EFFECT OF SUPPLEMENTING ACTIVE DRIED YEAST INTO LAYING JAPANESE QUAIL DIETS ON PERFORMANCE HATCHING TRAITS AND IMMUNE RESPONSE

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SUMMARY

The current study was conducted to evaluate the effect of adding active dried yeast into diets of laying quail on productive performance; immune response and intestinal wall thickness. For this purpose a total of 300 laying Japanese quail and 100 males were divided into five treated groups of 60 females and 20 males each. For eight weeks experimental period the groups were fed on basal diet supplemented with five graded levels of active dried yeast (Saccharomyces Cerevisiae) as 0.0% (control), 0.5%, 1%, 1.5% and 2%. The results showed that average egg production significantly increased due to adding 1% or 1.5% yeast into diets. Egg weight improved significantly and the most improvement was recorded at 1.5% yeast level. Eggshell percentage significantly improved due to treatments. Egg yolk and egg albumen was not influenced. Feed intake was not affected while feed efficiency ratios were enhanced due to adding yeast by 1% and 1.5% level recording 3.45and 3.39 g feed/g gain respectively against 3.75 g feed /g gain for control. There was no effect on body weight gain. Hatchability improved from 66% (control) to 76.3, 72.1 and 74.6 for 0.5, 1 and 1.5% yeast levels respectively. Similar improvement was recorded for infertile egg percentage. Embryonic mortality was not affected by treatments. Ovary weight significantly increased while oviduct weight was not affected. There were a reduction in intestinal wall thickness due to adding 0.5%,1% and 1.5% yeast levels to the diets , however the level of 2% yeast have an adverse effect on intestinal wall thickness. The count of WBCs and values of HI titre against sheep RBCs increased significantly due to adding yeast which may be led to enhancement of immune response of laying quail. Blood level of FSH hormone increased significantly while LH hormone was not affected. It can be concluded that, supplementation of live yeast into laying quail diets may be useful up to the level of 1.5%.

***Key words**: yeast, quail, immune response, productive performance.*

INTRODUCTION

The use of antibiotics as feed additives has been prohibited. This resulted in more intensive researches on finding substitutes.

Recently, active live yeast has been successfully examined as satisfactory alternative to antibiotics feed additives, due to its antagonistic effect against harmful pathologenic bacteria (Line *et. al.* 1998; Wakwak, *et. al* 2003). Furthermore live yeast is effective in counteracting aflatoxin or reducing aflatoxicosis in the small intestine (Stanley et al 1993) beside improving the

immune response of poultry (Santin *et al* 2003)..

Addition of yeast to laying diets showed contradictive results. Park *et al* (2002), Kim et al (2002) and Soliman (2003) stated that, including live yeast to laying diets improved egg production and laying performance. Contrary to these findings the results obtained by Brake (1991); Onol (2003) and Nursoy (2004) did not show any improvement in egg production or laying performance due to adding live yeast to the diets.

Research on the effect of feeding dietary yeast on fertility and hatchability is rather limited especially concerning laying quails Yildirm and Parlat (2003) showed that, hatchability fertility and embryonic mortality improved due to adding yeast into laying quail diets. However, Brake (1991) did not record any enhancement in hatching traits of broiler breeder hens, which were fed on yeast-supplemented diets.

The objective of the present study is to determine whether live yeast has an effect on laying performance, fertility and hatchability of Japanese quail under Egyptian conditions. The effect on feeding performance, immune response, some blood constituents and intestinal wall thickness has also been studied

MATERIALS AND METHODS

This study was carried out at Biological Application Department of Egyptian Atomic Energy Authority, Inshas. The study was conducted using three hundred laying Japanese quails at seven weeks of age. The birds were divided into five experimental groups of 60 birds each. Each experimental group was housed in two battery cages with 30 laying birds per cage and represented as replicate groups. With adding ten male quails at 7 weeks of age for studying the fertility and hatchability traits. For eight weeks experimental period the birds were fed on a basal diet (Table1) supplemented with five graded levels of active dried yeast (Saccharomyces cerevisiae, produced by Starch, Yeast and Cleaner Co. Alex). The yeast levels were 0 %(control), 0.5%, 1.0%, 1.5% and 2%. The basal diet was formulated to meet all nutrient requirements of laying Japanese quail according to N.R.C (1994). The birds were kept under the same environmental conditions of light and temperature, feed and water were provided ad lib.

