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EFFECT OF DIETARY YEAST ON PRODUCTIVE PERFORMANCE OF QUAIL UNDER NORTH SINAI CONDITIONS- EGYPT

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ABSTRACT

This study's goal was to determine how yeast affected quail's growth. From one day to 42 day of age. One hundred and twenty quail chicks (a day-old), were initially fed a basic diet containing 23.8% protein and 2800 Kcal ME/kg diet for one week. At seven days old, the birds were randomly grouped into four sets, each with 30 quail chicks, divided into three replications with 10 chicks each. The chicks were then fed on four levels of yeast: zero (control), 1, 2, and 3 g/kg. The study found that feeding diets with 3 g/kg of yeast resulted in a significant increase in the average weight gain of birds, while those fed on zero, 1, and 2 g/kg had the lowest weight gain without significant differences between them. Birds fed on 3g/kg of yeast also had the best feed conversion ratio (FCR) in comparison to the other treatments. The results showed that yeast supplementation led to a significant increase in the blood levels of total protein, albumin and globulin, along with a decrease in serum total cholesterol and triglycerides compared to the control group. In contrast, birds fed on the control diet had higher serum Aspartate transaminase (AST) and Alanine transaminase (ALT) levels than those fed on yeast. The study did not find any changes in a serum albumin and globulin (A/G) ratio, the serum low-density lipoprotein (LDL), and high-density lipoprotein (HDL) due to yeast supplementation.

INTRODUCTION

Quail birds have gained importance for its small body size, easy handling, ability to house a large number of birds in a limited space, high egg yield, and the potential to produce multiple offspring from a small number of parent birds (**Yousha *et al.*, 2014; Yousha *et al.*, 2020 a&b).** The economic feasibility of Japanese quails has recently caught the attention of the poultry sector (**Yousha *et al.*, 2020 a & b)**.

Using feed additives appropriately can result in improved feed utilization, increased production, and better health **(Hussain *et al.*, 2021; Eidrisha *et al.*, 2022)**. In the past, sub-therapeutic levels of antibiotics were incorporated into poultry diets to enhance their performance (**Chattopadhyay, 2014)**. Using antibiotics in feeding animals has brought about the presence of residues in each the feed and the environment, which has ended in bacterial resistance in each animals and humans **(Ronquillo and Hernandez, 2017)**.

The search for alternatives to antibiotic growth promoters in animal diets is imperative. These alternative substances are intended to enhance animal performance and health while also being environmentally safer (**Aabid *et al.*, 2016)**. So that the probiotics, such as yeast (*Saccharomyces cerevisiae*;), are a popular feed additive that has been utilized to enhance animal health and performance **(Ogbuewu *et al.*, 2018; Rafique *et al.*, 2020).**

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Yeast protein is considered to be of high quality and comparable to soybean protein in terms of its nutritional value as a vegetable protein. Both yeast and soybean proteins are rich in lysine, making them valuable supplements to cereal grains, which are typically low in this essential amino acid **(Reed and Nagodawithana, 1991)**.

Yeast is a significant group of microorganisms that have been extensively utilized by humans for commercial purposes. Yeasts are unicellular organisms that can be distinguished from bacteria by their larger cell size, various shapes such as oval, elongated, elliptical and spherical, and the production of buds during cell division. The size of yeast cells varies, with some being as small as 5 to 8 mm in diameter, while others can be as long as 100 mm.

Yeast has been recognized as an important additive in broiler chicken diets due to its rich nutritional content and beneficial effects on bird health and performance (**Reda *et al.*, 2022**).Yeast is an excellent source of crude protein, which is essential for muscle development in broiler chickens. Additionally, yeast is rich in vitamin-B complex, which plays a critical role in energy metabolism, immune function, and nervous system health in broiler chickens (**Aabid *et al.*, 2016)**. Moreover, yeast has been shown to improve nutrient digestibility and absorption, which can enhance feed efficiency and reduce the cost of feed. Furthermore, yeast has been found to have antimicrobial properties, which can reduce the risk of pathogen growth in the gut and improve gut health in broiler chickens. Overall, the use of yeast in broiler chicken feeding can improve bird performance, health, and welfare, while also reducing feed costs and enhancing the sustainability of poultry production **(Abd El-Maksoud *et al.*., 2011; Aabid *et al.*, 2016; Rafique *et al.*, 2020; Sabry *et al.*, 2021)**.

