EFFECT OF SACCHAROMYCES CEREVISIAE ON GROWTH PERFORMANCE AND HEMATO-BIOCHEMICAL PARAMETERS IN JAPANEASE QUAIL

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ABSTRACT

A study involving one hundred and five Japanese quail chicks was conducted to investigate the effect of different levels of Saccharomyces Cerevisiae (SAC) on their growth performance and hemato-biochemical parameters. Chicks were randomly divided into five groups of three replicates with 7 birds each replicate. Chicks were fed on abasal diet supplemented with SAC at 5 levels namely 0.0 (control group), 0.5, 1, 1.5 and 2 gm/kg diet. The result indicated that dietary supplementation of SAC had no significant effect on the growth performance. There was no significant differences in hematological parameters, except in total leucocyte count (TLC) that was increased in all groups fed diets containing SAC ($p<0.05$). T4 hormone increased in all groups fed on SAC ($p<0.05$). Groups fed diets containing SAC (0.5, 1, 1.5 gm/kg diet) had a lower serum growth hormone concentration. Total proteins showed significant higher

concentrations in groups fed diets containing SAC at lower rates (0.5, 1 gm/kg diet) and lower concentrations in groups fed diets containing SAC at higher rates (1.5, 2 gm/kg diet). All SAC Supplementations levels significantly ($p<0.05$) increased the levels of total serum lipids and triglycerides. Highest levels only of SAC (1.5, 2 gm/kg diet) were responsible for significant ($p<0.05$) decrease of cholesterol concentrations. Groups fed diets containing SAC (0.5, 1.5, 2 gm/kg diet) had a lower serum LDL concentration, while groups fed diets containing SAC (1, 2 gm/kg diet) had a higher serum HDL concentration ($p<0.05$). All SAC Supplementations levels significantly ($p<0.05$) decreased the levels of LDL and HDL in egg yolk. Thus it may be concluded that, SAC supplementation to Japanese quail diet have a significant increasing effect on TLC and decreasing LDL and HDL levels in egg yolk.

Key words: Saccharomyces cerevisiae, growth performance, Hemato-Biochemical Parameters,Japanese quail

INTRODUCTION

Probiotics could besuccessfully used as nutritional tools in poultry feeds for promotion of growth, modulation of intestinal microflora and pathogen inhibition, immunomodulation and promoting meat quality of poultry ***(Saadia and Nagla, 2010)***. Also the global paradigm is shifting from an emphasis on productive efficiency to one of public concerns ***(Cakir et al., 2008)***. A popular alternative to the use of antibiotics has been the use of probiotics which have been used in poultry for "competitive/exclusion" of bacterial pathogens ***(Barrow, 1992)***. Generally, probiotics are derived bacteria, fungi and yeast

(Chumpawadee et al., 2009b). Saccharomyces cerevisiae is considered as one of the most widely commercialized types of yeast that has long been fed to animals.The active Saccharomyces cerevisiae has biologically valuable proteins, vitamin B-complex, important trace minerals and several unique "plus" factors ***(Paryad and Mahmoudi, 2008)***. Recently, it was determined that β-glucan and mannan-oligosaccharide obtained from S. cerevisiae also improved feed conversion ratio and body weight gain when used as feed additives in farm animals ***(Rozeboomet al., 2005)***. Furthermore, mannan oligosaccharides and fructo oligosaccharide derived from the cell wall of S. cerevisiae, has shown promise in suppressing enteric pathogens, and modulating immunity in poultry ***(Yang et al., 2008)***. Additionally, there are trials showing that enrichment of diets with yeast could favorably improve the feed efficiency ***(Day, 1997)***, growth rate ***(Ahmed et al., 2012)*** and reducing the microbial properties of the meat and intestines of Japonica quail ***(Afshin et al., 2012)***. Japanese quail (Coturnix coturnix japonica) had gained attention in poultry industry, as they are resistant to pathogens and a good producer of organic egg and meat ***(Bishop, 2009)***. Japanese quail populations have increased appreciably in Egypt and could be considered an economical source of animal protein.The edible parts of its carcass are higher as compared to those of other poultry species ***(Saleh, 1988)***. Therefore, the purpose of this study was to determine the potential effect of dietary supplementation with Saccharomyces cerevisiae on general performance and hemato-biochemical parameters of Japanese quail.

