Full Length Research Article
Advancements in Life Sciences – International Quarterly Journal of Biological Sciences

ARTICLE INFO

Date Received: 21/10/2018;
Date Revised: 17/05/2019;
Date Published Online: 25/08/2019;

Authors' Affiliation:
1. University of Agriculture, Peshawar, Pakistan
2. Poultry Research Institute, Rawalpindi, Pakistan
3. Pir Mehr Ali Shah Arid Agriculture University Rawalpindi, Pakistan

***Corresponding Author:**
Sohail Hassan Khan
Email:
sohailhassan64@gmail.com

How to Cite:
Hameed R, Tahir M, Khan SH, Ahmad T, Iqbal J (2019). Effect of yeast supplementation on production parameters, egg quality characteristics and crude protein digestibility in hens. Adv. Life Sci. 6(4): 147-151.

Keywords:
Baker's yeast; feed intake; egg production; egg quality

Open Access

Effect of yeast supplementation on production parameters, egg quality characteristics and crude protein digestibility in hens

Rohban Hameed[1], Muhammad Tahir[1], Sohail Hassan Khan*[,2], Tanveer Ahmad[3], Javid Iqbal[3]

Abstract

Background: Yeast (*Saccharomyces cerevisiae*) has a buffering effect in the digestive tract, and proper feed additives in chicken diets can improve the birds' digestive efficiency. The present study planned with aim to investigate the effects of different levels of yeast supplementation on the egg production, egg quality traits and crude protein digestibility in hens.

Methods: A total of 84 hens (40 weeks of age) were fed the dietary treatments until 50 weeks of age. The hens were distributed into 4 treatments and 3 replicates with 7 hens per experimental unit. The yeast was incorporated into basal feed with various levels (0, 0.1, 0.15 and 0.2%). The production data was obtained during trial. For determining egg quality characteristics, 30 eggs from each treatment group were used at 14-day interval of the experiment from a 2-day collection of eggs during the week. The excreta from each replicate were collected after every 2 weeks for determining the crude protein digestibility.

Results: Maximum egg production and egg mass were attained from the hens provided 0.15% and 0.20% yeast supplementation. The eggshell thickness decreased with supplementation of yeast. Higher yolk weight, albumen weight, Haugh unit and grading values were observed at 0.2% level than other groups. Crude protein digestibility also improved at high levels of yeast supplementation at all ages.

Conclusion: This study envisaged that yeast supplementation between 0.15 and 0.20% could be sufficient during 40 to 50 weeks of age, to augment the overall layer performance.

Introduction

Feed additives, as distinct materials, have long been supplemented into poultry feed to enhance the consumption of diets with the amount and worth of poultry products [1]. Feed additives increase the availability of feed by improving feed efficiency; subsequently result in increased yield [2].

Feasible yeast foodstuffs are normally included into poultry diets as probiotic. The feed additive comprised of *Saccharomyces cerevisiae* has biologically valuable proteins, vitamin B-complex, mannan oligosaccharide, important trace minerals and several unidentified growths promoting factors [3]. Baker's yeast contains digestible proteins especially in the form of free amino acids and peptides, functional nucleic acids, vitamin B and natural immune enhancer such as β-glucan and Mannan oligosaccharides [4]. *S. cerevisiae* is recognized to augment the biological value of nitrogenous compound in the alimentary canal resulting in minimize the strain-generating factor in birds. The yeast mass too assists digestion by elevating the accessibility of nutrients [5].

Results of different experiments on the influence of addition of yeast (*S. cerevisiae*) to layer diets have been inconsistent. Some studies reported that addition of yeast to diets resulted with better feed efficiency [6, 7], increased egg weight [1, 8], increased egg production [9] and improved egg shell quality [10] in layers. On the contrary, some trials [11, 12, 13] reported there was no influence of yeast on dietary intake, egg yield, egg size as well as feed efficiency in layers. The results of above experiments depicted some disagreement on the useful impact of addition of yeast in layer feed. Thus, current trial was planned with aim to investigate the influence of various percentage of GroPro (*Saccharomyces cerevisiae*) supplementation in feed on the egg yield, egg value traits as well as crude protein (CP) digestibility in hens.

Methods

This experiment was carried out at commercial layer farm situated in Hassan Abdal district Attack, Pakistan. The laboratory facilitates existed at the PMAS Arid Agriculture University Rawalpindi, Pakistan and Poultry Research Institute Rawalpindi, Pakistan were utilized.