Experimental Measurements:

Feed consumption in grams was recorded weekly for each replicate and treatment group. Average feed consumption / bird / day was calculated. Feed consumption of males within each replicate group was estimated and discarded to calculate feed efficiency ratio, which was calculated as gram feed, consumed per gram egg produced (g feed/ g egg). Egg number and individual egg weight were recorded daily, and then the average egg weight and egg production percentage was calculated. Egg components percentages were assessed by using 40 eggs per treatment representing the two replicate groups. The tested eggs were collected on two consecutive days (10 eggs / replicate / day). The eggs were weighed individually, broken, yolk and albumen was separated, weighed and their percentages to the whole egg weight were calculated. Eggshell with membranes were cleaned, dried, weighed and related as percentage to the whole egg weight. Hatchability determination was done five times through the experiment using 30 eggs per replicate group (60/ treatment). The selected eggs were incubated at standard condition for 17 days. Hatchability rate, embryonic mortality and infertile eggs were calculated for the five times and the average was taken. Initial and final body

weights of the experimental birds were recorded and average body weight gain was calculated.

Slaughter studies and samples collection:

At the end of the experiment 4 birds of each replicate group (8birds /treatment) were slaughtered, allowed to bleed, defeathered, eviscerated and internal organs were separated. Liver, spleen, ovary and oviduct weights were recorded. Intestinal wall thickness was determined according to the procedure described by Stutz *et al.*, (1983) and calculated as small intestine weight (g) / small intestine length (cm).

Chemical analysis and blood parameters:

After slaughter, blood samples were analyzed for hematological parameters (RBCs, WBCs, Hb and PCV %) using PHAI (programmable hematology analyzer).

For chemical analysis of blood constituents, blood samples were centrifuged (4000 rpm/ minute). Plasma total protein was determined according to Biuret method (Henery 1964), albumin according to Doumas *et al* (1971). Plasma globulin was calculated by subtracting albumins from total protein. Immune response was determined by Haemagglutination inhibition test (Wegman and Smithies 1966) against sheep red blood cells (SRBC,s) and antibody titre (log2) was estimated

LH and FSH concentrations in plasma were determined by radio immunoassay using the Coat-A-count kit [Diagnosis products cooperation (DPC) 5700 west 90th street Los Angeles C A 9004]

Statistical analysis:

Statistical analysis was computerized by statistical program SAS (1988). Duncan, s multiple range test was used to separate means

RESULTS AND DISCUSSION

Laying performance:

Egg production percentages of laying quails fed 1% or 1.5% live yeast were significantly higher than the control group (Table 2). Average egg weight improved significantly due to supplementing various yeast levels into diets (Table2). The yeast level of 1.5% was the most effective level in improving egg weight. Improvement in egg production and egg weight was in good agreement with the results of Park et al (2001), Park et al (2002), Kim *et al* (2002) and Soliman (2003) who reported that, adding live yeast into laying hen diets enhanced egg production and laying performance. On the other hand the results reported herein disagree with those of Brake (1991), Onol (2003) and Nursoy (2004) who did not record any improvement in egg production or laying performance due to feeding diets supplemented with live yeast. This disagreement may be attributed to low inclusion of yeast levels in their experiments where the yeast levels did not exceed 0.5% compared with the current study which use higher levels of yeast. Soliman (2003) attributed the improvement in laying performance to the decreasing effect of yeast on pathogenic bacteria. However in the current experiment, the administration of yeast to laying quail diets enhanced the blood level of Gonadotrophins F.S.H hormone (Table 6) which may be responsible for the improvement in egg production noted in our experiment. Lee *et al* (1998) speculated that, release of gonadotrophins stimulated the ovarian follicles growth and thereafter enhanced the production of egg.

Table (1). Composition and calculated analysis of the basal diets

Contents	Percentage
Ground yellow corn	54.3
Soybean meal (44%)	34.8
Calcium carbonate	5.0
Dicalsium phosphate	1.5
Fat	3.7
Common salts	0.3
Methionine	0.1
Premix	0.3
	100
Calculated analysis	
Crude protein	20.2
Kcal ME/kg	2895
Calcium %	2.62
Av. Phosphorus	0.41
Methionine+cyst%.	0.74
Lysine%	1.07

1-Each kilogram of diet contains Copper, 10mg; Iodine, 1mg; Iron, 30mg; Manganese, 55mg; Zing, 55mg and Selenium, 1mg

2- Each kilogram of diet contains, A, 12000 I.U; D3, 2000 I.U; E, 10mg; K, 2mg; B1, 1mg; B6, 1.5mg; B12, 10ug; B2, 4mg; Pantothenic acid, 10mg; Niacin, 20mg; Folic acid,1000ug; Biotin, 50ug; and Choline chloride, 500ug.