The main objective of this research was to investigate the effect of adding yeast (*Saccharomyces cerevisiae*) as a natural growth promoter to the diets of quail on their performance, selected blood parameters, and economic efficiency under the specific environmental conditions of North Sinai.

MATERIALS AND METHODS

The study was conducted at the farm of the Department of Animal and Poultry Production, Faculty of Environmental Agricultural Sciences, Arish University, El Arish, North Sinai, Egypt.

One hundred and twenty, seven (a day-old) quail chicks with similar live body weights have been acquired from a nearby hatchery and randomly distributed into four groups, with 30 birds in each group based on a completely randomized design with three replications. The control group was given a basal diet without yeast, while the other treatments were supplemented with yeast at levels of 1, 2, and 3 g/kg. The birds were housed in battery cages under similar environmental and managerial conditions throughout the entire experimental period and given *ad libitum* access to feed and water. Biweekly recordings of body weight and feed consumption were conducted, and the average body weight gain and feed conversion ratio were calculated. The basal diets used in the experiment were formulated according to the nutrient requirements recommended by **NRC (1994)** for growing Japanese quail, and Table 1 presents the composition and calculated formulation of the basal diets used during the starting and growing periods.

Nine birds from each treatment (three birds from each replication) were selected and deprived of feed for eight hours, weighed, and then slaughtered in the end. Blood samples were collected to determine the serum levels of total protein, albumin, globulin, glucose, total lipids, low-density lipoprotein (LDL), high-density lipoprotein (HDL), cholesterol, serum Aspartate transaminase (AST), and Alanine transaminase (ALT).

Table 1. Composition and calculated analysis of starter and grower diets

Ingredients (%)	Starter period (7-21 day of age)	Grower period (22-42 day of age)
Yellow corn	54	59.7
Soybean (44%)	37.5	32
Wheat bran	1.9	1.6
Protein concentration 45 % CP*	5	5
Calcium Carbonate	1.5	1.5
Salt (Nacl)	0.1	0.2
Total	100	100
Calculated analysis		
Metabolizable energy **(ME Kcal / kg diet)	2803.45	2867.85
Crude protein (%)	23.8	21.8
Calcium (%)	0.92	0.9
Available phosphorus (%)	0.31	0.31
Methionine (%)	0.47	0.44
Lysine (%)	1.44	1.28
Methionine +Cystine (%)	0.86	0.80
Crude fiber (%)	2.95	2.83

The globulin value was calculated by subtracting the albumin value from the total protein value, and the serum albumin and globulin (A/G) ratio was calculated based on the albumin and globulin results as described by **El-Kashef *et al.* (2017 a&b)**. Throughout the study, the economic evaluation of the feeds was conducted by determining the net revenue per unit feed cost using component prices prevailing in the market and yeast (*Saccharomyces cerevisiae*). The economic efficiency of the feeds was calculated according to the method of **Hussain *et al.* (2021)**. The collected data was statistically analyzed using the general linear model procedure described in the SAS User's Guide (**SAS, 2004**), and the means were compared using Duncan's multiple range test **(Duncan, 1955)** with a significance level of $P \leq 0.05$.

RESULTS AND DISCUSSION

Growth Performance

Table 2 presents the impact of yeast on different growth performance parameters observed during the experimental period ranging from day 7 to day 42. The dietary treatments had a significant impact ($P < 0.05$) on the final body weight and body weight gain of Japanese quails. Quails fed diets containing 3g/kg of yeast showed significantly higher ($P<0.05$) final body weight and body weight gain than those fed on other treatments and control diets from day 7 to day 42 of the experimental period.

Table 2. Growth performance of quail birds fed diets with varying levels of yeast during the experimental period spanning from day 7 to day 42

Item	Dietary supplementation of yeast (g/kg)			
	Control	1	2	3
Initial live body weight (g)	30.40^{a}± 0.58	29.66^{a}± 0.61	30.25^{a}± 0.53	29.97^{a}± 0.33
Final live body weight (g)	182.98^{b}±2.00	184.31^{b}±4.09	184.97^{b}±0.57	196.30^{a}±0.34
Body Weight Gain (g)	158.33^{b}±0.09	159.62^{b}±4.16	166.34^{b}±0.43	171.66^{a}±0.46
Feed Intake (g)	497.00^{b}±0.77	511.18^{a}±1.87	481.18^{c}±1.89	485.77^{bc}±7.24
Feed conversion ratio	3.14^{a}±0.030	3.20^{a}±0.07	3.00^{b}±0.01	2.82^{c}±0.04