Birds, management and diets

A total of 84 laying hens (Novogen white light) at 40 weeks old was selected and provided the experimental diets till 50 weeks old. These experimental birds were divided following a completely randomized design into 4 treatments and 3 replicates (A-type commercial cage) with 7 birds per experimental unit. These birds were offered a standard feed holding 16% crude protein and 2750 kcal/kg metabolizable energy (Table 1). The baker's yeast (GroPro) was incorporated into basal feed with various percentages (0, 0.1, 0.15and 0.2%). The water and feed were provided *ad libitum*. The lighting program followed as suggested by the Novogen instruction booklet. The highest and lowest mean temperatures noted throughout the study duration were 21.94 ± 2.90°C and 21.71 ± 2.91°C, respectively. The experimental trial lasts for 10 weeks.

Item	Composition
Ingredients	
Corn	64.5
Soybean meal	15
Sunflower meal	7.8
Meat & bone meal	3.0
DL-Methionine	0.05
Lime stone	8.2
Di-calcium phosphate	1.0
Salt	0.2
Vitamin & mineral premix*	0.25
Calculated nutrient level	
Metabolizable energy (Kcal/kg)	2753
Crude protein	16.0
Calcium	3.45
Phosphorus	0.62

*Provides per kg: 15,372.00 mg vitamin A; 6.28 mg vitamin E; 0.64 mg vitamin K3; 27.36 mg Mn; 89 mg Fe; 25 mg Zn; 8.76 mg Cu; 0.03 mg Co; 0.05 mg I; 0.91 mg Se.

Table 1: Composition (%) and nutrient level of basal diet

Production performance

The production data [Egg yield on daily basis, egg size, egg mass, feed intake (FI) and feed efficiency (g feed: g egg mass)] were noted throughout study period. Egg yield was noted daily at similar moment and was calculated on a hen-day basis as follows: total number of eggs collected divided by total number of live hens per day in each group. Records of the FI were taken on biweekly basis. Egg mass was calculated as a factor of egg weight and hen-day egg production. Feed efficiency was calculated as the ratio of grams of feed to grams of egg mass.

Egg quality characteristics

To determine egg quality characteristics (shell thickness, yolk weight, Haugh unit, albumen weight and grading of eggs), 40 eggs from each treatment group (10 eggs/replicate) were used at 14-day interval of the experiment from a 2-day collection of eggs during the week. Eggs were stored 2-day biweekly to measure egg weight. Shell thickness was determined biweekly on the same eggs from each treatment group (without the shell membranes): the measure was carried out with a digital caliper with a sensitivity of 0.001 mm at three points of the egg shell (air cell, equator and sharp end). The egg size, Haugh unit and grading of egg were measured automatically by Egg Analyzer TM manufactured by Orka Food Technology Limited at feed testing laboratory, Poultry Research Institute, Rawalpindi, Pakistan.

Determination of crude protein digestibility

For estimation of CP digestibility, total faeces collection method was used. The excreta from each replicate were collected after every 2 weeks. The faeces tray was cleaned and known amount of feed was offered. The total faeces (free of feathers and waste feed) were collected for 24 hours and weighed. A sample of 10% of the excreta was frozen until the further analysis. The samples of faecal were dried in hot air oven at 55°C till a stable weight was attained and then ground for the estimation of CP by the micro-Kjeldahl procedure [14].

Statistical analysis

The data was analyzed with the help of SPSS version 16, statistical analysis program. P-value (<0.05) was believed for significant differences among treatments and the comparison of means was made by applying Duncan's Multiple Range Test [15].

Results

Production performance

The supplementation of yeast in the layers feed did not considerably influence on FI, feed efficiency and egg size (Table 2). However, the highest (p< 0.05) egg production and egg mass was obtained from the groups fed 0.15% (87.18% and 51.79, respectively) and 0.20% yeast supplementation (88.60% and 52.91, respectively), while control and 0.1% groups had an average egg production (83.20 and 83.98%, respectively) and egg mass (49.80 and 49.88, respectively).

Item	Yeast level (%)				
	Control	0.10	0.15	0.20	P-value
Feed intake (g/hen/day)	79.72 ±7.97	78.3 ±9.06	82.27 ±6.7	83.61 ±5.3	0.21
Egg yield (hen-day basis (%)	83.20±7.94^{b}	83.9±6.9^{b}	87.1±6.8^{a}	88.6±6.9^{a}	0.02
Egg size/weight (g)	59.85±0.67	59.40±0.45	59.41±0.4	59.7±0.6	0.80
Egg mass (g/hen/d)*	49.80±0.68^{b}	49.88±0.6^{b}	51.79±0.58^{a}	52.9±0.6^{a}	0.01
Feed efficiency (g feed: g egg mass)	1.60±0.04	1.57±0.10	1.59±0.08	1.58±0.05	0.21

$^{a–b}$ Means within rows without common superscripts are significantly different (P < 0.05). *Egg mass= (egg production x egg weight)/100.