Table (2). Effect of feeding different yeast levels on laying performance and egg components percentage

Yeast levels	Egg production %	Av. Egg Wt. %	*Egg components%		
			Shell	Yolk	Albumen
Control	57.5^{b}	11.13^{c}	11.87^{c}	35.77	52.14
0.5%	65.2^{ab}	11.57^{b}	13.27^{ab}	34.35	52.38
1.0%	67.9^{a}	11.49^{b}	12.42^{bc}	36.53	51.08
1.5%	68.9^{a}	12.0^{a}	13.84^{a}	32.4	53.84
2.0%	57.6^{b}	11.41^{b}	12.89^{ab}	34.13	53.00

a,b,c means with different superscript are significantly different (P<0.05).

*** Percentage to egg weight.**

Table (3). Effect of active yeast levels on feeding performance and body weight gain of laying Japanese quail.

Yeast levels	Feed intake g/h/day	Feed efficiency (g feed/g egg)	*Body weight		
			Initial(g)	Final(g)	Gain%
Control	24.05	3.75	228	242	6.1
0.5%	27.36	3.62	234	253	8.1
1.0%	26.97	3.45	221	244	10.4
1.5%	28.08	3.39	239	249	4.18
2.0%	24.80	3.79	236	258	9.3

Non significant differences

***Gain as Percentage to initial weight**

Egg components:

Egg shell percentages significantly improved due to adding different yeast levels into laying quail diets (Table 2).This increment may be related to an increase in calcium absorption and deposition in egg shell. Bradley and Savage (1995) observed an improvement in calcium retention due to adding yeast into turkey diets. Park *et al.,* (2001) observed an improvement in egg shell quality of laying hens fed dietary yeast. However, the improvement in egg shell did not agree with the finding of Onol *et al.,* (2003) who did not find any significant effect on egg shell weight of heat stressed laying quail fed diets supplemented with yeast.

Both of egg yolk and egg albumen percentages (Table2) were not affected significantly by adding yeast into diets. Similar results were obtained by Nursoy *et.al* (2004)

Feeding performance and body weight gain:

Administration of active dried yeast to laying quail diets did not affect feed intake significantly, however there were a slight increase in daily feed intake at yeast levels of 0.5%, 1% and 1.5 %(Table3). This result is in consistence with the results of Park *et al.,* (2001) and Yossef *et al.,* (2001) who reported that, feed intake increased due to adding yeast to laying hen diets. In contrast, Wakwak *et. al.,* (2003) observed a reduction in feed consumption of growing quail fed yeast supplemented diets.

Feed efficiency ratio was enhanced due to supplementing yeast to diets by 1% and 1.5% recording the values of 3.45 and 3.39 g feed / g egg respectively against the value of 3.75 for control. These results confirms the findings of Wakwak *et al* (2003) who observed an improvement in feed conversion of growing quails which were fed on yeast supplemented diets. The improvement in feed efficiency may be attributed to the enhancement of nutrient digestion and absorption associated with adding yeast to the diets. Soliman (2003) observed significant improvement in digestion coefficient of protein due to adding yeast into laying hen diets. Bradly and Savage (1995) observed an increase in energy utilization of turkey pullets fed yeast supplemented diets. The current results show a slight impairment in feed efficiency ratios of birds fed 2% yeast level compared with the control (3.79 vs. 3.75). These results may suggest that, addition of yeast to diets more than 1.5% has no additional improvement in feed utilization, Romashko (1999) stated that, the higher level of yeast has an adverse effect on nutrients digestibility.

Body weight gain of laying quail did not show any effect due to adding yeast to the diets (Table3), Maia; et al., (2001) did not observe any significant effect on body weight of laying hens fed yeast supplemented diets.

Hatching traits and reproductive organs:

Hatching traits are shown in Table (4) .Incorporating of yeast into laying quail diets improved the hatchability from 66% (control) to 76.31%, 72.1% and 74.6% for 0.5%,1%and 1.5% yeast levels respectively, however the differences lacked significance. The improvement in hatchability may be related to the obvious reduction in infertile eggs rates which was 15.4% for control and decreased to be 7.7%, 6.3% and 6.1% for 0.5 %, 1% and 1.5% yeast levels respectively.