MATERIALS AND METHODS

Experimental design and animal management:

A total of one hundred and five, one-day old Japanese quail chicks were obtained from the Animal Production Department, Faculty of Veterinary Medicine, Kafr El Sheikh University, Egypt. Chicks were housed in experiment room with initial temperature set at 38°C then gradually decreased during the first 20 days of life to 20°C. These chicks were exposed to a photoperiod of 24 h of light that was then gradually changed to 16 Light: 8 Dark. Feed and water were provided *ad libitum*. The birds were fed formulated ration that meet the nutritional requirements according to the ***NRC (1994)*** as shown in Table 1. Chicks were randomly divided into five groups. Each group were subdivided into three replicates (7 animals/each) and received one of five treatments: basal diet without SAC supplementation (SAC0); basal diet plus 0.5 gm of SAC /kg diet (SAC0.5); basal diet plus 1 gm of SAC /kg diet (SAC1); basal diet plus 1.5 gm of SAC /kg diet (SAC1.5) and basal diet plus 2 gm of SAC /kg diet (SAC2). SAC were obtained from Dosu Maya Mayacilik A. S. Company (Turkey). Body weights (BW), feed conversion ratio (FCR), feed intake (FI) and mortality rate were recorded weekly.

Sampling and parameters measured:

After 45 days, blood was collected from six randomly selected birds from each group through the brachial vein. Approximately 3 ml of blood were collected per animal. 1 ml of this blood was mixed immediately in Ependorf tubes with EDTA(Anticoagulant) and used for hematological analysis. The rest of blood was kept in sterilized Ependorf tubes overnight at 4°C. Serum was separated from clotted blood by

centrifugation at 3,000 x g for 15 minutes and stored at -80ºC until use. Egg was collected 10 days after blood collection from each group. The weight of Egg, egg albumin and egg yolk were measured. 2 ml of egg yolk were preserved in Ependorf tubes and stored at -80 until used. Red and white blood cell (RBC, WBC) counts were performed using an improved Neubauerhemocytometer and Natt and Herrick solution ***(Natt and Herrick, 1952)*** as a special diluent for chicken's blood according to ***Harrison and Harrison (1986)***. The hemoglobin concentration is measured spectrophotometrically by using cyanomethemoglobin method after centrifugation removal of free red cell nuclei and membrane debris. Hematocrit (PCV) was determined using a micro-haematocrit centrifugation (10,500 ×g for 5 min) and a micro-capillary reader ***(Seiverd, 1983)***. The values found were used to calculate the mean corpuscular haemoglobin concentration (MCHC), the mean corpuscular haemoglobin (MCH), and the mean corpuscular volume (MCV). Blood films were stained by Giemsa stain for differential leukocytic count ***(Feldman et al., 2000).***

The concentration of thyroxin hormone (T4) was determined in the serum according to ***Reiners et al, (1983)***, growth hormone according to ***Macchia and Mariano (1993)***. The total protein level in the serum was determined according to ***Henry (1964)***. Total lipids level was determined in the serum according to ***Zollner and Kirsch (1962)***. Total cholesterol was determined in the serum and egg yolk according to ***Allain et al., (1974)***. LDL was determined in the serum, and egg yolk according to ***Wieland and Seidel (1982)***. HDL was determined in the serum, and egg yolk according to ***Lopez-Virella et al., (1977)***.The triglycerides level was determined according to ***Fossati and Prencie(1982)***.

Statistical analysis:

The obtained numerical data were statistically analyzed using ***SPSS, (1997)*** for one-way analysis of variance. When F-test was significant, least significant difference was calculated according to ***Duncan (1955)***.

RESULTS AND DISCUSSION

A. Growth performance:

Data presented in **table2** showed the effect of different supplemented rates of SAC on body weight gain, feed consumption and feed conversion in all groups. There was no significant difference in growth performance values in comparison with negative control group ($p>0.05$). Previous studies reported controversial findings about the effect of SAC on growth performance. It was reported that SAC has no effect on growth performance of Japanese quails ***(Chumpawadee et al., 2009a)***, broilers ***(Chumpawadee et al., 2008)***, and laying hens ***(Chumpawadee et al., 2009b)***. On the other hand, other studies stated that SAC may improve growth performance of broiler chicks ***(Shareef and Al-Dabbagh, 2009)***. The variable effect of SAC may be confounded by variations in gut flora and environmental condition ***(Mahdavi et al., 2005)*** as well as the used strain, its concentration. ***Santin et al. (2001)*** found that supplementation of feed with S. cerevisiae cell wall (0.2%) improved broiler body weight.