Table 2: The effect of yeast supplementation on the performance of laying hen from 40 to 50 week of age

Egg quality traits

The greatest (p<0.01) eggshell thickness was obtained from hens provided the feed without yeast additive and it decreased (p<0.01) with supplementation of yeast (Table 3). Higher (P<0.01) yolk weight, albumen weight and Haugh unit values were recorded at 0.2% level as compared to control and other levels containing 0.1 and 0.15% of the yeast additive did not differ (Table 3). Eggs grading was enhanced at the maximum concentrations (0.15 or 0.20%) of yeast supplementation.

Item	Yeast level (%)				
	Control	0.10	0.15	0.20	P-value
Shell thickness (mm)	0.59±0.10^{a}	0.48 ±0.04^{b}	0.43 ±0.04^{c}	0.4±0.03^{c}	0.01
Yolk weight (g)	15.43±0.64^{c}	15.53±0.30^{c}	16.34±0.67^{b}	16.46 ±0.24^{a}	0.02
Albumen weight (g)	32.27 ±1.30^{b}	33.57 ±1.44^{b}	34.08±1.33^{b}	35.58 ±1.20^{a}	0.02
Haugh unit	79.86±0.30^{b}	79.71±0.31^{b}	80.49±0.37^{ab}	81.1±0.29^{a}	0.02
Egg grading	A	A	AA	AA	

$^{a–c}$ Means within rows without common superscripts are significantly different (P < 0.05).

Table 3: The effect of yeast supplementation on the egg quality of laying hen from 40 to 50 week of age

Crude protein digestibility

The results showed that CP digestibility improved (p<0.02) at high levels (0.15 or 0.20%) of yeast supplementation in layer diet at all ages (Table 4).

Age (week)	Yeast level (%)				
	Control	0.10	0.15	0.20	P-value
41-43	68.55 ±0.67^{c}	69.11±0.48^{c}	70.96±0.48^{b}	71.87±0.57^{a}	0.02
44-46	65.18 ±0.24^{c}	64.36±0.58^{d}	67.13±0.34^{b}	68.89±0.33^{a}	0.02
47-50	68.19 ±0.64^{c}	66.81±0.66^{d}	70.22±0.53^{b}	71.72±0.77^{a}	0.02
Overall (40-50)	67.13 ±1.72^{b}	66.75±2.26^{b}	69.28±1.88^{a}	70.65±1.56^{a}	0.02

$^{a–d}$ Means within rows without common superscripts are significantly different (P < 0.05).

Table 4: The effect of yeast supplementation on the digestibility of crude protein of laying hen from 40 to 50 week of age.

Discussion

The current findings showed that diet supplemented with high levels (0.15 or 0.20%) of baker's yeast improved ($p<0.02$) the egg production and egg mass as compared to low level (0.10%) and control groups. These results are supported by researchers [16], who found that supplementation with 0.005% of yeast enhanced egg yield. According to one study [17], the use of mannan-oligosaccharides (derived from the outer cell wall of *S. cerevisiae*) at 0.10% level led to increased egg production of the laying hens, whereas, egg production was not increased at this level in the present study. Recently, scientists [9] reported that egg production and egg mass were higher at 0.045% yeast level than the other levels (0, 0.023 and 0.900%). The enhancement in egg yield in hens might be elucidated so as to the yeast decrease the load of pathogenic bacteria in the alimentary canal, and subsequently the nutrients in the feed are accurately diverted toward yield in hens offered yeast, which might improve egg yield in hens [18].

Average daily FI was not influenced by nutritional treatments in this study. These results are agreed with findings of different studies that inclusion of yeast did not show any influence on FI of hens [12, 13, 17] and quails [19]. Though, recently researchers [1] found that inclusion of yeast to the feed with 0.2% caused diminish FI in layers. Addition of yeast (*S. cerevisiae*: 0.09-0.1%) to diets of Japanese quail [20] and laying hens [9] considerably improved FI than that of control group.

Non-significant difference was found in feed efficiency among all treatments in the current study. Similar findings were reported by other scientists, who observed that addition of yeast did not influence on feed efficiency of layers [11, 12, 16], broiler breeders [21], turkeys [22] and quail [20]. In contrast of above studies, some studies indicated that feed efficiency was enhanced by inclusion of yeast into feed of layers [6, 7] and broilers [23]. It may be assumed that enhancement in feed efficiency in layers might somewhat be recognized to establish beneficial bacteria in an intestine which advantaged to get better nutrient preservation [6].

