrointestinal tract is particularly responsive to various stressors, which can cause a variety of changes including alteration of the normal protective

Table 3. Mean $\log_{10}$ value of *Enterobacteriaceae* spp. isolated from intestine of birds

	Ileum (Mean ± SD*)	Caeca (Mean ± SD)	Colon (Mean ± SD)
T1(control)	4.08 [a] ± 0.31	4.03 [a] ± 0.24	4.23 [a] ± 0.24
T2	3.68 [b] ± 0.22	3.70 [b] ± 0.15	3.92 [b] ± 0.50
T3	3.53 [b] ± 0.12	3.55 [b] ± 0.05	3.62 [b] ± 0.13

[a,b]Mean with different superscripts within column differ significantly ($p \leq 0.05$)
*SD = standard deviation (n = 8 birds for each treatment)

microflora and decrease the intestinal epithelial integrity. The stabilization of balanced intestinal microflora plays a major role in improving intestinal health and functions (Vineetha *et al.,* 2018). Yeast cell wall extracts such as yeast α-mannans and β-glucans have been reported to increase growth performance, modify intestinal microbiota in broilers (Cox *et al.,* 2010). Yeast (*S. cerevisiae*) prebiotic additives have also been reported to control bacterial diseases by serving as a decoy or attachment site for some pathogenic microorganisms (Fanelli *et al.,* 2015; Ahiwe *et al.,* 2019). Bortoluzzi *et al.,* (2018) found that the supplementation of 0.4 per cent *S. cerevisiae* reduced the colonization of Enterococcus in the ileum of chicken.

The present study supports various research reports stating that *S. cerevisiae*, when used as probiotic (live yeast), or as prebiotic (autolyzed yeast and its components) could serve as a growth enhancer in Japanese quails through ensuring improved gut health; reducing the growth of many pathogenic intestinal bacteria, decreasing the intestinal colonization and infections.

CONCLUSION

The results of the present study showed that yeast supplementation has beneficial effect on the growth in broiler quails. The antagonistic activity of yeast against pathogenic micro-organisms *Enterobacteriaceae* spp. suggests that the isolate can be used as a promising alternative for antibiotic growth promoters, which in turn may reduce the presence of antibiotic residues in human food chain.

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