B. Hematology:

Regarding to the effect of SAC on the hematology of Japanese quail, all supplemented SAC levels had no significant effects on all

measured hematological indices like RBC, Hb and PCV, except a significant (P<0.05) improving in total leukocytic count. TLC was significantly increased (p<0.05) in all groups fed diets containing SAC compared with those of the control group as shown in **Table 3**. Although TLC was significantly higher in all treated group,there were no changes in the percentages of heterophils, lymphocytes, monocytes, eosinophils and basophiles was noticed in all treatment groups fed yeast compared with those of the control group(data not shown). Leukocytosis may be indicative of higher activity of innate immune responses in chicks fed saccharomyces supplemented diets.Yeast cell wall is containing chitin, mannan and glucan that have been known as immune-stimulators ***(Li and Gatlin, 2003).***

C. Serum biochemistry:

From the present study, it was clearly observed that there was a pronounced increase in T4 level in different groups compared to negative control group and decrease in growth hormone concentration in those groups fed SAC at 0.5, 1 and 1.5gm/kg diet (**Table 4**). ***Vahdatpour et al., (2011)*** stated that mixed active and inactive Saccharomyces (as a synbiotic) may elevate the growth related hormones for production of healthier and organic meat and egg for human nutrition. But active and inactive Saccharomyces alone not affected growth related hormones.Total proteins showed significant higher concentrations (p<0.05) in groups fed diets containing SAC at lower rates (0.5, 1 gm/kg diet) and lower concentrations (p<0.05) in groups fed diets containing SAC at higher rates (1.5, 2 gm/kg diet) as shown in **table 5**. Serum total protein has been reported to be directly responsive to protein intake and quality ***(Eggum, 1989)***. Serum total lipid and triglyceride were

significantly increased in groups fed diets containing SAC. ***Saleh et al., (2013)*** reported that SAC not decreased plasma triglycerid and increased muscle fatty acids. All yeast additive levels (0.5, 1, 1.5 and 2%) were responsible for significant (P<0.05) reduction of serum triglycerides ***(Shareef and Al-Dabbagh, 2009)*.** Serum cholesterol and serum LDL were significantly decreased in groups fed 1.5 and 2 gm/kg diet, while serum HDL was significantly increased in groups fed 1 and 2 gm/kg diet **(table 5)**. Previously, it was reported that Saccharomyces cerevisiae reduce the cholesterol concentration in chicken. Reduction in circulating cholesterol and LDLwith supplemental yeast was remarkable and agree with the results of other researchers ***(Onifade et al, 1999)*** that the addition of innocuous micro organisms including yeast to diet of rabbit and broiler chickens decrease serum cholesterol, triglycerides, phospholipids and abdominal fat. Mannan oligosaccharides derived from the cell wall of S. cerevisiae is considered as substrate for lactic acid producing bacteria like Lactobacillus spp. and Bifidobacterium bifidum ***(Van Loo, 2004)***. Increasing level of MOS also increase the CFU of this lactic acid producing bacteria ***(Xu et al., 2003)***. ***Gilliland et al. (1985)*** hypothesized that some Lactobacillus spp. are able to incorporate cholesterol into the cellular membrane of the organism, thus, cholesterol assimilation by Lactobacillus inturn reduce cholesterol absorption in the system. Also, the results showed significantly decreased of egg LDL and HDL in all groups supplemented with SAC **(Table 5)**. It is beneficial for human health to provide a low-cholesterol egg ***(Abdulrahim et al., 1996)*** and research efforts should direct toward this goal. SAC had no effect on egg weight parameters except a significant increase in egg weight and egg albumin in group 1.5 SAC (data not shown).

Table (1): Ingredients and composition of the basal diet

Ingredient	%
Corn grains	51.5
Corn gluten meal 60%	7.00
wheat bran	2.50
Soybean meal, 44%	32.00
Vegetable oil	2.00
DDGS	9.00
Dicalcium phosphate	1.80
Limestone	2.00
Sodium chloride	0.18
Sodium bicarbonate	0.33
DL-Methionine	0.15
Lysine	0.04
Premix	0.30
Other additives	0.2
Chemical analysis	
DM	90.00
ME	2910
CP	22.84
EE	2.75
CF	6.09
Ash	6.88
NFC	48.2
Ca	1.10
Avp.P	0.51

Table (2): Effect of saccharomyces cerevisiae supplementation on growth performance of Japanese quail