There were non-significant differences in egg size among all groups in this study. Similar findings were reported by researchers [9, 13], who found that yeast supplementation (from 0.02 to 0.40%) to diets of laying hens did not effect on egg weight. In contrast of above results, some studies showed that maximum egg size obtained in layers provided 0.1and 0.2% yeast [1, 8].

The maximum thickness of egg shell was obtained in layers offered the feed without yeast supplementation. Egg shell thickness is negatively affected by various concentration of yeast. As the levels of baker's yeast increases a significant decrease was found in egg shell thickness. These results were similar to findings of researchers [9], who found higher eggshell thicknesses values were noted in control diet. However, some studies [12, 13] found that supplementation of yeast did not effect on eggshell thickness.

The internal egg characteristics (yolk weight, albumen weight and Haugh unit) were improved at high level of yeast supplementation in layer diet. Similar results obtained from previous studies [24, 25, 26] indicated an improvement in weight of egg yolk through inclusion of yeast in layer's diet. Current findings are also compatible with results of workers [1], who reported that the greatest Haugh unit was recorded in the 0.2% yeast additive. Eggs that display values superior than 72 Haugh unit are regarded as excellent quality, values within 60 to 72 Haugh unit are high quality, and values lesser than 60 Haugh unit are low quality [27]. Thus, the eggs obtained from all groups showed excellent quality in this study.

Crude protein digestibility was increased by mounting yeast concentrations. Maximum CP digestibility was noted in hens provided 0.2% yeast and minimum in hens offered control feed. The increase in CP digestibility by enhancing the yeast contents in feed explained the advantage of the yeast diets over without yeast diet. However, recent study [28] showed that CP digestibility decreased at 3% yeast diet in quail. This difference possibly owing to higher contents of yeast added in quail diet than layer diet in the present study.

The baker's yeast supplementation between 0.15 to 0.20% enhanced egg production and feed intake. Supplementation of baker's yeast at different high levels significantly improved the egg quality parameters and crude protein digestibility. Generally, the best effect was found at highest level of baker's yeast supplementation.

Conflict of Interest Statement

The authors declare that there is no conflict of interest regarding the publication of this paper.