The embryonic mortality rates were significantly similar for all treatments. The improvement effect of yeast on hatchability and fertility is still obscure and may be related to the yeast production of enzymes, vitamins and unknown co-factors (Kornegay *et al.,* 1995). The current results are in harmony

Table (4). Effect of feeding different yeast levels on hatching traits and reproductive organs.

Yeast levels	*Hatchability %	*Died embryo%	*Infertile egg%	Ovary wt. (g)	Oviduct wt.(g)
Control	66.0	18.6	15.4	0.69^{b}	6.99
0.5%	76.3	16.0	7.7	0.83^{ab}	7.58
1.0%	72.1	21.6	6.3	1.1^{a}	7.68
1.5%	74.6	19.3	6.1	1.07^{a}	7.92
2.0%	69.3	19.3	11	0.97^{ab}	6.91

a,b,c means with different superscript are significantly different (P<0.05).
*** Percentage to total egg number.**

Table (5). Effect of feeding different yeast levels on small intestine thickness, liver and spleen weight.

Yeast levels	Small intestine			Liver (g)	Spleen (g)
	Length (cm)	Weight (g)	Thickness		
Control	69.2	3.12	0.045(100)	4.26	0.16
0.5%	66.4	3.29	0.041(91)	4.82	0.18
1.0%	79.2	3.52	0.040(88)	5.3	0.16
1.5%	80.5	3.84	0.042(93)	4.87	0.16
2.0%	78.2	3.52	0.047(104)	4.57	0.17

Non significantly different (P<0.05).
( ) as Percentage to control.

Table (6). Effect of feeding different yeast levels on blood parameters and immune traits.

Items	Yeast levels				
	0.0%	0.5%	1.0%	1.5%	2.0%
WBCs (10^3/mm^3)	11.6^{b}	14.4^{ab}	17^{a}	17.0^{a}	12.8^{b}
RBCs (10^6/mm^3)	4.81	5.49	4.68	5.17	4.5
Hb	9.88	12.22	12.44	12.13	12.36
PCV%	36.26	40.5	39.14	40.14	41.1
HI titre Log_2	6.9^{b}	7.7^{ab}	9.1^{ab}	9.5^{a}	6.8^{b}
Total protein(g/dl)	3.04	3.33	3.95	4.1	3.7
Albumin(g/dl)	1.42	1.64	1.75	2.34	1.86
Globulins(g/dl)	1.62	1.69	2.2	1.76	1.84
FSH (ng/ml)	0.164^{c}	0.294^{b}	0.398^{a}	0.262^{b}	0.220^{bc}
LH (ng/ml)	0.306	0.312	0.282	0.298	0.272

a,b,c within raw means with different superscript are significantly different (P<0.05).

with the results of Yildirm and Parlat (2003) who observed an improvement in fertility, embryonic mortality and hatchability, of eggs from laying quail fed yeast supplemented diets.

Ovary weights (Table 4) were significantly increased by adding 1% and, 1.5% yeast to laying quail diets. This increment is considered as a good reflection for increasing blood level of FSH hormone which may be responsible for this increment. Yildirm and Parlat (2003) observed an increase in ovary weight of quail fed dietary yeast. Average oviduct weights of different treatments were similar and lacked significance.

Small intestine thickness and some internal organs.

Small intestine lengths (Table 5) were increased by adding 1%, 1.5% and 2% yeast to the diets, however the increment lacked significance. These results are in a good agreement with those of Onifads (1999) who observed a lengther intestinal tract due to adding live yeast to the broilers diets.

Small intestine thickness (g. weight/ cm length) values tend to be lower by adding yeast to the diets (Table 5). As percentage to the control, the intestinal wall thickness were 91%, 88%, 93% and 104% for yeast levels of 0.5%, 1%, 1.5% and 2%, respectively. Wakwak *et al.*, (2003) recorded a reduction in small intestine thickness due to adding yeast to the growing quail diets. Also, Bradley *et al* (1994) observed a reduction in ileal wall thickness of poults fed dietary yeast.

The reduction in intestinal wall thickness is a good indicator for the inhibitory effect of live yeast against enteric harmful microorganisms which produce toxic substances causing an increase in its thickness (Scott *et al.*, 1982, Wakwak *et al.*, 2003). The inhibitory effect of live yeast against enteric pathogenic bacteria has been established by Line (1998), Spring *et al.*, (2000).