Item	Treatment				
	Control	SAC0.5	SAC1	SAC1.5	SAC2
Initial weight (g)	126.52 ± 0.59[a]	128.11 ± 8.14[a]	131.56 ± 8.92[a]	125.67 ± 11.65[a]	131.46 ± 2.85[a]
Final weight (g)	217.95 ± 4.83[a]	224.63 ± 5.94[a]	227.22 ± 5.25[a]	238.75 ± 8.61[a]	222.54 ± 3.99[a]
Total gain (g)	91.51 ± 5.42[a]	96.52 ± 4.99[a]	95.66 ± 9.13[a]	113.08 ± 17.99[a]	91.08 ± 1.93[a]
Total feed intake (g)	1219.68 ± 152.64[a]	1528.66 ± 119.68[a]	1623.06 ±256.74[a]	1600.17 ± 122.31[a]	1808.59 ± 59.93[a]
FCR	13.51 ± 2.14[a]	15.97 ± 1.74[a]	16.78 ± 1.53[a]	15.05 ± 3.04[a]	19.89 ± 1.03[a]

Values are expressed as mean ± standard errors. Means in the same row had different letters significantly differ at ($p<0.05$).

You have to stand in a row.

Table (3): Effect of saccharomyces cerevisiae supplementation on hemogram of Japanese quail

Item	Treatment				
	Control	**SAC0.5**	**SAC1**	**SAC1.5**	**SAC2**
RBCs ($x10^6$/ µl)	2.97± 0.09 a	2.93 ± 0.06 a	2.76± 0.06 a	2.89± 0.11 a	2.86± 0.11 a
Hb (g/dl)	10.73 ± 0.51 a	10.68 ± 0.57 a	10.2 ± 0.55 a	10.8 ± 0.94 a	10.39 ± 1.14 a
PCV (%)	48.75 ± 0.95 a	48.25 ± 1.03 a	46.5 ± 0.87 a	49± 2.12 a	47.5 ± 1.85 a
MCV (fl)	164.29 ± 2.20 a	164.83 ± 1.39 a	168.64 ± 1.75 a	168.41 ± 2.52 a	166.22 ± 1.14 a
MCH (pg)	36.07 ± 0.95 a	36.41 ± 1.31 a	36.9 ± 1.36 a	37.45 ± 1.72 a	36.06 ± 2.70 a
MCHC (%)	22.97± 0.69 a	22.08 ± 0.72 a	21.89 ± 0.80 a	21.92 ± 1.03 a	21.69 ± 1.56 a
WBCs ($x10^4$/µl)	2.38 ± 0.13[a]	2.96 ± 0.17 [b]	3.01 ± 0.16 [b]	2.86 ± 0.09 [b]	3.11 ± 0.09 [b]

Values are expressed as mean ± standard errors. Means in the same row had different letters significantly differ at ($p<0.05$).

Table (4): Effect of saccharomyces cerevisiae supplementation on growth related hormones in Japanese quail serum

Item	Treatment				
	Control	**SAC0.5**	**SAC1**	**SAC1.5**	**SAC2**
T4 (nmol/l)	8.013 ±0.794 [a]	11.923 ±1.612[b]	10.655 ±0.547[c]	12.420 ±0.806 [d]	12.231±0.497 [d]
Growth hormone(pg/ml)	3.043 ± 0.086 [a]	2.349 ± 0.095[b]	1.687 ±0.242[b]	1.148 ±0.216[b]	2.518 ± 0.148 [a]

Values are expressed as mean ± standard errors. Means in the same row had different letters that significantly differ at ($p<0.05$).

Table (5): Effect of saccharomyces cerevisiae supplementation on serum total protein, serumlipid profileand egg LDL and HDL in Japanese quail

Item	Treatment				
	Control	**SAC0.5**	**SAC1**	**SAC1.5**	**SAC2**
Total protein(gm/l)	6.604±0.305 [a]	7.321±1.336 [d]	7.510±0.805 [d]	5.117±0.624 [b]	5.389±0.429[c]
Total lipid (mg/dl)	3070.56±157.19 [a]	3914.90±420.69 [b]	8396.77±560.59 [b]	3896.55±293.80 [b]	5192.28±422.61[b]
Triglyceride(mg/dl)	150.79±6.39 [a]	408.258±28.001 [b]	418.257±18.955 [b]	223.807±17.876 [b]	263.258±16.063[b]
Cholesterol(mg/dl)	347.748±7.558 [a]	336.142±15.625 [a]	365.095±24.591 [a]	294.877±16.222 [b]	276.006±20.094[b]
Serum LDL (mg/dl)	48.447±0.541 [a]	44.314±0.852 [b]	49.016±1.013 [a]	37.103±0.520 [b]	38.757±0.595[b]
Serum HDL (mg/dl)	25.049±1.6159[a]	22.221±1.158[a]	35.161±2.100[c]	28.637±1.668[a]	35.652±6.227[b]
Egg LDL (mg/gm yolk)	309.727±13.941 [a]	153.005±9.495 [b]	101.886±11.021 [b]	184.059±10.936 [b]	141.945±6.658[b]
Egg HDL(mg/gm yolk)	50.666±2.787 [a]	25.982±4.007[b]	28.832±1.474 [b]	33.313±2.514 [b]	28.179±0.897[b]

Values are expressed as mean ± standard errors. Means in the same row had different letters that significantly differ at ($p<0.05$).