References

1. Özsoy B, Karadağoğlu O, Yakan Önk K, Çelik E, *et al.* The role of yeast culture (*S. cerevisiae*) on performance, egg yolk fatty acid composition, and fecal microflora of laying hens. Brazilian Journal of Animal Science, (2018); 7: e20170159.
2. Krasowska A, Kubik A, Prescha A, Lukaszewicz A. Assimilation of omega 3 and omega 6 fatty acids and removing of cholesterol from environment by *S. cerevisiae* and *S. boulardii* strains. Journal of Biotechnology, (2007); 131: 63-64 (Abstr).
3. Van Leeuen GI, Savien LS, Aydies MK, Turkan S. Effect of *Saccharomyces cerevisiae* as a feed source. Animal Feed Science and Technology, (2005); 42 (7): 212-217.
4. Mohamed EA, Talha E, Abbas E, Mojahid A. Effect of dietary yeast (*S. cerevisiae*) supplementation on performance, carcass characteristics and some metabolic responses of broilers, Animal and Veterinary Sciences, (2015); Special Issue: Poultry Welfare: Housing Systems and Feeding:15-10.
5. Stanley VG, Ojo R, Woldesenbet S, Hutchinson DH, Kubena L. The use of *S. cerevisiae* to suppress the effects of aflatoxicosis in broiler chicks. Poultry Science, (1993); 72(10): 1867-1872.
6. Liu Z, Qi G, Yoon I. Effect of yeast culture on production parameters and intestinal microflora in laying hens. Page 89 in Poultry Science Association 91st Annual Meeting Abstracts. August 11-14, (2002). Newark, DE. Abstract No: 381.
7. Tangendjaja B, Yoon I. Effect of yeast culture on egg production and mortality in layer chickens. Page 89 in Poultry Science Association 91st Annual Meeting Abstracts. August 11-14, (2002). Newark, DE. Abstract No: 380.
8. Yalçin S, Özsoy B, Erol H, Yalçin S. Yeast culture supplementation to laying hen diets containing soybean meal or sunflower seed meal and its effect on performance, egg quality traits and blood chemistry. Journal of Applied Poultry Research, (2008); 17(2): 229-236.
9. Koiyama NTG, Utimi NBP, Santos BRL, Bonato MA, Barbalho R, *et al.* Effect of yeast cell wall supplementation in laying hen feed on economic viability, egg production and egg quality. Journal of Applied Poultry Research, (2017); 0:1-8.
10. Bozkurt M, Tokus¸og˘lu O¨, Ku¨c¸u¨kyılmaz K, *et al.* Effects of dietary mannan oligosaccharide and herbal essential oil blend supplementation on performance and oxidative stability of eggs and liver in laying hens. Italian Journal of Animal Science, (2012); 11: 223-229.
11. Nursoy H, Kaplan O, Og˘uz MN, Yılmaz O. Effects of varying levels of live yeast culture on yield and some parameters in laying hen diets. Indian Veterinary Journal, (2004); 81: 59-62.
12. Sacakli P, Ergun A, Koksal BH, Ozsoy B, Cantekin Z. Effects of inactivated brewer's yeast (*S. cereviciae*) on egg production, serum antibody titers and cholesterol levels in laying hens. Veterinarija ir Zootechnika, (2013); 61(83): 55-60.
13. Yalçin S, Yalçin S, Onbaşilar I, Eser H, Özsoy B, *et al.* Effects of dietary yeast cell wall on performance, egg quality and humoral immune response in laying hens. Ankara *Üniversitesi* Veteriner Fakültesi Dergisi, (2014); 61: 289-294.
14. AOAC. Official methods of analytical chemist (18thed.). Gaithersburg, MD: Association of Official Analytical Chemists, (2011): 69-88.
15. Steel RGD, Torrie JH. Principles and Procedures of Statistics, Inten. Student Ed., McGraw Hill, Tokyo, Japan, (1984): 207-208.
16. Gurbuz E, Balevi T, Kurtoglu V, Oznurlu Y. Use of yeast cell walls and *Yucca schidigera* extract in layer hen's diet. Italian Journal of Animal Science, (2011);10:134-138.
17. Cabuk M, Bozkurt M, Alcicek A, Atli AUC, Baser KHC. Effect of a dietary essential oil mixture on performance of laying hens in the summer season. South African Journal of Animal Science, (2006); 36: 215-221.
18. Shashidhara RG, Devegowda G. Effect of dietary mannan oligosaccharide on broiler breeder production traits and immunity. Poultry Science, (2003); 82: 1319-1325.
19. Yıldız AO, Parlat SS, Yıldırım I. Effect of dietary addition of live yeast (*S. cerevisiae*) on some performance parameters of adult Japanese quail (*Coturnix coturnix Japonica*) induced by aflatoxicosis. Revue de médecine vétérinaire, (2004); 155:38-41.
20. Parlat SS, Zcan MO, Oguz H. Biological suppression of aflatoxicosis in Japanese quail (*Coturnix coturnix Japonica*) by dietary addition of yeast (*S. cerevisiae*). Research in Veterinary Science, (2001); 71: 207-211.
21. Brake J. Lack of effect of a live yeast culture on broiler breeder and progeny performance. Poultry Science, (1991);70: 1037-1039.
22. Savage TF, Nakaue HS, Holmes ZA. Effects of feeding live yeast culture on market turkey performance and cooked meat characteristics. Nutrition Reports International, (1985); 31: 695-703.
23. Onifade AA, Odunsi AA, Babatunde GM, Olorede BR, *et al.* Comparison of the supplemental effects of *S. cerevisiae* and antibiotics in low-protein and high-fibre diets fed to broiler chickens. Archives of Animal Nutrition, (1999); 52: 29-39.
24. Asli MM, Hosseini SA, Lotfollahian H, Shariatmadari F. Effect of probiotics, yeast, vitamin E and vitamin C supplements on performance and immune response of laying hen during high environmental temperature. International Journal of Poultry Science, (2007); 6(12): 895-900.
25. Yousefi M, Karkoodi K. Effect of probiotic Thepax® and *Saccharomyces cerevisiae* supplementation on performance and egg quality of laying hens. International Journal of Poultry Science, (2007); 6: 52-54.
26. Zhong S, Liu H, Zhang H, Han T, Jia H, *et al.* Effects of *Kluyveromyces marxianus* isolated from Tibetan mushrooms on the plasma lipids, egg cholesterol level, egg quality and ıntestinal health of laying hens. Revista Brasileira de Ciência Avícola, (2016); 18: 261-268.
27. USDA Egg-Grading Manual. Agricultural Handbook Number 75. USDA Agricultural Marketing Service, Washington, DC, (2000); 56p.
28. Sharif M, Shoaib M, Aziz Ur Rahman M, Ahmad F, Shahid Ur Rehman. Effect of distillery yeast sludge on growth performance, nutrient digestibility and slaughter parameters in Japanese quails. Scientific Reports, (2018); 8: 8418.