The slight increase in small intestine thickness of birds fed 2% live yeast may be attributed to the adverse effect of high yeast levels which may irritate the intestinal wall, and increase its thickness.

Various yeast levels did not affect liver or spleen weight. These results disagree with the findings of Onifade (1999) who recorded a greater liver and spleen weight of broiler chicks fed dietary yeast.

Immune response and blood constituents:

Both of white blood cells count (WBCs) and Heamagglutination inhibiting (HI) antibody titre against sheep RBCs significantly increased due to adding yeast into diets. Similar results were recorded by Wakwak et al., (2003) who observed an increase in WBCs and HI of growing quails fed diets with live yeast. The increment in WBCs and HI titer indicated that, adding yeast into laying quail diets may improve immunity system. Santin *et al.*, (2003) and Wakwak *et al.*, (2003) reported that the immune response of birds improved by adding yeast into diets.

Blood total protein, albumin and globulin were not affected significantly by adding yeast into laying quail diets (Table 6). These results are in accordance with Stanley *et al* (1993) who did not find any effect on blood total protein or albumin due to including live yeast into broiler diets.

Haematological indices did not show any effect of adding yeast on red blood cells (RBCs) count , packed cell volume (PCV%) or haemoglobulin level . Abdel-Azeem *et al.*, (2002) did not find any effect of haematological parameters due to adding yeast into broiler diets.

Blood levels of L.H hormone was not affected significantly by adding yeast to the diets, however F.S.H hormone significantly increased. The literature is scarce in this concern. The stimulation effect of yeast on F.S.H hormone may be attributed to yeast secretion of vitamins, and unknown co-factors which are previously discussed.

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تأثير إضافة الخميرة الحية لعلائق السمان البياض على الأداء الإنتاجي ومعدلات التفريخ والاستجابة المناعية

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أجريت هذه الدراسة لمعرفة تأثير إضافة الخميرة الحية لعلائق السمان البياض على معدلات إنتاج البيض والكفاءة الغذائية ومعدلات التفريخ والاستجابة المناعية كذلك تم قياس سمك الأمعاء. استخدمت التجربة عدد 300 سمانة بياضة و100 ذكر تم تقسيمهم لخمسة مجموعات بواقع 60 أنثى و20 ذكر بكل مجموعة. استمرت التجربة 8 أسابيع وتم تغذية المجموعات على خمس مستويات مندرجة من الخميرة وهي صفر% (كنترول) 0.5 و 1% و1.5 ثم2%، و قد أشارت النتائج إلى:

- تحسن معنوي في معدلات إنتاج البيض نتيجة إضافة الخميرة للعلائق بمعدلات1% و1.5% وكذلك تحسن وزن البيض معنويا ووصل التحسن أقصاه عند مستوى 1.5% خميرة بالعلائق. النسبة المئوية لقشرة البيض تحسنت معنويا نتيجة للمعاملة بينما لم يطرأ لم تغير على نسبة الألبومين أو الصفار.
- معدل الاستهلاك الغذائي لم يتأثر بينما تأثر معدل الكفاءة الغذائية معنويا بإضافة الخميرة بمعدل 1% و1.5% ليصبح 3.45و 3.39 غذاء/جم بيض مقارنة بـ 3.75 للمجموعة الكنترول.
- معدلات التفريخ تحسنت من66% للكنترول لتصبح 76.3% و72.1% و74.6% للطيور المغذاة على 0.5% و1% و 1.5% خميرة على التوالي وبنفس المعدل تحسن معدل البيض المخصب. إما نسبة النفوق الجنيني فلم تتأثر المعاملة.
- وزن المبيض أزداد معنويا نتيجة للمعاملة بينما لم تتأثر وزن قناة البيض.
- سمك جدار الأمعاء انخفض بإضافة الخميرة بنسبة 0.5 % و 1% و 1.5 % بينما أدى إضافة الخميرة بنسبة 2% لزيادة سمك جدار الأمعاء.
- عدد كرات الدم البيضاء ازدادت معنوياً نتيجة إضافة الخميرة و هذه الزيادة صاحبها زيادة في مستوى الأجسام المناعية بالدم مما يشير إلى تحسن مناعة الطيور نتيجة للمعاملة.
- مستوى هرمون F.S.H. ازداد معنويا بينما لم يتأثر مستوى هرمون L.H.
- ويستخلص أنّ إضافة الخميرة الحية لعلائق السّمان البياض تكون مفيدةً حتى مستوى 1.5%.