CONCLUSIONS

The result suggested that SAC supplementations may have an improving effect on total leukocytic count as well as lowering LDL and HDL levels in egg yolk of Japanese quails.

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تأثير السكارواميسس سيرفيسى على كفاءة النمو والقياسات الهيماتولوجية - الكيميائية الحيوية في السمان الياباني

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[2] قسم التغذية والتغذية الإكلينيكية– طب بيطري كفر الشيخ – مصر.

[3] قسم الكيمياء الحيوية– معهد بحوث صحة الحيوان– مصر.

شملت هذه الدراسة على 105 كتكوت سمان ياباني لفحص تأثير استخدام السكارواميسس سيرفيسى على كفاءة النمو والقياسات الهيماتولوجية–الكيميائية الحيوية فى السمان اليابانى.الطيور قسمت عشوائيا إلى خمسة مجموعات كل مجموعة احتوت على ثلاثة أجزاء متساوية احتوت على 7 طيور. تم تربية الكتاكيت لمدة 55 يوم. بعد 45 يوم تم أخذ 3 مل دم من الوريد العضدى بصفة عشوائية من عدد 6 طائر من كل مجموعة واحد مل على مادة مضادة للتجلط لعمل قياسات الدم وباقي العينة جمعت لفصل السيرم لعمل القياسات الكيميائية الحيوية. تم تجميع البيض بعد 10 أيام من أخذ عينات الدم لعمل التحاليل الكيميائية الحيوية فى البيض.

غذيت الكتاكيت على علف أساسي مع 5 معالجات: مزودة بالسكارواميسس سيرفيسى عند 5 معدلات وهى مجموعة ضابطة ،0.5، 1 ، 1.5 ،2 جرام /كجم علف. وقد دلت النتائج على أن استخدام السكارواميسس سيرفيسى فى السمان الياباني ليس له تأثير معنوي على كفاءة النمو. ولا يوجد تأثير معنوي على صورة الدم فيما عدا كرات الدم البيضاء والتى زادت فى كل المجاميع المغذاة على

عليقه تحتوى على السكاروميسس سيرفيسى. وقد زاد هرمون الغدة الدرقية فى كل المجموعات التى تتغذى على السكاروميسس سيرفيسى بينما قل هرمون النمو فى المجموعات التى تحتوى على سكاروميسس سيرفيسى (0.5، 1 ، 1.5) .

وقد لوحظ زيادة تركيز البروتين الكلى إحصائيا فى المجموعات التى تحتوى على معدلات قليلة من السكاروميسس سيرفيسى وقل التركيز فى المجموعات التى تحتوى على معدلات عالية من السكاروميسس سيرفيسى. زاد معنويا معدل الدهون الكلى والدهون الثلاثية فى السيرم فى كل المستويات المضافة من السكاروميسس سيرفيسى. لوحظ تقليل مستوى الكولستيرول فى المجموعات التى تأخذ مستوى عالى من السكاروميسس سيرفيسى(1.5، 2). المجموعات التى تتغذى على علف يحتوى على السكاروميسس سيرفيسى (0.5، 1.5، 2) قل بها تركيز البروتين الدهنى منخفض الكثافة فى السيرم. بينما المجموعات التى تتغذى على السكاروميسس سيرفيسى (1 ، 2) زاد بها تركيز البروتين الدهنى عالى الكثافة فى السيرم. لوحظ قلة مستوى الكولستيرول منخفض وعالى الكثافة فى صفارالبيض فى كل المجموعات التى تأخذ السكاروميسس سيرفيسى. لذلك ربما نستطيع أن نستخلص أن إضافة السكاروميسس سيرفيسى لعلف السمان اليابانىكان له تاثير معنوى علىزيادة كرات الدم البيضاء وتقليل مستوى الكولستيرول منخفض الكثافة و عالى الكثافة فى صفار البيض.