Feed intake was highest (P<0.05) in birds fed a diet containing 1g/kg of yeast and lowest in birds fed a diet containing 2g/kg of yeast. At the end of the experimental period, the feed conversion ratio was significantly improved (P<0.05) by adding dietary yeast at contents of 2g/kg and 3g/kg compared to the other groups. No significant differences have been observed in initial body weight between treatments. The findings indicated that birds fed a diet containing 3g/kg of yeast exhibited a significant improvement in their growth performance. This improvement could be attributed to the beneficial effects of yeast, which include improved nutrient digestibility, inhibition of pathogens, and interaction with the gut immune system (**Borda-Molina *et al.* 2018)**. The aforementioned results are consistent with the findings of **Hossain *et al.* (2012)**. Incorporating 3 g of yeast/kg (*Saccharomyces cerevisiae*) into the basal diet resulted in a significant improvement in weight gain in quail birds. Also, **Ghally and Abd El-Latif (2007)** found that feeding birds with diets containing yeast (*Saccharomyces cerevisiae*) at either 1% or 2% of the basal diet resulted in a greater improvement (P<0.05) in body weight and body gain compared to the control diet. However, **Abd El-Wahab *et al.* (2019)** observed that the higher concentrations of dietary 3.5% of yeast can be utilized in Japanese quails to enhance their growth performance. Additionally, **Ashok (2016)** reported an improvement in body weight gain by adding yeast to the basal diet at levels of 5% and 10% of quail birds. In contrast, **Yalçın *et al.* (2010)** showed that adding yeast to the diet of laying hens at levels of 2,3 and 4 g/kg, did not have any significant effect on body weight gain. Moreover, **Rezaeipour *et al.* (2012)** found that supplementing broiler diets with *Saccharomyces cerevisiae* at levels of 0, 2.5, 5 and 7.5 g/kg did not have any noticeable impact on the performance parameters and carcass characteristics of the birds.

Blood Constituents

Table 3 presents the statistical analysis of the blood components in the various treatments. The study findings suggested that supplementing the diet with yeast at various levels (1, 2 and 3 gm/kg) did not produce any significant differences in the A/G ratio, (HDL) and (LDL) levels compared with the control group. This result in the opposite direction from of the study conducted **by Reda *et al.* (2022)** found broiler chicks that were fed diets containing 3 and 4 g/kg of yeast exhibited higher levels of HDL and LDL compared to those fed the control diet.

Table 3. The impact of the experimental diets with varying levels of yeast on the blood biochemical constitutes of quail chicks

Item	Dietary supplementation of yeast (g/kg)			
	Control	1	2	3
Total Protein (g/ dl)	5.18^{a}±0.04	4.85^{b}±0.03	4.80^{b}± 0.02	4.72^{b}± 0.12
Albumin (g/ dl)	1.50^{a}± 0.04	1.35^{b}± 0.01	1.18^{c}± 0.01	1.16^{c}± 0.03
Globulin (g/ dl)	3.86^{a}± 0.02	3.56^{b}± 0.01	3.58^{b}± 0.01	3.44^{b}±0.10
A/G ratio	0.33^{a}± 0.01	0.31^{a}± 0.01	0.30^{a}± 0.01	0.33^{a}± 0.04
Glucose (mg/dl)	305.00^{b}±9.72	334.16^{a}±4.62	316.33^{b}±2.91	344.16^{a}±1.04
Total cholesterol (mg/dL)	280.66^{a}±2.97	277.83^{a}±6.50	228.00^{b}±20.24	233.16^{b}±12.77
Triglycerides (mg/dL)	155.00^{a}± 10.98	108.00^{b}± 5.76	99.56^{bc}±7.12	85.00^{c}±1.52
ALT (U/L)	42.66^{a}±0.93	14.00^{c}±1.05	18.33^{b}±0.55	14.33^{c}±0.33
AST (U/L)	309.16^{a}±10.36	248.83^{b}±1.99	239.66^{b}±5.76	244.33^{b}±7.40
HDL (mg/dl)	184.33^{a}±0.66	179.83^{a}±1.95	171.33^{a}±11.40	173.83^{a}±11.54
LDL (mg/dl)	64.66^{a}±4.10	72.50^{a}±7.88	60.00^{a}±11.18	50.66^{a}±0.66

The findings of the study showed that adding yeast to the diet of quail chicks at levels of 1, 2 and 3 g/kg resulted in a significant decrease in the concentrations of serum total protein, albumin, and globulin compared to the control group, which had the highest values. This result is consistent with the observation made by **Ahmed *et al.* (2015)** that adding yeast to the diet of broiler chicks led to a reduction in serum albumin levels compared to the control group. However, **Abd El-Wahab *et al.* (2019)** reported that incorporating yeast (at a range of 0.5 up to 3.5%) into the diet resulted in a significant increase in serum total protein levels compared to the group that did not receive yeast supplementation. Also, **Sabry *et al.* (2021)** observed an increase in the total protein and albumin levels of Japanese quails that were fed on a diet supplemented with 3 and 4 mg yeast/kg, respectively, compared to the control group. Additionally, **Ghally and Abd El-Latif (2007)** reported a significant improvement ($P<0.05$) in the blood plasma levels of total protein, albumin, and globulin in birds fed diets containing yeast culture at 1% or 2% levels. However, **Pouraziz *et al.* (2013)** found no significant difference in the serum total protein levels between the quail groups that received yeast supplementation and those that did not.

Birds that were fed diets containing yeast have displayed a reduction in the levels of cholesterol and triglycerides in comparison to those that were fed diets without yeast supplementation **(**Table 3). The lowest values of serum cholesterol and triglycerides have been discovered in birds fed in diet supplemented with 3 gm/kg yeast and the highest values were in control diet. These results are in agreement with **Abdelrahman (2013)** who reported that the inclusion of yeast culture in the diet led to a significant decrease ($P < 0.05$) in the serum cholesterol levels compared to the control group of chicks. Also**, Abd El-Wahab *et***

***al*. (2019)** found that adding yeast (at a range of 0.5% up to 3.5%) to the diet resulted in a significant decrease ($P < 0.05$) in serum cholesterol and triglyceride levels compared to the group that did not receive yeast supplementation. Furthermore, **Tomaszewska *et al*. (2018)** observed that supplementing the diet with yeast resulted in a significant ($P<0.05$) reduction in serum cholesterol levels compared to a diet without yeast supplementation. **Shareef and Al-Dabbagh (2009)** discovered that adding yeast to the diet at levels of 1.0%, 1.5%, and 2.0% resulted in a decrease in serum triglyceride levels. However, only the highest concentration of yeast (2%) led to a reduction in cholesterol compared to the other treatments. In contrast, **Ahmed *et al.* (2015)** found no significant ($P\geq0.05$) differences in the serum levels of triglycerides in quail chicks fed diets supplemented with or without yeast. Also, **Yalcin *et al*. (2010)** reported that feeding broiler chicks with *S. Servisiae* had no significant effect on the serum levels of triglycerides. The decrease of cholesterol levels could be attributed to the fact that bacteria have the capacity to absorb or break down cholesterol into bile acids and then remove their conjugation to prevent the cholesterol from being re-synthesized **(Aabid *et al*., 2016)**.

In the present study, birds fed the control diet demonstrated a significant ($P < 0.05$) rise in the serum levels of AST and ALT compared to the birds fed different levels of yeast. This is consistent with **Ghally and Abd El-Latif (2007)** findings, which revealed that birds fed diets contain yeast culture at levels of 1% or 2% had significantly higher ($P<0.05$) levels of GOT and GPT than the control group. In contrast, **Sabry *et al*. (2021)** found that adding different levels of yeast to the diet significantly ($P<.0001$) increased the plasma concentrations of AST and ALT compared to the control group. However, **Abd El-Wahab *et al*. (2019)** did not observe any significant ($P\geq0.05$) effects on the serum blood AST and ALT concentrations between birds fed diets with or without yeast (at 0.5%, 1.5%, 2.5% and 3.5%). Also, **Yalçın *et al*. (2010)** demonstrated that supplementing the diet of laying hens with yeast autolysate at 2 and 3g/kg, and 4g/kg did not impact the levels of serum ALT and AST.

Quail chicks fed dietary yeast supplementation presented higher values ($P<0.05$) of serum glucose in comparison to the control group as shown in Table 3. This previous finding is in an agreement with **Omar (2020)** who feeding broiler chicks with yeast at levels of 0.2% and 0.4% resulted in an increase in serum glucose levels compared to the control diets.

Economic Efficiency

The economic outcomes of quail chicks in experiment across different treatment groups are presented in Table 4. The results indicated that the diet containing 3g/kg of yeast (*Saccharomyces cerevisiae*) generated the highest net revenue, economic efficiency, and relative economic efficiency throughout the entire experimental period compared to the other groups. These findings are consistent with **Aabid *et al.* (2016)** research, who demonstrated that the highest net revenue, economic efficiency, and relative economic efficiency were observed in quail birds fed a diet supplemented with different levels of dried yeast. In contrast**, Abd El-Latif *et al*. (2019)** observed that the economic efficiency, relative economic efficiency, and net revenue did not improve in quail birds fed a diet supplemented with 0.5% and 1% of yeast compared to the control diet.

Conclusion

Based on our findings, it can be inferred that incorporating 3g/kg of yeast (*Saccharomyces cerevisiae*) into the basal diet improved the performance of quail birds without any observed adverse effects and resulted in the best economic efficiency.

Table 4. The impact of varying levels of yeast on the economic efficiency of quail chicks

Item	Dietary supplementation of yeast (g/kg)			
	Control	1	2	3
Fixed cost (LE)	4.50	4.50	4.50	4.50
Total feed cost (LE)	9.95	10.23	9.63	9.73
Total cost (LE)	14.45	14.73	14.13	14.23
Final LBW (Kg.)	0.183	0.184	0.185	0.196
Total revenue (LE)	21.96	22.12	22.20	23.56
Net revenue (LE)	7.50	7.39	8.06	9.33
Economic efficiency	1.52	1.50	1.57	1.66
Relative economic efficiency (%)	100.00	98.84	103.37	108.96

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الملخص العربي

تأثير الخميرة على الأداء الإنتاجي للسمان تحت ظروف شمال سيناء- مصر

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هدفت هذه الدراسة إلى دراسة تأثير إضافة مستويات مختلفة من الخميرة كمنشط نمو طبيعي على الأداء الإنتاجى والخواص الكيميائية للدم والكفاءة الإقتصادية للسمان من عمر يوم الى 42 يوم. تم استخدام عدد 120 كتكوت عمر يوم غذيت الطيور في الأسبوع الأول على عليقة أساسية تحتوي على 23.8% بروتين وطاقة 2800 كيلو كالوري/كجم عليقة. عند عمر 7 أيام قسمت الطيور عشوائيا إلى 4 مجموعات تحتوي كل مجموعة على 30 طائر في ثلاثة مكررات بكل مكررة 10 طائر. غذيت الكتاكيت على 4 مستويات من الخميرة صفر(كنترول)، 1، 2 ، 3 جرام/كجم. أظهرت النتائج وجود زيادة معنوية في متوسط الزيادة في وزن الجسم في الطيور المغذاة على علائق تحتوي على 3 جم/كجم من الخميرة بالمقارنة بالطيور المغذاة علي صفر و1و 2 جم/كجم والتي حققت اقل زيادة في وزن الجسم وبدون اختلافات معنويه بالمقارنة بباقي المعاملات. اظهرت الطيور المغذاة على عليقه تحتوي على 3 جم/كجم من الخميرة أفضل معدل تحويل غذائي بالمقارنة بباقي المعاملات. أوضحت النتائج وجود زيادة معنوية في مستوى الدم من كل من البروتين الكلي والألبيومين والجلوبيولين ونقص في مستوى الكوليسترول والدهون الثلاثية مقارنة بالكنترول. الطيور المغذاة على عليقة الكنترول كانت بها اعلى نسبة في مستوى انزيمات الكبد مقارنة بالطيور المغذاة على الخميرة. وأوضحت النتائج عدم وجود أى تغير في نسبة الألبيومين إلى الجلوبيولين ومستوى الدم من الكوليسترول الضار(LDL) والكوليسترول النافع (HDL) مقارنة بالطيور التي غذيت على الخميرة.

الكلمات الإسترشادية: خميرة، السمان، الأداء الإنتاجي، معاملات الدم.

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